APPRAISAL STUDY

PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE PROJECT

Prepared for

Washington State Department of Ecology
Office of the Columbia River
303 S. Mission Street, Suite 200
Wenatchee, WA 98801

Chelan County Natural Resources Department
316 Washington Street, Suite 401
Wenatchee, WA 98801

Prepared by

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

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LIST OF ACRONYMS AND ABBREVIATIONS

CCNRD	Chelan County Natural Resources Department
cfs	cubic feet per second
Chelan PUD	Public Utility District No. 1 of Chelan County
Corps	U.S. Army Corps of Engineers
DAHP	Washington Department of Archaeology and Historic Preservation
Ecology	Washington State Department of Ecology
EFH	Essential Fish Habitat
ESA	Endangered Species Act
fps	feet per second
HDPE	high density polyethylene
IID	Icicle Irrigation District
NAVD	North American Vertical Datum
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
OHWM	ordinary high water mark
PHS	Priority Habitat and Species
PID	Peshastin Irrigation District
PVC	polyvinyl chloride
RM	River Mile
SEPA	State Environmental Policy Act
TDH	total dynamic head
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VFD	variable frequency drive
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area
WSDOT	Washington State Department of Transportation

EXECUTIVE SUMMARY

Peshastin Irrigation District (PID) provides water for irrigation of approximately 3,700 acres in the Wenatchee River Valley. The primary water supply for PID is a diversion on Peshastin Creek approximately 2.4 miles upstream of the Wenatchee River. Additional flow is needed in Peshastin Creek downstream of the PID diversion to improve passage and habitat conditions for bull trout, Chinook salmon, and steelhead. The proposed PID pump exchange project would divert water to the PID Canal through a pump station on the Wenatchee River, allowing for reduced diversions and increased flows in lower Peshastin Creek. The increased flows would improve late summer fish passage, spawning, and rearing conditions in lower Peshastin Creek. The intent of this Appraisal Study is to provide a preliminary evaluation of project alternatives, assess whether the alternatives are viable, select one or two preferred project alternatives, and recommend steps for additional study and implementation of the project.

PID diverts up to 50 cubic feet per second (cfs) from Peshastin Creek during the late summer for irrigation. Due to diversions and natural fluctuations in flow, late summer flows in Peshastin Creek downstream of the PID diversion often fall below 10 cfs. An instream flow analysis completed by Hydrology Northwest (2012) indicates that 41 cfs is needed to provide adequate fish passage conditions for Chinook salmon through the entire length of lower Peshastin Creek. With channel improvements at the worst cross sections, the flow rate needed to maintain adequate fish passage conditions could potentially be reduced to 28 cfs. During a typical year, reducing late summer diversions by pumping approximately 20 cfs from the Wenatchee River for irrigation would allow for maintenance of a minimum 28-cfs flow in Lower Peshastin Creek, when that flow rate is available upstream of the PID diversion.

The instream flow analysis also indicated that increased flow would improve habitat for steelhead rearing, Chinook salmon spawning, and Chinook salmon rearing. An analysis of the relationship of flow versus weighted usable area (WUA), a relative measure of habitat abundance, indicates that the WUA for steelhead rearing would be 4 times greater at a flow of 22 cfs than at a flow of 5 cfs, which is typical of the historic, late summer low flow downstream of the PID diversion during a dry year. The WUA for Chinook salmon spawning would be 20 times greater at a flow of 20 cfs than at a flow of 4 cfs. Additional discussion between regulatory agencies and local stakeholders is needed to determine how the proposed project, which is intended to improve late summer stream flows in lower Peshastin Creek, can be implemented in conjunction with other improvements to the stream channel and floodplain as part of a more comprehensive restoration approach for lower Peshastin Creek.

The following alternatives were evaluated as part of this study (See Figure 4-1):

- Alternative 1 would include a pump station on the Wenatchee River upstream of the easternmost U.S. Highway 2 bridge in the study area, 1,240 feet of pipeline, and delivery to the PID Canal 19,560 feet downstream of the PID Diversion.
- Alternative 2 would include a pump station on the Wenatchee River downstream of the easternmost U.S. Highway 2 bridge in the study area, 1,790 feet of pipeline, and delivery to the PID Canal 19,560 feet downstream of the PID Diversion.
- Alternative 3 would include a pump station on the Wenatchee River downstream of the westernmost U.S. Highway 2 bridges in the study area, 1,490 feet of pipeline, and delivery to the PID Canal 14,720 feet downstream of the PID Diversion.
- Alternative 4 would include a pump station on the Wenatchee River downstream of Dryden Dam, 3,240 feet of pipeline, and delivery to the PID Canal 14,240 feet downstream of the PID Diversion.
- Alternative 5 would include a pump station on the Wenatchee River upstream of Dryden Dam, 4,910 feet of pipeline, and delivery to the PID Canal 12,860 feet downstream of the PID Diversion.

The alternatives were evaluated by completing preliminary hydraulic analyses, geomorphic evaluations of proposed pump station sites, geologic reviews of pipeline alignments, reviews of property impacts, environmental and permitting reviews, and opinions of probable cost. The alternatives evaluation revealed the following:

- Alternative 1 would have the lowest cost ($1.88 to $3.90 million depending on pump capacity). The pump station site is more suitable for diverting flows under low flow conditions than the other alternatives, except for Alternative 5. However, pump station access would be a challenge, a private orchard would be impacted, and the pipeline would be steep and difficult to construct.

- Alternative 2 would have the third lowest cost ($2.13 to $4.43 million depending on pump capacity). The pump station site would be more accessible than Alternative 1. However, channel modifications would likely be required for diversion from the river, the pipeline would cross U.S. Highway 2 and a private orchard, and the pipeline would be steep and difficult to construct.
- Alternative 3 would have roughly the same cost as Alternative 1 ($1.86 to $3.97 million depending on pump capacity). This alternative would have little impact to private property. However, the Dryden Transfer Station would be impacted, channel modifications would likely be required for diversion from the river, the pipeline would be steep and difficult to construct, and slope stability risk would be high.
- Alternative 4 would have the second highest cost ($2.76 to $5.36 million depending on pump capacity). The pipeline alignment is more favorable from a construction standpoint. However, channel modifications would likely be required for diversion from the river, pump station access could be challenging, a private orchard would be impacted, the pipeline would have to cross U.S. Highway 2, and the overall cost would be relatively high.
- Alternative 5 offers the most favorable pumping conditions, best pump station access, lowest power requirements, and least impact to private property. However this alternative would have the highest cost ($3.17 to $6.15 million depending on pump capacity), would require coordination with other existing and proposed uses of the pump station site, the delivery pipeline would need to cross U.S. Highway 2, and pipeline construction would impact a newly paved roadway.

Following the evaluation of the proposed alternatives, the evaluation was presented to PID, Chelan PUD, Chelan County, and Ecology. Based on the review of project alternatives with PID and others, Alternative 1 was selected as the preferred project alternative because of more favorable hydraulic conditions at the proposed diversion location, a lower projected project cost, and the potential for improving the reliability of the PID system by providing an alternate source of supply downstream of the most vulnerable part of the system.

PID also recommended that Alternative 5 be studied further as a backup to the preferred alternative. Alternative 5 would not provide the same benefit to the PID system's reliability as Alternative 1 and would have the highest implementation costs of the project alternatives evaluated. However, Alternative 5 would provide the most favorable hydraulic conditions at the proposed diversion location and would likely have the least impact on private property.

Improvement of fish habitat and passage conditions in lower Peshastin Creek will need to consider and evaluate stream channel and floodplain functions in more detail. It is anticipated that as the technical feasibility of the pump exchange project is further evaluated, channel and floodplain improvements will also be evaluated as part of a more comprehensive approach to improving conditions in Lower Peshastin Creek.

As part of future study of the pump exchange project, stakeholders may want to give further consideration to the potential for using the project to also reduce late summer diversions from Icicle Creek to the Icicle Irrigation District (IID) Canal. The diversions could be reduced by replacing water delivered to the PID Canal through a bifurcation at the downstream end of the IID Division 2 Canal with water pumped from the Wenatchee River. The proposed PID pump exchange facilities could also be expanded to deliver water directly to IDD Division 3A Canal. A cursory evaluation was completed of facilities that would be needed to extend deliveries to the IID Canal, which is approximately 160 to 170 feet higher than the PID Canal. The additional facilities would likely include a booster pump station at the PID Canal, additional discharge pipeline, and a delivery facility at the IID Canal. Depending on the pump capacity, the additional facilities could add $1.65 to $3.33 million to the project implementation costs for Alternative 1 and $1.78 to $4.30 million to project implementation costs for Alternative 5.

Development of a feasibility-level study, providing a more detailed design analysis of the preferred alternatives is recommended. A detailed evaluation of pump station operations would be completed as part of the feasibility study, and would include a determination of whether facilities will also be designed to reduce flows in Icicle Creek; property owner coordination; geotechnical exploration; a more detailed environmental and permitting review; a more detailed engineering analysis; and a refined cost analysis. The feasibility study would also include feasibility-level drawings for the preferred alternative, pump station operational recommendations, a detailed summary of property owner concerns and issues, geotechnical engineering recommendations, engineering calculations and analysis, and a more detailed list of permitting requirements and environmental issues.

1 INTRODUCTION

This report presents an Appraisal Study of the proposed Peshastin Irrigation District (PID) pump exchange project. The project would provide an alternate supply of water for PID by pumping water to the PID Canal from the Wenatchee River. PID provides water for irrigation to nearly 3,700 acres west of the town of Cashmere, in Chelan County, Washington. PID typically diverts up to 50 cubic feet per second (cfs) from Peshastin Creek, approximately 2.4 miles upstream of its confluence with the Wenatchee River. The Chelan County Natural Resources Department (CCNRD) has been working jointly with the Washington State Department of Ecology (Ecology), other local and federal agencies, and local water users to implement projects in the Wenatchee River basin aimed at improving the management of water resources to better meet the needs of water users and improve instream flow conditions. This Appraisal Study was funded under a grant (Grant G1100240) from the Columbia River Basin Water Supply Development Account administered by Ecology's Office of the Columbia River.

The proposed pump exchange project would deliver water to PID through a pump station constructed on the right bank (looking downstream) of the Wenatchee River. The pump station would operate primarily during the late summer to deliver water from the Wenatchee River through a transmission pipeline to the PID Canal, located on the hillside south of the river. Pump station deliveries would allow for a reduction in diversions from Peshastin Creek at the existing PID Diversion, which would increase flow in Peshastin Creek downstream of the PID Diversion and in the Wenatchee River upstream of the pump station. The increased flows would improve late summer fish passage conditions.

1.1 Previous Studies

This study is intended to build on previous work done to evaluate the concept of pumping from the Wenatchee River as an alternative for improving flows in lower Peshastin Creek. The following subsections provide a brief review of previous studies that have evaluated pumping from the Wenatchee River to the PID Canal.

1.1.1 Peshastin Subbasin Needs and Alternatives Study

The proposed pump exchange project was initially identified as part of the *Peshastin Subbasin Needs and Alternatives Study* (Anchor Environmental 2007). That study evaluated the primary summertime water needs within the Peshastin Creek subbasin, which include diversions for irrigation and instream flow for passage of bull trout (*Salvelinus confluentus*) and Chinook salmon (*Oncorhynchus tshawytscha*). Several alternatives were identified for improving water management in the subbasin to better meet both instream and out-of-stream water needs. Pumping from the Wenatchee River was identified as a potential alternative and more detailed study was recommended.

1.1.2 Campbell Creek Reservoir Feasibility Study

Another alternative that was identified as part of the *Peshastin Subbasin Needs and Alternatives Study* was an off-channel storage reservoir in Campbell Creek Canyon. The storage reservoir would allow for capture and storage of Peshastin Creek flows during the high flow season and release of water in the late summer to offset irrigation diversions and improve flows in lower Peshastin Creek. A detailed feasibility study of the reservoir began in 2009. However, the site investigations and design analysis intended to be part of the study could not be completed due to property owner issues that prevented access to the site. The *Campbell Creek Reservoir Feasibility Study* (Anchor QEA 2010) provides a partial evaluation and summary of the Campbell Creek Reservoir alternative. It also includes a summary and evaluation of other alternatives for improving water use in the Peshastin Creek subbasin, including a preliminary evaluation of the proposed pump station on the Wenatchee River.

The evaluation provided in the *Campbell Creek Reservoir Feasibility Study* of the proposed pump exchange project included development of preliminary pumping, fish screening, pipeline, and delivery concepts. Preliminary design criteria were identified for the facilities. Five conceptual alternatives were identified, each with a different pump station location, pipeline alignment, and delivery location. A preliminary evaluation and comparison of the alternatives was provided and preliminary opinions of the probable construction and operation costs were developed for each alternative. The alternatives were evaluated for three different pump station design flow rates; 10 cfs, 20 cfs, and 40 cfs.

1.2 Appraisal Study Description

This Appraisal Study builds on the work done in the *Peshastin Subbasin Needs and Alternatives Study* and the *Campbell Creek Reservoir Feasibility Study*. The following subsections summarize the scope of work and purpose of this Appraisal Study.

1.2.1 Scope of Work

The scope of work for this Appraisal Study approved by CCNRD and Ecology included the following tasks:

1. **Frame the Proposal** – This task included preparation of a summary of the project background, review of water supply needs, and a definition of requirements and design criteria for the pump exchange project.
2. **Instream Flow Benefit Analysis** – This task, which was completed by Hydrology Northwest, included an update of the instream flow needs analysis that was completed for prior studies and development of a more detailed analysis of instream benefits that would result from pumping alternatives evaluated as part of this study.
3. **Appraisal Study** – This task included further evaluation and development of the concepts presented in prior studies and development of this report to provide stakeholders with the information needed to make decisions regarding future implementation of the project. The following was completed as part of this task:
    - Collection and review of background information
    - A site visit to review and document existing site conditions
    - A geomorphic analysis of the Wenatchee River within the reach evaluated for a proposed pump station in this Appraisal Study
    - Geologic review and field inspection of proposed pipeline alignments
    - An initial property ownership and right-of-way investigation
    - Preliminary environmental review and permitting fatal flaw analysis
    - A preliminary evaluation of probable capital and long-term operating costs
    - A workshop and review with stakeholders to select preferred alternative(s)
    - Preparation of this Appraisal Study
4. **Project Management** – This task included coordination with CCNRD, project updates, additional meetings, and management of the Appraisal Study.

1.2.2 Purpose

The intent of this Appraisal Study is to evaluate the project concept and alternatives in enough detail to provide PID and other stakeholders with the information needed to narrow down the alternatives to one or two preferred alternatives, identify apparent "fatal flaws" and challenges, assess whether the project is viable, and determine whether to proceed with a more detailed evaluation of the preferred alternative(s) as part of the feasibility study phase of the project.

1.3 Report Organization

This report includes the following sections:

- **Project Background –** This section describes existing conditions at the proposed project site and summarizes the design criteria and requirements for the project.
- **Water Supply Needs –** This section summarizes both instream and out-of-stream water supply needs, with reference to the detailed instream flow analysis completed by Hydrology Northwest. It also includes a summary of instream flow benefits that would result from the pumping alternatives identified in this report.
- **Description of Preliminary Alternatives –** This section provides a brief description of the preliminary alternatives that were evaluated as part of this study.
- **Evaluation of Preliminary Alternatives –** This section describes the design analyses, field investigations, and evaluations completed as part of this study, including hydraulic analysis, geomorphic analysis of the Wenatchee River, geologic review of pipeline alignments, property ownership and right-of-way investigations, and preliminary environmental review and permitting fatal flaw evaluation.
- **Opinions of Probable Costs –** This section includes a review and update of the preliminary opinions of the probable project costs developed as part of the *Campbell Creek Reservoir Feasibility Study*, including capital costs and long-term operating costs. This section also identifies cost considerations that will need to be evaluated and refined as part of the feasibility study phase of the project.
- **Summary of Alternatives and Fatal Flaw Evaluation –** This section summarizes the challenges and benefits of each alternative, provides a comparison of alternatives, and identifies potential "fatal flaws" or other significant challenges with each alternative presented in this study.

- **Description of Preferred Alternative(s) –** This section provides a more detailed description of the preferred alternative(s) selected for further analysis and potential implementation by PID and other stakeholders.
- **Additional Considerations** – This section outlines additional items that may warrant further consideration as part of future study and an overall approach to improving conditions in lower Peshastin Creek.
- **Summary and Recommendations –** This section provides an overall summary of the Appraisal Study and recommendations for future study and implementation.

Tables and figures are included throughout the report. Appendices follow the main body of the report and include supplemental information and documents prepared as part of this study. These documents include photographs, the instream flow benefit analysis by Hydrology Northwest, hydraulic calculations, fish screening criteria and calculations, geologic review data, property ownership data, environmental review data, opinions of probable cost, and preliminary pump information from a pump manufacturer.

2 PROJECT BACKGROUND

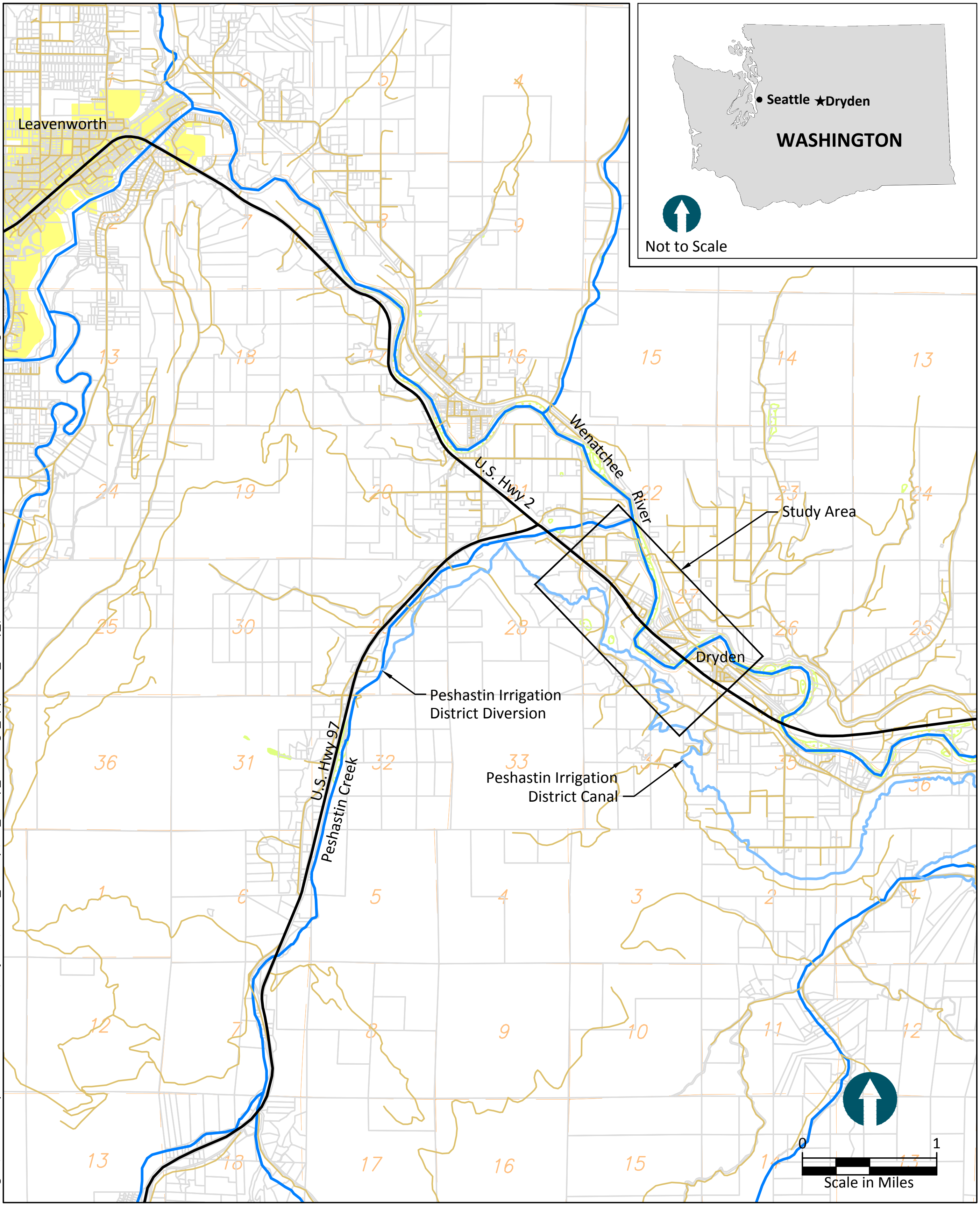
This section includes a brief description of the project site, existing conditions, and design criteria and requirements for the project. The background information provided in this section is based on information from prior studies, Chelan County GIS data, field observations and measurements, photographs taken at the site (Appendix A), aerial photography, existing geologic mapping, input from PID and other stakeholders, and other publicly available sources.

2.1 Existing Conditions

2.1.1 Location

The proposed pump exchange project would be located in the lower Wenatchee River basin, near the town of Dryden, Washington. The study area is adjacent to the Wenatchee River in Section 27, of Township 24 N, Range 18 E. The Wenatchee River forms a narrow valley as it flows through the Cascade foothills to the Columbia River. Peshastin Creek joins the Wenatchee River approximately 1.5 miles upstream of the town of Dryden, at River Mile (RM) 17.9. PID diverts water from Peshastin Creek approximately 2.4 miles upstream of its confluence with the Wenatchee River for delivery to irrigators along the south side of the Wenatchee River Valley from Peshastin Creek to the town of Cashmere.

The study area is shown in Figure 2-1. The project would include a pump station located on the right bank (looking downstream) of the Wenatchee River, at a suitable location downstream of Peshastin Creek. Pump station location alternatives identified in this study are generally within a reach extending from approximately 700 feet downstream of Peshastin Creek to 7,800 feet downstream of Peshastin Creek. Each alternative evaluated also includes a transmission pipeline that would extend through county road or state highway right-of-way and, where necessary, private property from the pump station to the PID Canal. Each alternative would also include a delivery structure or piped transition at the PID Canal to dissipate energy and convey flows to the canal.



L:\Projects\Chelan_County\PID_Pump_Exchange_Appraisal_Study_(110382-01)\CAD\11038201-RP-001-PUMP STA.dwg FIG 2-1

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Figure 2-1
Location Map
Peshastin Irrigation District Pump Exchange Appraisal Study
Chelan County Natural Resources Department

ANCHOR QEA

2.1.2 Existing Facilities and Site Features

Existing irrigation facilities near the study area include the PID Canal and Dryden Dam. The PID Canal, which is located on a hillside south of the Wenatchee River, is more than 13 miles long and is comprised of open concrete-lined canal, unlined canal, and pipe. Within the study area, the PID Canal is mostly welded-steel pipe and open, concrete-lined canal. Canal invert elevations range from approximately 1,142 feet to 1,158 feet (North American Vertical Datum [NAVD] 88) in the study area. Elevations at the Wenatchee River range from approximately 920 feet to 972 feet (NAVD 88) in the study area.

Dryden Dam is owned and operated by the Public Utility District No. 1 of Chelan County (Chelan PUD). The Wenatchee Reclamation District diverts up to 200 cfs from the left bank of the Wenatchee River at Dryden Dam for irrigation of properties mostly in and around the City of Wenatchee, Washington. Wenatchee Reclamation District facilities include a fixed plate fish screen located in a diversion channel approximately 500 feet downstream of the dam and fish bypass facilities designed to return fish from the fish screen to the Wenatchee River. Chelan PUD also operates fish trapping facilities located on the right bank of the Wenatchee River at the Dryden Dam. The facility is used to collect adult broodstock for hatchery programs in the Wenatchee River Watershed.

Other notable features within the study area include U.S. Highway 2, local roads, bridges, homes, buildings, and the Dryden Landfill. U.S. Highway 2, which is operated by the Washington State Department of Transportation (WSDOT), is a divided 4-lane highway within the study area and is the major transportation route between Wenatchee and cities to the west, including Seattle. U.S. Highway 2 is generally aligned along the valley floor and crosses a bend in the Wenatchee River at two locations in the study area. Local roadways include paved county roads in and near the town of Dryden and local gravel roads and driveways. Primary land uses in and near the study area include rural residential and agriculture (primarily orchards). Some limited commercial and industrial uses exist along U.S. Highway 2 and in the town of Dryden. The Dryden Landfill includes property south of U.S. Highway 2 on a hill adjacent to the Wenatchee River. The landfill has been covered and closed. Chelan County currently operates a solid waste transfer station at the entrance to the old landfill.

2.1.3 Hydrology

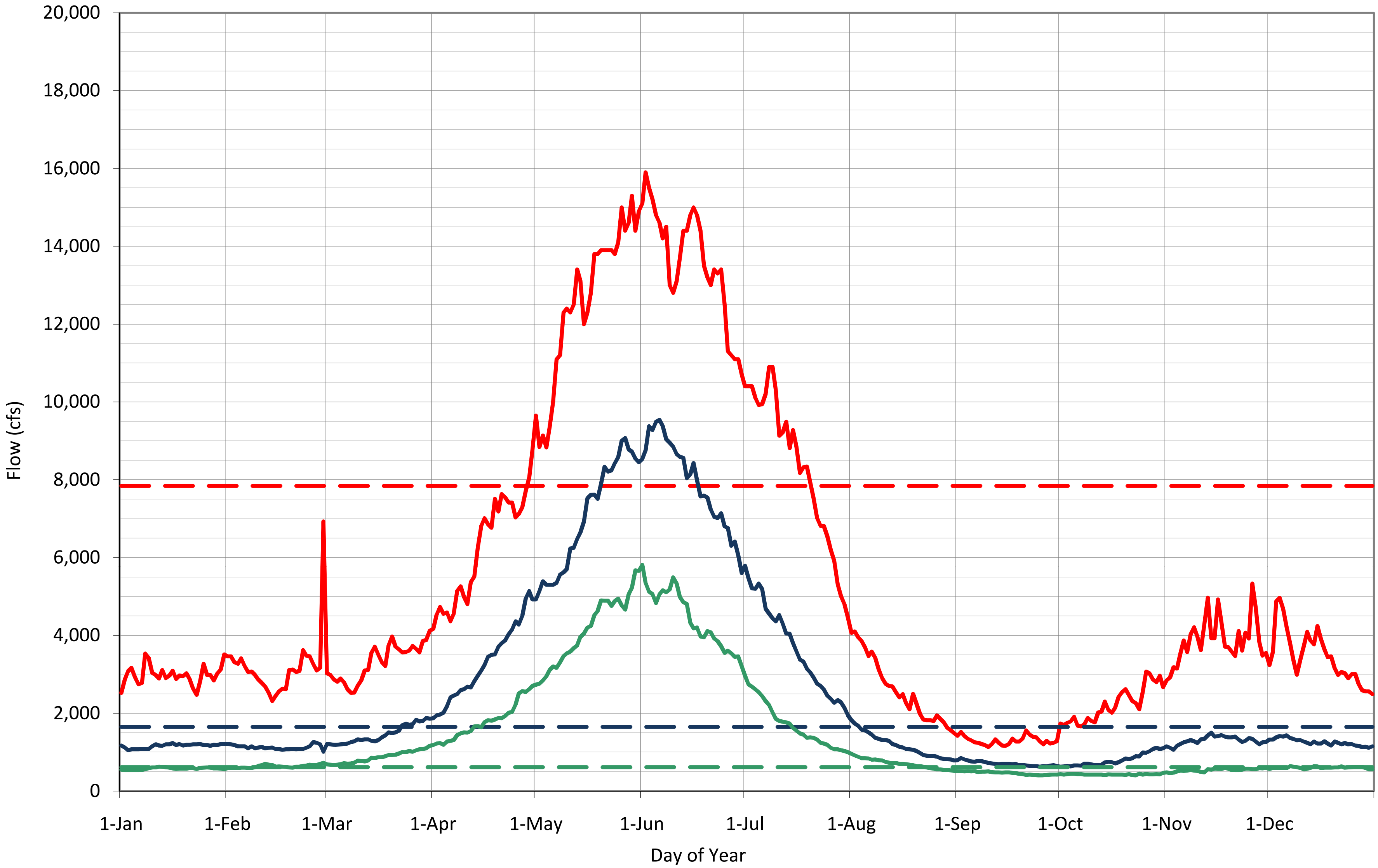
The Wenatchee River is one of the larger tributaries to the Columbia River, with a watershed totaling 1,371 square miles. The watershed comprises most of Ecology's Water Resource Inventory Area (WRIA) 45. Wenatchee River hydrology is similar to other Columbia River tributaries that drain the east slopes of the Cascade Mountains, characterized by high flows in the late spring and low flows in the late summer and early fall. Annual precipitation in the watershed varies from less than 10 inches, at the Columbia River, to more than 100 inches, at the crest of the Cascade Mountains. Precipitation in the upper watershed falls mostly in the form of winter snow, so the hydrology is largely driven by snow melt in the late spring and early summer.

PID is one of several irrigation districts in WRIA 45 that rely on surface water diversions for irrigation. The pump exchange project would divert water from the Wenatchee River near Dryden, somewhere between RM 16.4 and RM 17.9. The U.S. Geological Survey (USGS) operates flow monitoring stations at Peshastin (near RM 21.4) and at Monitor (near RM 6.9). Flow statistics for the Wenatchee River at Peshastin (USGS Gage No. 12459000) and at Monitor (USGS Gage No. 12462500) are listed in Table 2-1. Exceedance hydrographs are provided in Figures 2-2 and 2-3. The USGS station at Peshastin is upstream of Peshastin Creek. The flows at Monitor reflect inflows from Peshastin Creek and Mission Creek.

Table 2-1
Wenatchee River Daily Flow Statistics

Flow Parameter (cfs)	Wenatchee River at Peshastin (USGS No. 12459000)[1]	Wenatchee River at Monitor (USGS No. 12462500)[2]
Mean Daily Flow Rate	3,071	3,230
10 Percent Exceedance Daily Flow Rate	7,840	8,010
50 Percent Exceedance Daily Flow Rate	1,650	1,800
90 Percent Exceedance Daily Flow Rate	616	644
Peak Mean Daily Flow Rate	38,900	45,200
Low Mean Daily Flow Rate	210	221

Notes:
1. Period of Record for USGS No, 12459000 is March 1929 to present.
2. Period of Record for USGS No. 12462500 is October 1962 to present.



Legend:

USGS Gage No.: 12459000
Period of Record: 3/1929 - Present

10% Daily Mean Exceedance
50% Daily Mean Exceedance
90% Daily Mean Exceedance
10% Overall Exceedance
50% Overall Exceedance
90% Overall Exceedance

Figure 2-2
Daily Mean Flow Exceedance Probability
Wenatchee River at Peshashtin
PID Pump Exchange Appraisal Study

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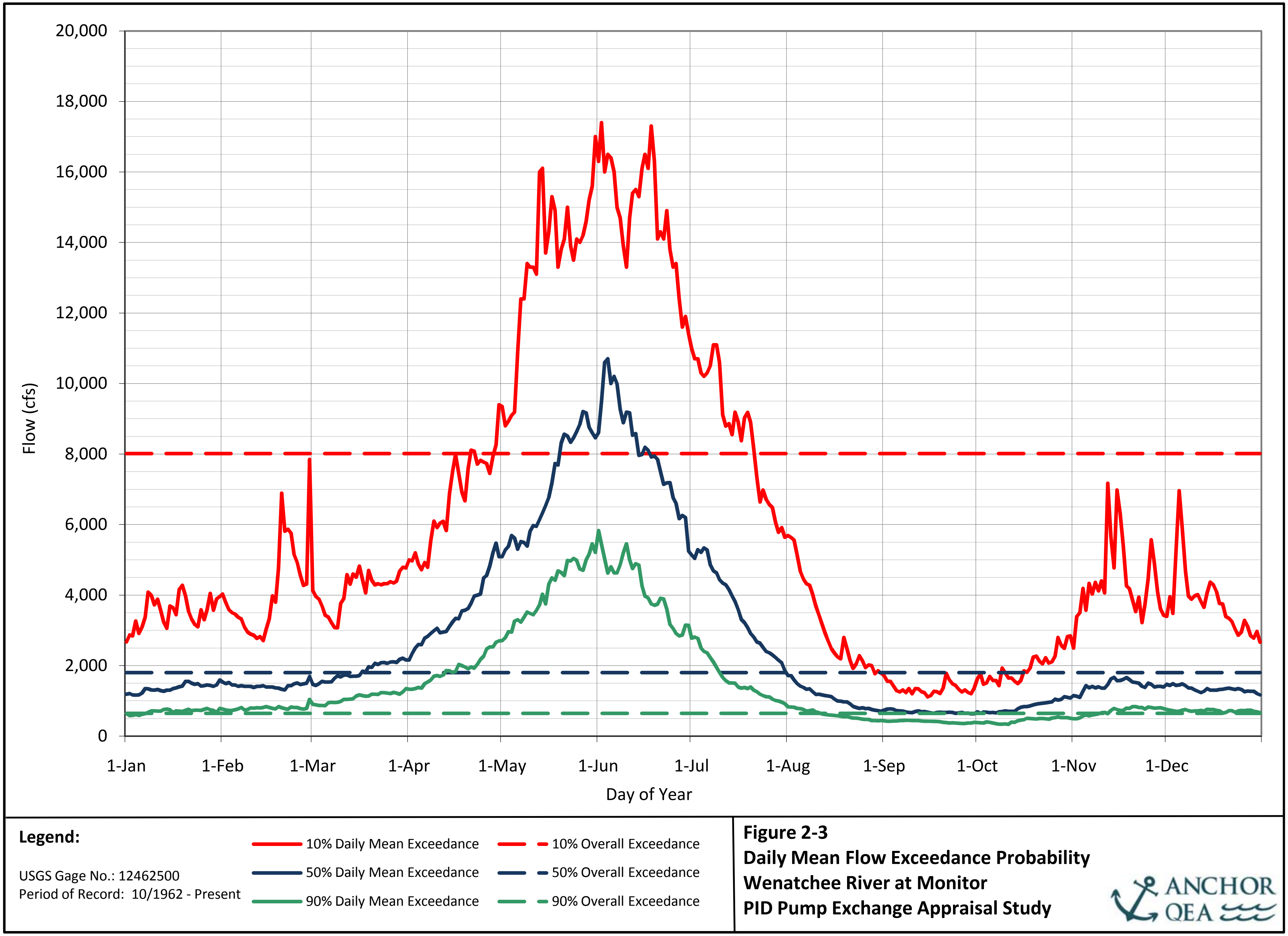
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Flow (cfs)
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
Day of Year
Legend:
USGS Gage No.: 12462500
Period of Record: 10/1962 - Present
10% Daily Mean Exceedance
50% Daily Mean Exceedance
90% Daily Mean Exceedance
10% Overall Exceedance
50% Overall Exceedance
90% Overall Exceedance
Figure 2-3
Daily Mean Flow Exceedance Probability
Wenatchee River at Monitor
PID Pump Exchange Appraisal Study
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2.1.4 Site Geomorphology

The Wenatchee River channel through the study area is confined by geologic features and constructed infrastructure and little channel migration is evident in the historical aerial record. Upstream of the site the channel is confined for approximately 8 miles and little to no movement of the channel or gravel bar deposition is evident in the aerial record. Much of the bed and banks of the river are composed of large rock that is not typically moved by the river during high flow periods. Just downstream of the Peshastin Creek confluence is Dryden Dam and no channel movement occurs in this location. The river flows beneath U.S. Highway 2 at two locations within the study area. Bedrock is located along the right bank between the two crossing locations. In summary, the river channel through the study area has not changed in the recent past likely because of the resistant geologic features along the channel margins and significant infrastructure that stabilizes banks along the river. Therefore, change in the river channel through the study area likely only occurs during very large, infrequent flood events; and during those events, change is likely minor.

2.1.5 Geology

Review of geologic maps, soil maps, and subsurface information obtained from water well logs indicate the majority of the study area is underlain at depth by the Chumstick formation consisting of thick deposits of interbedded sandstone, shale, conglomerate, and some tuff. This formation was deposited in lacustrine and fluvial environments during the late middle to late Eocene period (55 to 34 million years ago). It is bounded on the east by the Entiat fault and on the west by the Leavenworth fault. The moderate hillside reliefs running along the east and west sides of the Wenatchee River valley are comprised mainly of Chumstick formation sandstone. Within the Wenatchee River valley, quaternary period deposits overlay the Chumstick formation, and depending on the proximity to the river channel, consist of alluvial deposits (gravels, sands, and silts), glacial outwash deposits, and landslide deposits derived from upslope weathered sandstone conglomerate. For the purposes of this study, the subsurface geology can be classified into the following main units:

- *Fine Grained Alluvium* - This unit consists of fine grained bedded silts, clays, and sands deposited during flood events within the Wenatchee river valley. The unit is typically encountered at the surface and may vary in thickness from 1 to 20 feet. This unit may also be encountered in varying thickness at higher elevations along the river valley as it was deposited during a period of differential uplift and depression of the land surface in reference to sea level.

- *Coarse Grained Alluvium* - This unit is comprised of coarse gravel and cobbles with occasional boulders and includes both alluvial deposits and glacial outwash deposits. This unit varies in thickness and may underlie the Fine Grained Alluvium unit, or is present at the surface depending on proximity to the river channel.
- *Landslide* - This unit is comprised of historical landslide deposits consisting of angular sediments and fragments of pre-existing sedimentary rock deposits (Chumstick formation) derived from upslope areas. This unit is present at the surface and varies in thickness.
- *Sandstone* - This unit includes the Chumstick formation consisting of interbedded sandstone, conglomerate, shale, and very minor tuff. Sedimentary structures and plant remains indicate deposition in environments ranging from alluvial fan and fluvial to lacustrine. Within the study area, the sandstone unit may consist of predominately shaly sandstone and shale and is susceptible to landslides along the steeper reliefs. The contact interface between the Sandstone unit and overlying Fine Grained Alluvium or Landslide units can create potential slip planes for slope stability failures.

2.2 Design Criteria

In general, the pump exchange project is intended to provide facilities that will deliver water from the Wenatchee River to PID in the late summer to allow for reduced diversions from Peshastin Creek so that more flow is available in Peshastin Creek to meet instream flow needs for fish passage. The project will also need to provide a reliable, cost effective, alternative source of supply for PID. In order to accomplish these goals, design criteria and requirements have been developed in consultation with PID and other stakeholders for analysis of the proposed project. These requirements and criteria are summarized below.

2.2.1 Design Flow Rates

A range of design flow rates were selected for analysis based on instream and irrigation water needs and the potential for meeting those needs with other sources of supply. A detailed evaluation of instream flow needs is outlined in Section 3. The evaluation included a review of the benefit to fish passage conditions that would result from increasing late summer flows in lower Peshastin Creek. PID has historically diverted up to 50 cfs during the peak irrigation season from Peshastin Creek. Increased flow in lower Peshastin Creek would result from reductions in PID's late summer diversions, which would need to be offset by pumping from the Wenatchee River or through a combination of pumping and delivery through PID's connection to a bifurcation at the downstream end of the IID Division 2 Canal. In order to evaluate a range of potential pumping and delivery conditions, the facilities were evaluated at design flows of 10, 20, and 40 cfs.

2.2.2 Pump Station

The pump station and associated transmission pipeline would be designed to deliver the required flow from the Wenatchee River to the PID Canal. Design criteria and requirements for the pump station would include the following:

- Pump Station Location – The pump station would be built into the right bank (looking downstream) of the Wenatchee River somewhere between RM 16.4 and RM 17.9. The pump station site would be selected based on system hydraulics, geomorphology, accessibility, geology, environmental impacts, property impacts, and other factors that are evaluated as part of this Appraisal Study.
- Pump Station Configuration – The pump station would include a screened intake (see Section 2.2.3) designed to fit into the side of the river channel and divert flow under a wide range of river conditions to reinforced concrete sumps for pumping.
- Type and Number of Pumps – It is anticipated that the pumps would be vertical turbine pumps designed to draw water from reinforced concrete sumps. Two or more pumps would be included. The number of pumps would be selected based on the design flow rate and the size of pumps available.
- Pump Sizing – Pumps would be sized to deliver the design flow rate from the Wenatchee River to the PID Canal through a transmission pipeline. The delivery elevation at the canal would be approximately 186 to 224 feet higher than the water surface elevation of the river. Pump and pipe sizing would be optimized by balancing capital costs with energy requirements and related long-term costs.
- Pump Station Structure – The pump station structure would be reinforced concrete designed to support the pumps, screens, and related equipment. It is anticipated that

the pumps would sit on a reinforced concrete pad above the pump sumps and intake. A small metal or concrete masonry unit building, or some other type of weather tight enclosure, would be provided to house electrical and control equipment for the pumps and screen.

- Electrical and Controls – Each pump would be equipped with a variable frequency drive (VFD) to optimize pump performance, provide flexibility in delivering a range of flow rates, and allow for soft pump starts and stops. The pump station would require extension of three-phase power service.
- Other Equipment – Associated equipment would include discharge piping, valves, fittings, pressure transmitters and switches, a flow meter, and other appurtenances. Discharge and fittings would be steel or ductile iron with appropriate linings and coatings to reduce the risk of corrosion.

2.2.3 Intake and Fish Screening

Fish screening facilities would be designed to meet the most current requirements for screening of diversions from the Washington Department of Fish and Wildlife (WDFW) and the National Marine Fisheries Service (NMFS) *Anadromous Salmonid Passage Facility Design Guidelines* (NMFS 2008), developed by the NMFS Northwest Region. The criteria applicable to the sizing and design of a pump station intake constructed on the Wenatchee River would include the following:

- Maximum approach velocity = 0.4 feet per second (fps) for active screens, or 0.2 fps for passive screens
- Effective Screen Area = Maximum Screen Flow/Approach Velocity
- Sweeping Velocity = 0.8 to 3.0 fps
- Screen Material = Must be corrosion-resistant and sufficiently durable to maintain a smooth, uniform surface with long-term use
- Maximum Opening Size
  - 0.087 inch for Woven Wire Mesh (6-14 mesh)
  - 1.75 millimeters for Slotted Screens
  - 3/32 inch diameter for circular screen openings (includes perforated plate)
  - 3/32 inch on diagonal for square screen openings
- Minimum Open Area = 27 percent

2.2.4 Pipelines

The transmission pipeline would be designed to convey water from the pump station to the PID Canal. The following requirements and criteria would apply to the design of the transmission pipeline:

- Sizing – The pipeline would be sized based on balancing pressure loss in the delivery pipeline with the corresponding increase in pumping power required. As a general guideline, pressure pipe would be sized to limit velocities to 5 fps.
- Material – It is anticipated that the majority of the pipeline would be constructed with either pressure-rated steel, ductile iron (DI), high density polyethylene (HDPE), or polyvinyl chloride (PVC) pipe depending on size, pressure rating required, and other design factors.
- Pipe Roughness – For completing preliminary hydraulic analyses of the proposed transmission pipeline, Hazen-Williams coefficients (C) were conservatively estimated to be 130 for plastic pipe and 110 for metal pipe.
- Trenching and Backfill – The transmission pipeline would be buried with a minimum cover of at least 30 inches. Imported bedding and select backfill would be used to provide a solid foundation and protection for the pipeline.
- Pressure Rating – Pipe and fittings would be rated to handle at least 150 percent of the projected maximum working pressure. Blocking and/or restraints would be used to ensure that the pipe does not move during pressure surges. No solvent welded joints on PVC pipe would be allowed.
- Appurtenances – Air release and vacuum valves would be provided at key locations along the transmission pipeline.

2.2.5 Delivery to PID Canal

The type and configuration of the delivery structure will depend on whether the delivery is made to an open section of PID Canal or a section of the canal that has been piped. The following criteria would apply to the design of the delivery structure:

- Location – If possible, the structure would be located within the existing PID Canal easement. Other factors that would be considered as part of the selection of a location for the delivery to the Canal would include whether the Canal was open or piped, site topography, geology, accessibility, and environmental impacts.

- Extent and Reliability of Service – The closer the delivery is located to the diversion, the more customers PID will be able to serve through the pump station. However, the most vulnerable section of the PID Canal runs through the slide area on the hillside south of the Dryden Transfer Station and the bend in the Wenatchee River. This reach includes a segment of steel pipe approximately 30 feet long that is suspended above a slide area. If the delivery to the canal is upstream of that location, the additional supply from the pump station would not provide as much benefit to the reliability of the system.
- Sizing and Configuration – The structure would be designed to convey the design flow rate from the transmission pipeline to the PID Canal at velocities that would be low enough to prevent Canal erosion or damage to existing pipe, fittings, and appurtenances. The structure would also be configured to allow for accurate measurement of water levels for hydraulic control of the pump station.
- Material – It is anticipated that the structure would be constructed with reinforced concrete or appropriate pipe fittings and would likely include a baffle, diffuser, or other device designed to dissipate energy.

3 WATER SUPPLY NEEDS

The proposed pump exchange project is being evaluated for its potential to improve water resource management in the Wenatchee River Watershed, and more specifically in the Peshastin Creek Subbasin, to better meet both instream and out-of-stream water needs. This section includes a brief description of the instream and out-of-stream water uses in the Peshastin Creek Subbasin, summarizes a detailed instream flow analysis prepared by Hydrology Northwest (Appendix B), and compares existing water supply to water needs.

3.1 Out-of-Stream Water Needs

The primary out-of-stream water need within the Wenatchee River Watershed is for irrigation. Additional out-of-stream water needs include municipal, light commercial and industrial, and domestic use. For surface water in the Peshastin Creek Subbasin, the primary out-of-stream water needs are irrigation supply for PID and the Tandy Ditch Company.

3.1.1 Irrigation Diversions

Both PID and the Tandy Ditch Company have irrigation diversions on Peshastin Creek. These are the primary surface water diversions within the Peshastin Creek Subbasin. PID diverts up to 50 cfs from Peshastin Creek, approximately 2.4 miles upstream of its confluence with the Wenatchee River. The diversions typically occur between early April and mid-October.

PID diversions from 2002, 2003, 2010, and 2011 were reviewed for this analysis. Data from 2002 and 2003 was obtained from Ecology from diversion records submitted by PID. Records from 2010 and 2011 were obtained directly from PID. Figure 3-1 includes a chart showing PID's average daily diversion from Peshastin Creek during 2002, 2003, 2010, and 2011. The chart also shows Peshastin Creek flows during 2003, 2010, and 2011, continuously measured at an Ecology flow monitoring station at Green Bridge Road, which is downstream of the PID diversion.

The data indicates that diversion rates are typically the greatest from early June through the middle of August, when irrigation demand is the highest. Diversions are reduced in late August when flows in Peshastin Creek cannot sustain peak diversion rates. Late summer diversions are typically supplemented by flows from the bifurcation at the downstream end of the IID Division 2 Canal. During 2002 and 2003, the peak 2-week average diversion rate was just over 30 cfs. During 2010, the peak average 2-week diversion rate was nearly 40 cfs. During 2011, it was over 41 cfs. In 2010 and 2011, peak average daily diversion rates were in the range of 45 to 50 cfs. Diversion rates are affected by flow availability in Peshastin Creek, timing of the fruit harvest, and reductions in water use following the fruit harvest.

In addition to surface water from Peshastin Creek, PID relies on surface water diverted from Icicle Creek to the IID Canal during the late summer. PID has a surface water right on Icicle Creek and jointly operates the diversion and conveyance facilities, including the IID Division 1 and Division 2 Canals, with Icicle Irrigation District. The IID Division 1 and Division 2 Canals convey water to a bifurcation structure located near Peshastin Creek. The *Peshastin Irrigation District Comprehensive Water Conservation Plan* (Klohn Leonoff 1993) indicates that an agreement between IID and PID governs the operation of the bifurcation structure. IID has a right to the first 30 cfs. IID conveys flow from the bifurcation through a siphon under Peshastin Creek and U.S. Highway 97 to the IID Division 3A Canal. PID has the right to the next 30 cfs. Historically, 16 cfs of that amount was diverted to the Gibbs and Tandy Ditches. The remaining 14 cfs was available for conveyance through a 20-inch steel pipeline to the PID Canal. The bifurcation structure was refurbished in 1996. PID estimates the maximum flow capacity of the pipeline from the bifurcation at 30 cfs. No records have been provided documenting recent late summer deliveries to the PID Canal from the bifurcation, but the *Peshastin Irrigation District Comprehensive Water Conservation Plan* (Klohn Leonoff 1993) indicated that historical flows were between 7 and 14 cfs. Flows from the bifurcation are used to supplement diversions from Peshastin Creek, particularly during the late summer, when irrigation demand is still high and flows in Peshastin Creek are low.

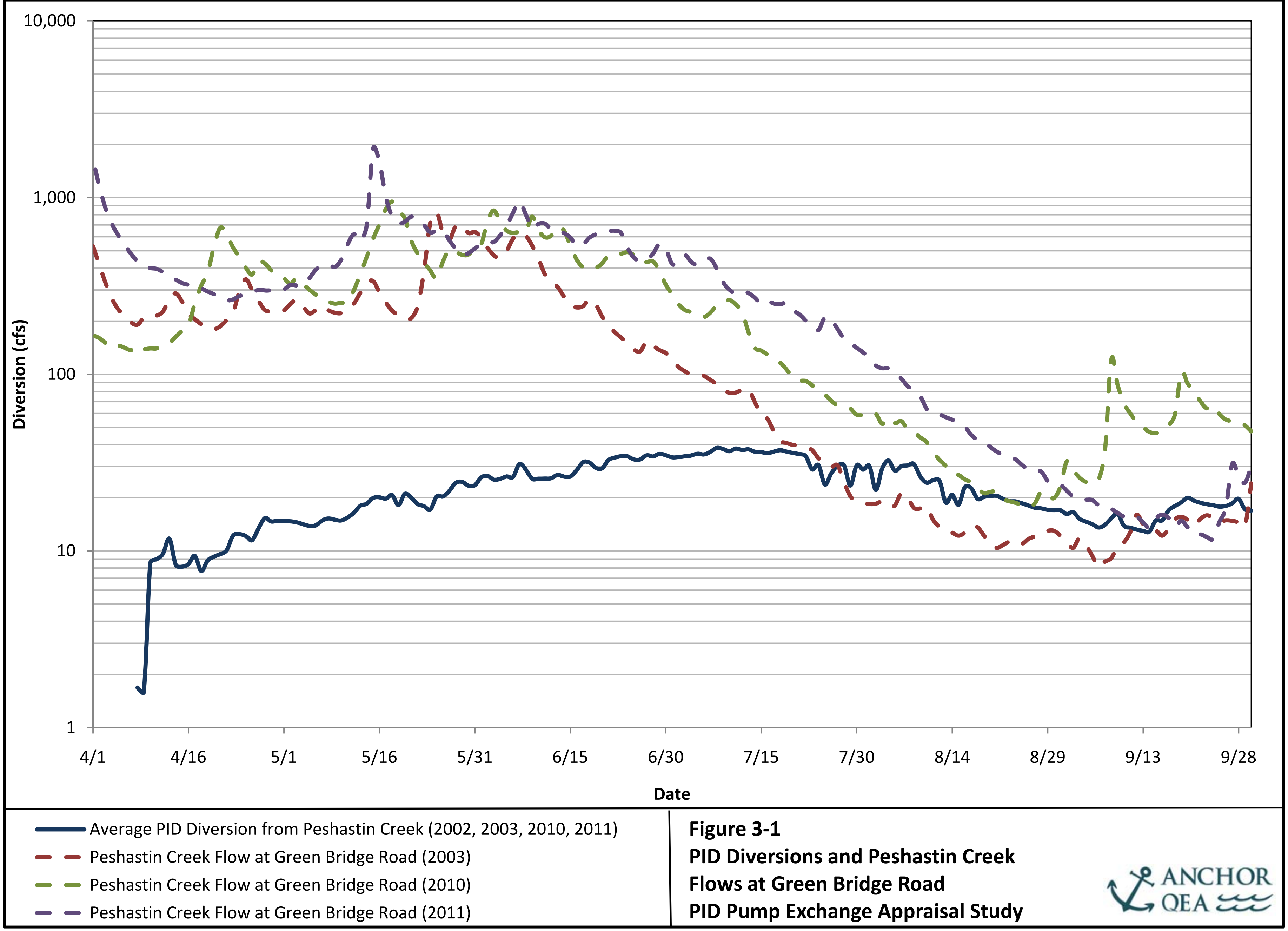

Figure 3-1
PID Diversions and Peshastin Creek Flows at Green Bridge Road
PID Pump Exchange Appraisal Study

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3.1.2 Water Rights

Table 3-1 summarizes PID's surface water rights, as listed in Ecology's water rights database. PID has water right claims for diversion of up to 57.5 cfs from Peshastin Creek. PID also has water right certificates that allow for diversion of up to 34.4 cfs from Icicle Creek at the IID Canal diversion and up to 2.4 cfs from the Wenatchee River downstream of the Dryden Dam. The information contained in Table 3-1 is presented for information only and is not to be construed as a representation of PID's legal water rights.

Table 3-1
PID Surface Water Diversion Rights

Source	Water Right Document	Flow Rate (cfs)	Volume (acre-feet)	Area of Use (acres)	Purpose
Peshastin Creek	S4-064984CL	50.0	15,000	2,258	Irrigation
	S4-113257CL	3.1	620	155	Irrigation
	S4-064985CL	4.4	550	110	Irrigation
Total		57.5	16,170	2,523	
Icicle Creek	S4-*00329CWRIS	34.4		2,063	Irrigation
Wenatchee River	S4-CV1P260	2.4		60	Irrigation

Notes:
cfs = cubic feet per second

3.2 Instream Water Needs

The primary instream flow needs in lower Peshastin Creek during summer are fish passage for ESA-listed Chinook salmon and bull trout, spawning for Chinook salmon, and rearing of ESA-listed Chinook salmon, bull trout, and steelhead. A fish passage and revised instream flow analysis was completed by Hydrology Northwest as part of the development of this Appraisal Study. A report summarizing the instream flow analysis, *Lower Peshastin Creek Fish Habitat and Passage Assessment 2011* (Hydrology Northwest 2012), is included in Appendix B. The following is a brief summary of the findings of the instream flow analysis.

As part of the study, Hydrology Northwest used the "Oregon Method" (Thompson 1972) to estimate stream flows for upstream migration of Chinook salmon and bull trout. That method assumes adequate flow when depth criteria are met on at least 25 percent of an individual transect width and on at least a 10 percent contiguous portion of the transect width. Hydrology Northwest also evaluated the impact of stream flow rates on habitat functions, including spawning and rearing for Chinook salmon, and rearing for steelhead and bull trout by computing weighted usable area (WUA), which is a relative measure of habitat abundance. Relationships between the WUA for different habitat functions and flow rate were estimated for the lower 2.4 miles of Peshastin Creek, downstream of the PID diversion, by using the calibrated transects from the Peshastin Creek instream flow study portion of the *Final Technical Report Lower Wenatchee River PHABSIM Studies* (EES Consulting 2005).

3.2.1 Fish Passage

A stream survey was completed in August and September of 2011 to complete the fish passage analysis. Five transects were surveyed for the field study. The transects include both representative and critical bar sections along lower Peshastin Creek. Transects were surveyed over the course of three field days as flows were dropping during the late summer to capture "high," "medium," and "low" late summer flow conditions for passage modeling. In addition, Hydrology Northwest surveyed lower Peshastin Creek for habitat types.

The data collected were entered into the PHABSIM hydraulic model for lower Peshastin Creek to evaluate passage conditions for a range of flows from 5 to 50 cfs. Modeled depths were tallied to determine the stream flows needed to create adequate passage conditions at each transect according to the "Oregon Method." The results are summarized for bull trout and Chinook salmon in Tables 3-2 and 3-3 and are included in Appendix B.

Table 3-2
Discharges for Meeting Bull Trout Passage Conditions

Passage Criteria	Transect T-1 (cfs)	Transect T-2 (cfs)	Transect T-3 (cfs)	Transect T-4 (cfs)	Transect T-5 (cfs)
25 Percent of Total Width	6	5	10	16	18
10 Percent Contiguous Width	6	5	6	16	30
Both Criteria	6	5	10	16	30

Table 3-3
Discharges for Meeting Chinook Salmon Passage Conditions

Passage Criteria	Transect T-1 (cfs)	Transect T-2 (cfs)	Transect T-3 (cfs)	Transect T-4 (cfs)	Transect T-5 (cfs)
25 Percent of Total Width	15	17	28	16	34
10 Percent Contiguous Width	13	13	25	10	41
Both Criteria	15	17	28	16	41

For bull trout, both fish passage criteria are met for all transects surveyed for flows in excess of 30 cfs. Fish passage criteria are met for all but the worst transect surveyed for flows in excess of 16 cfs.

Flows required to meet passage conditions for Chinook salmon are greater because the minimum depth recommended for passage (0.8 foot) is greater than the minimum depth recommended for bull trout passage (0.6 foot). For Chinook salmon, both fish passage criteria are met at all transects surveyed for flows in excess of 41 cfs. Fish passage criteria are met at all but the worst transect surveyed for flows in excess of 28 cfs.

3.2.2 WUA Results

Estimates of the WUA (a relative measure of habitat abundance) in lower Peshastin Creek were evaluated, including steelhead juvenile rearing, Chinook salmon spawning and juvenile rearing, and bull trout juvenile and adult rearing. The results, shown in Appendix B, indicate that for all species except bull trout, the WUA increases relatively consistently as flow increases. For example, the WUA for steelhead rearing is nearly 4 times more abundant at a flow rate of 22 cfs than at a flow rate of 5 cfs. Chinook salmon spawning habitat is nearly 20 times more abundant at a flow rate of 20 cfs than at a flow rate of 5 cfs.

3.2.3 Summary

The results of the instream flow study indicate that wide gravel bars in lower Peshastin Creek likely pose a significant passage barrier under low flow conditions. Flows needed for adequate passage conditions are greater for Chinook salmon than for bull trout. The average flow required to meet passage conditions at the 5 transects measured was 23.4 cfs. Although a flow of 23.4 cfs would likely create adequate passage conditions through the majority of lower Peshastin Creek, higher flows would be needed to pass fish at the most critical transects surveyed (Transects T-3 and T-5), unless channel modifications can be made to improve passage flow conditions through the worst transects.

3.3 Comparison of Water Needs to Flows

Following development of the analysis of instream water needs by Hydrology Northwest, additional analysis was completed to compare Peshastin Creek flows with water needs. The following provides a more detailed summary of flows in Peshastin Creek and compares those flows to the flows needed to support fish passage and irrigation needs.

3.3.1 Peshastin Creek Flows

Historical flow data for Peshastin Creek was recorded at three flow monitoring stations operated by Ecology as part of the Washington State Flow Monitoring network. Those stations are:

- Ecology No. 45F110 – This station is located on Peshastin Creek just upstream of its confluence with Ingalls Creek, which is at RM 9.4. The station consists of a manual stage height gage, which was read manually several times a year between 2003 and 2009. The gage has not been monitored since October 1, 2009.
- Ecology No. 45F100 – This station is located on Peshastin Creek approximately 1 mile downstream of its confluence with Ingalls Creek, which is at RM 9.4. The station consists of a manual stage height gage, which was read manually several times a year between 2003 and 2009. The gage has not been monitored since October 1, 2009.
- Ecology No. 45F070 – This station is located on Peshastin Creek at Green Bridge Road, approximately 1.5 miles upstream of the Wenatchee River. This is the only continuously operated station on Peshastin Creek and is the only station downstream of the irrigation diversions. The station has been in operation since October 2002.

Data from the three flow monitoring stations can be obtained from the Ecology website at https://fortress.wa.gov/ecy/wrx/wrx/flows/regions/state.asp?region=3. Figure 3-2 provides a log scale plot of historical flows measured at each of the monitoring stations. Figure 3-3 provides a comparison of the variation of annual flows measured at Green Bridge Road, plotted on a log scale, to illustrate the range of flows in Peshastin Creek at different times of the year.

Annual peak flows at Green Bridge Road typically exceed 500 cfs. Peak flows recorded in 2006 and 2007 were in excess of 2,000 cfs. Late summer flows typically drop below 10 cfs. Low recorded flows in 2004, 2005, and 2007 were less than 5 cfs. The flow rates at Green Bridge Road reflect surface water diversions to the Tandy Ditch and the PID Canal.

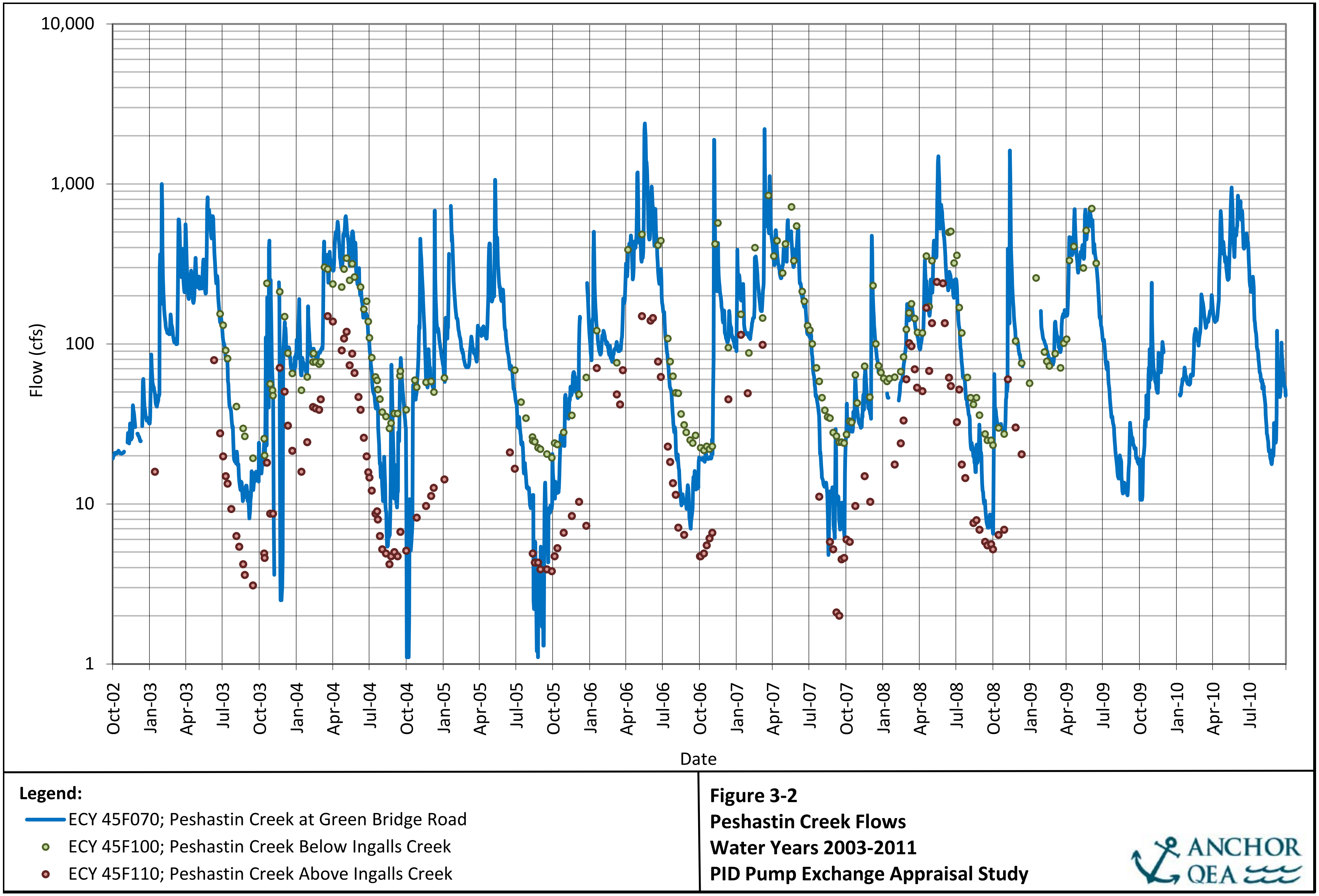

Figure 3-2
Peshastin Creek Flows
Water Years 2003-2011
PID Pump Exchange Appraisal Study

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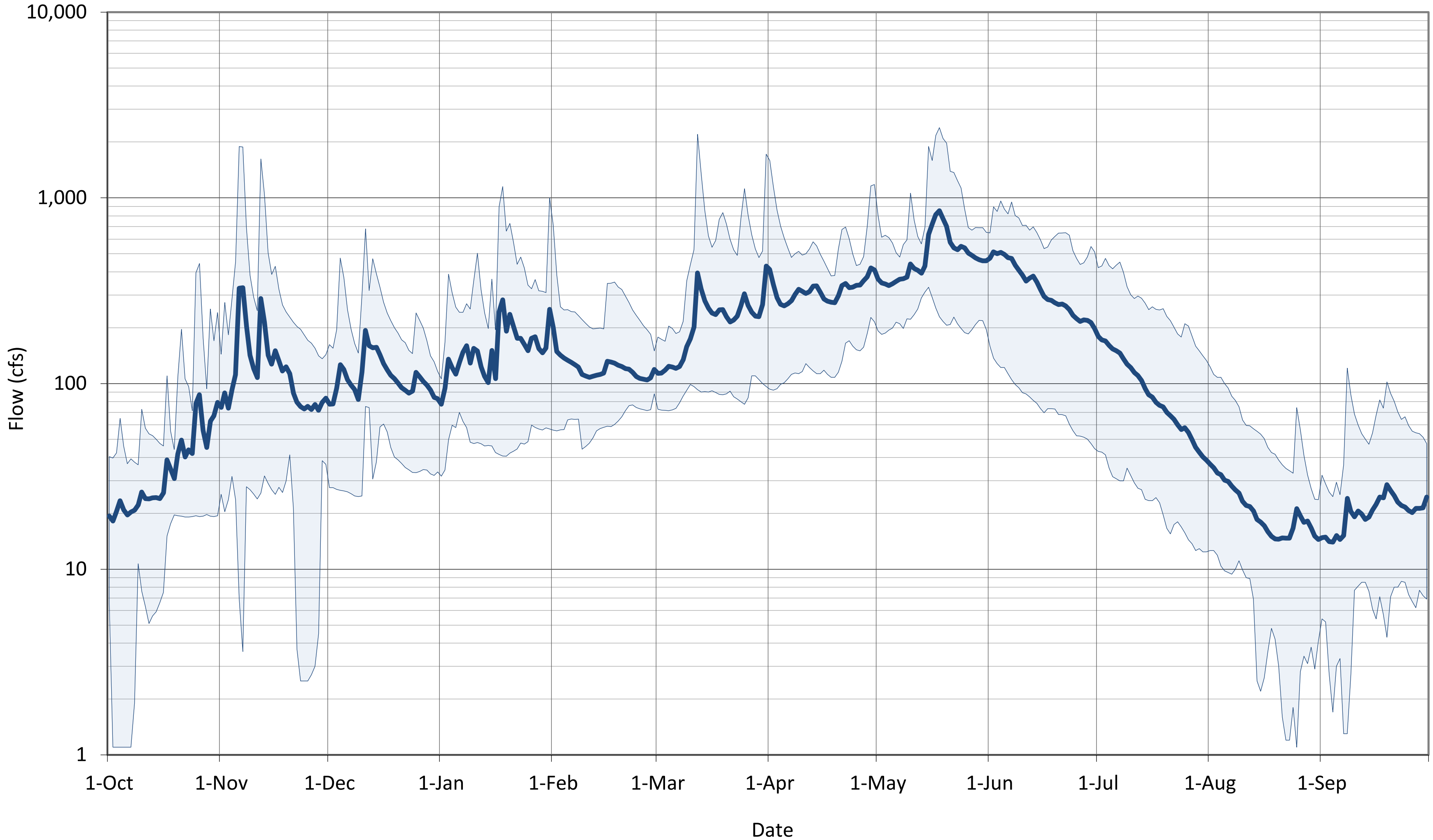

Legend:

ECY No. 45F070
Peshastin Creek at Green Bridge Road

Range of flow (2003-2011)
Average

Figure 3-3
Comparison of Annual Flow Variation
Peshastin Creek
PID Pump Exchange Appraisal Study

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3.4 Comparison of Late Summer Flows to Fish Passage Flows

The flow monitoring records for Peshastin Creek at Green Bridge Road indicate that the flow in the creek is less than what is needed to establish fish passage in lower Peshastin Creek. As discussed in Section 3.2, approximately 41 cfs is needed downstream of the PID Diversion to maintain adequate fish passage conditions for Chinook salmon at all transects surveyed for the instream flow analysis. With appropriate channel modifications at key sections of the creek channel (similar to Transect T-5), the flow needed to maintain fish passage for Chinook salmon could be reduced to approximately 28 cfs.

The flows measured at Green Bridge Road and at the next upstream gage (Ecology No. 45F100) were plotted against the flow required for Chinook salmon passage for the period of 2003-2008 in Figures 3-4 through 3-8. The period of year plotted is June to November to capture the entire late summer/early fall low flow period for each year. The critical flow period for passage of Chinook salmon is August and September. The PID diversion operates until the end of September in most years. The critical flow period for passage for bull trout is from mid-August through mid-November. However, incubation and rearing of Chinook salmon and bull trout occur throughout the year. Note that the natural flow in Peshastin Creek (as estimated using Ecology Station 45F100 at RM 9.4) is less than the fish passage flow for much of the August-September time period.

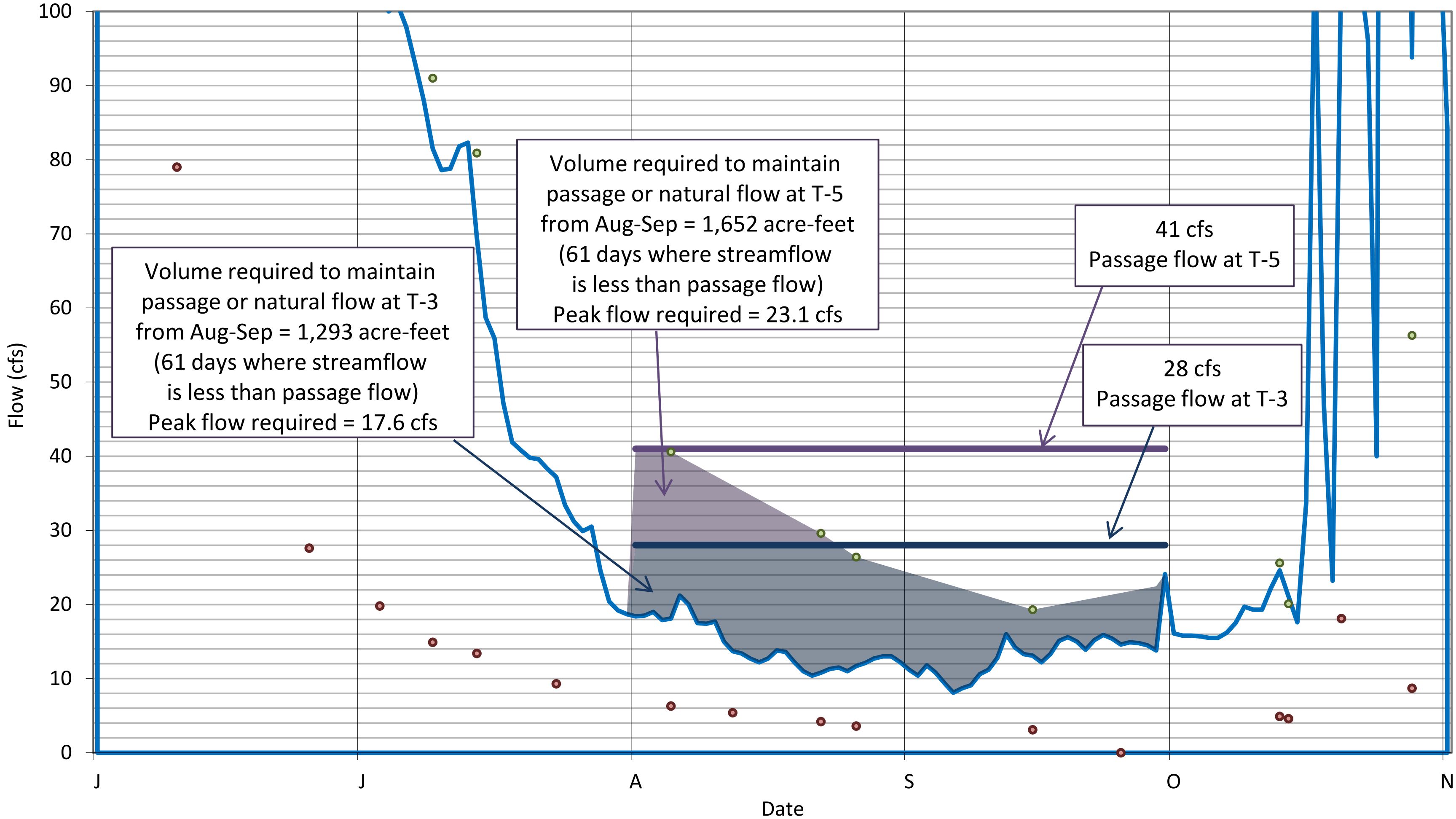
Table 3-4 summarizes the flow volume that would be needed to provide the difference in flow between that measured at Green Bridge Road and the natural flow in Peshastin Creek. This volume would equal the volume of water diverted by the PID from Peshastin Creek. It is the maximum amount of water that could be provided by exchanging water pumped from the Wenatchee River with water diverted from Peshastin Creek. The volume was calculated by subtracting either the fish passage flow or the natural flow in Peshastin Creek from the flow at Green Bridge Road. Table 3-4 also summarizes the number of days in August and September that flows were less than those recommended for Chinook salmon passage, and the peak flow that would be needed to maintain either the required passage flow at Transects T-3 and T-5 or natural flow. On average, streamflows were less than the 28 cfs passage flow at Transect T-3 for an average of 56 days during August and September during the period of record. The average maximum additional flow that would have been needed to maintain a stream flow of 28 cfs downstream of Green Bridge Road during the period of record was 20 cfs. The average volume required would have been 1,538 acre-feet. Streamflows were less than the 41-cfs passage flow required at Transect T-5 for an average of 59 days during the late summer and early fall during the period of record. The average maximum additional flow that would have been needed to maintain a passage flow of 41 cfs or the natural flow downstream of Green Bridge Road during the period of record was 26 cfs. The average volume required would have been 1,995 acre-feet.

Table 3-4

Flows Needed to Maintain Chinook Salmon Passage Flow (August and September)

Year	Transect T-3 (Passage Flow=28 cfs)			Transect T-5 (Passage Flow=41 cfs)		
	Volume Needed (acre-feet)	Days Streamflow < Passage Flow	Maximum Additional Flow Needed (cfs)	Volume Needed (acre-feet)	Days Streamflow < Passage Flow	Maximum Additional Flow Needed (cfs)
2003	1,293	61	17.6	1,652	61	23.1
2004	1,186	38	22.6	1,851	48	29.0
2005	1,935	61	22.4	1,959	61	22.4
2006	1,633	59	18.4	2,125	61	28.1
2007	1,869	60	23.2	2,339	61	29.9
2008	1,313	56	18.1	2,041	61	25.2
AVERAGE	1,538	56	20.4	1,995	59	26.3

As a check, the diversion data illustrated in Figure 3-1 were compared to the volumes shown in Table 3-4. The average volume diverted by PID in August and September for the years data is available is approximately 1,700 acre-feet, which is consistent with the results shown in Table 3-4.



Legend:

- ECY 45F070; Peshastin Creek at Green Bridge Road
- Volume Required to Maintain Passage or Natural Flow at Transect T-3
- Volume Required to Maintain Passage or Natural Flow at Transect T-5
- ECY 45F100; Peshastin Creek Below Ingalls Creek
- ECY 45F110; Peshastin Creek Above Ingalls Creek
- Flow Required for Chinook Passage at Transect T-3
- Flow Required for Chinook Passage at Transect T-5

Figure 3-4
Comparison of Flows to Fish Passage Flows
Calendar Year 2003
PID Pump Exchange Appraisal Study

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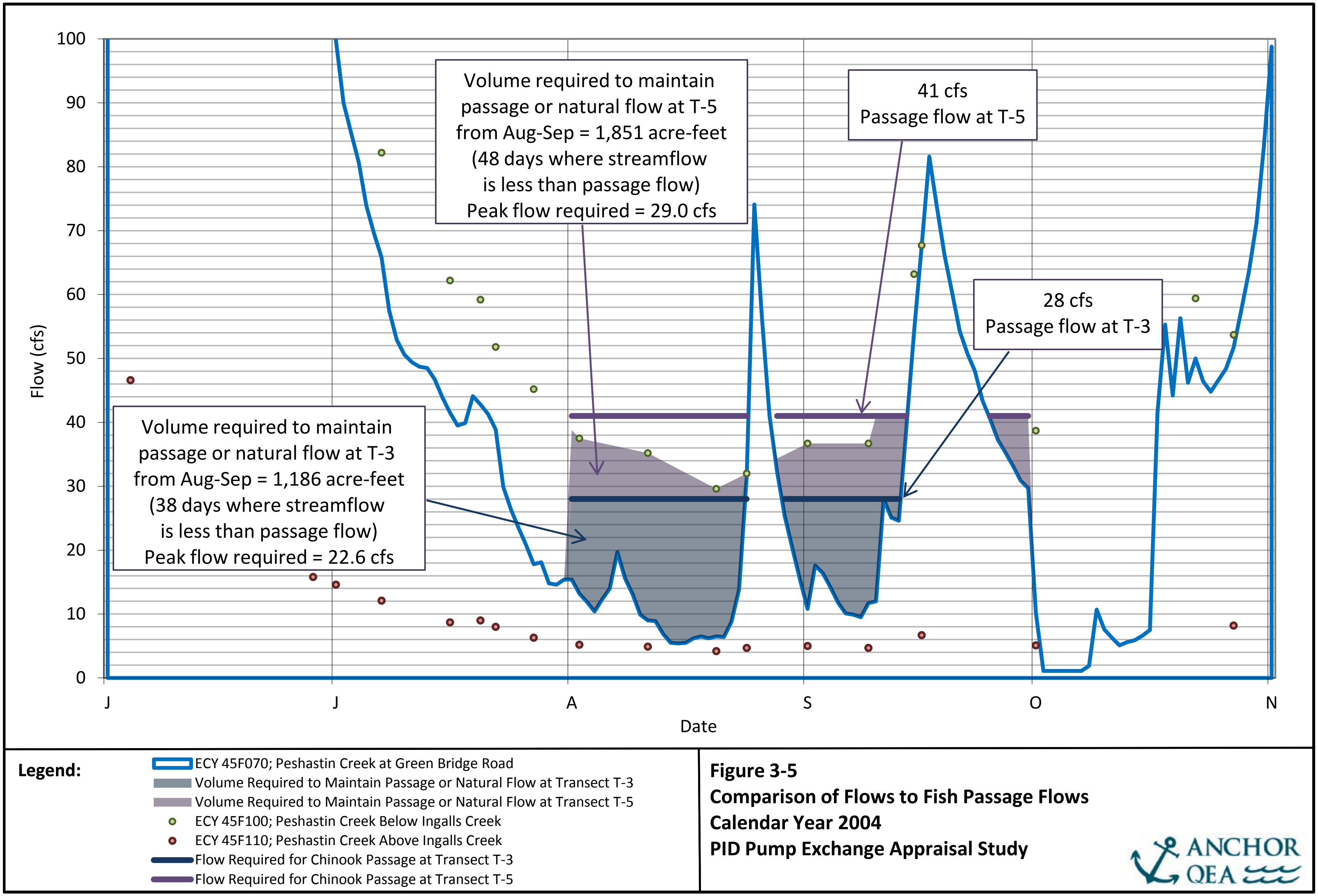

Figure 3-5
Comparison of Flows to Fish Passage Flows
Calendar Year 2004
PID Pump Exchange Appraisal Study

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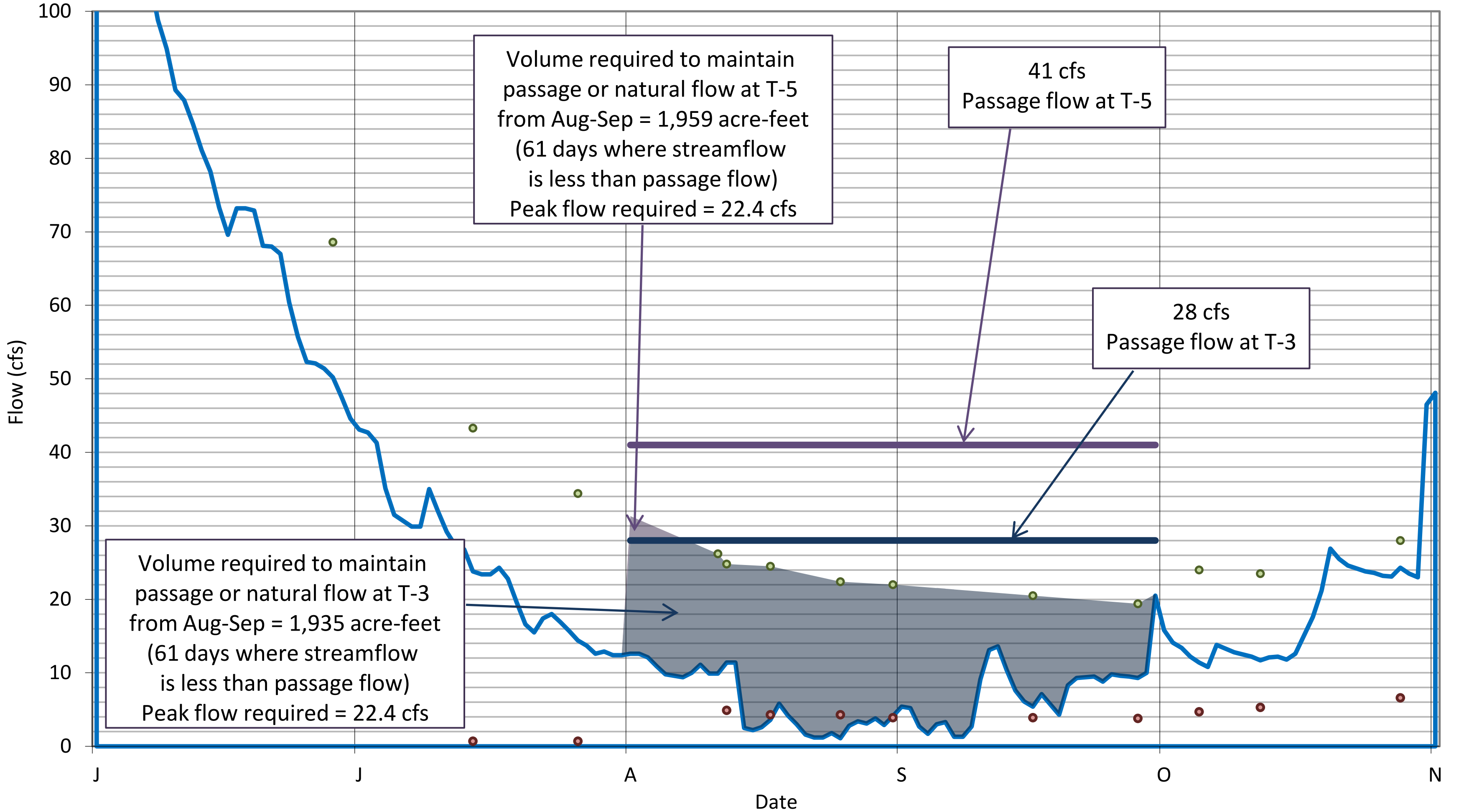

Legend:

- ECY 45F070; Peshastin Creek at Green Bridge Road
- Volume Required to Maintain Passage or Natural Flow at Transect T-3
- Volume Required to Maintain Passage or Natural Flow at Transect T-5
- ECY 45F100; Peshastin Creek Below Ingalls Creek
- ECY 45F110; Peshastin Creek Above Ingalls Creek
- Flow Required for Chinook Passage at Transect T-3
- Flow Required for Chinook Passage at Transect T-5

Figure 3-6
Comparison of Flows to Fish Passage Flows
Calendar Year 2005
PID Pump Exchange Appraisal Study

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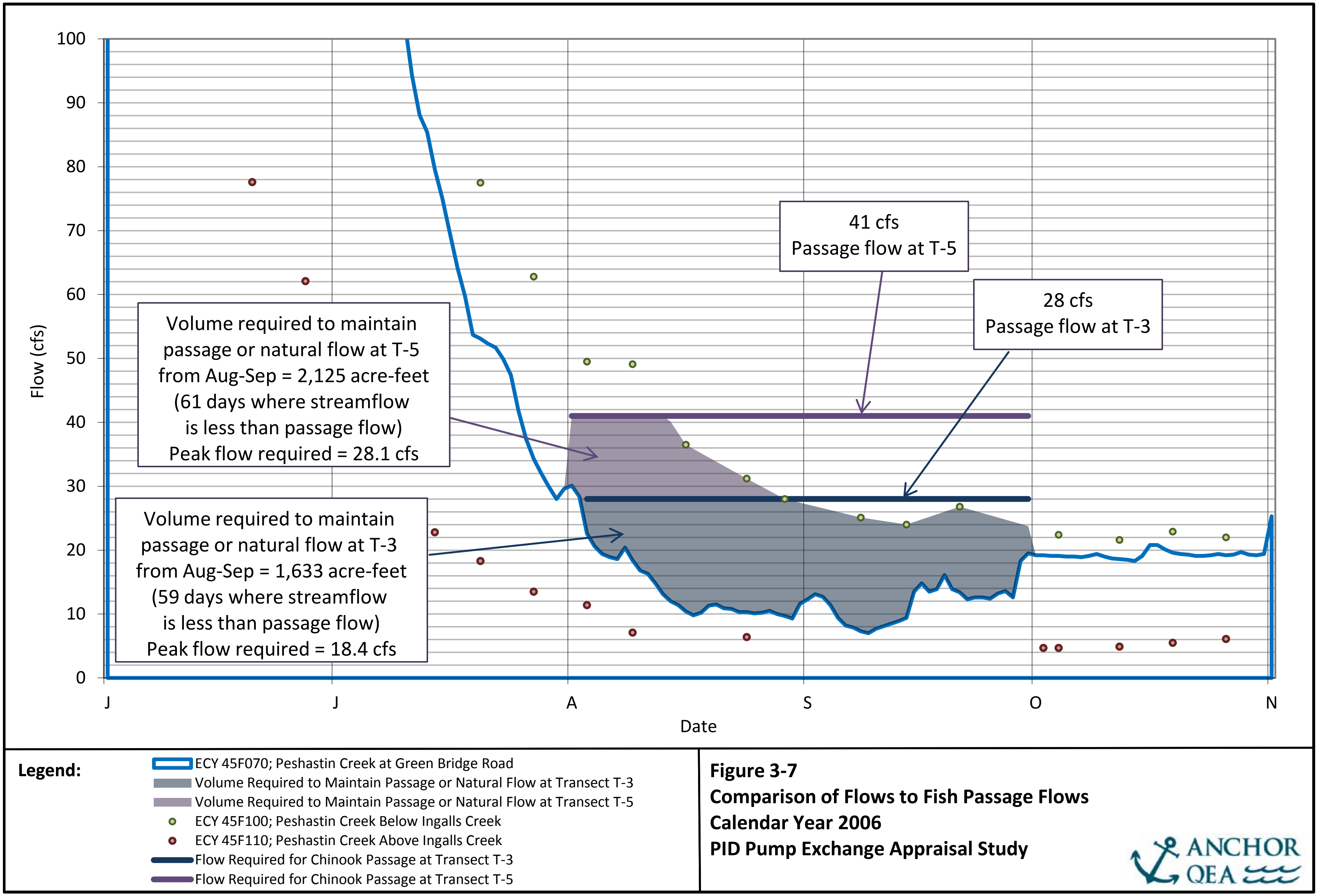
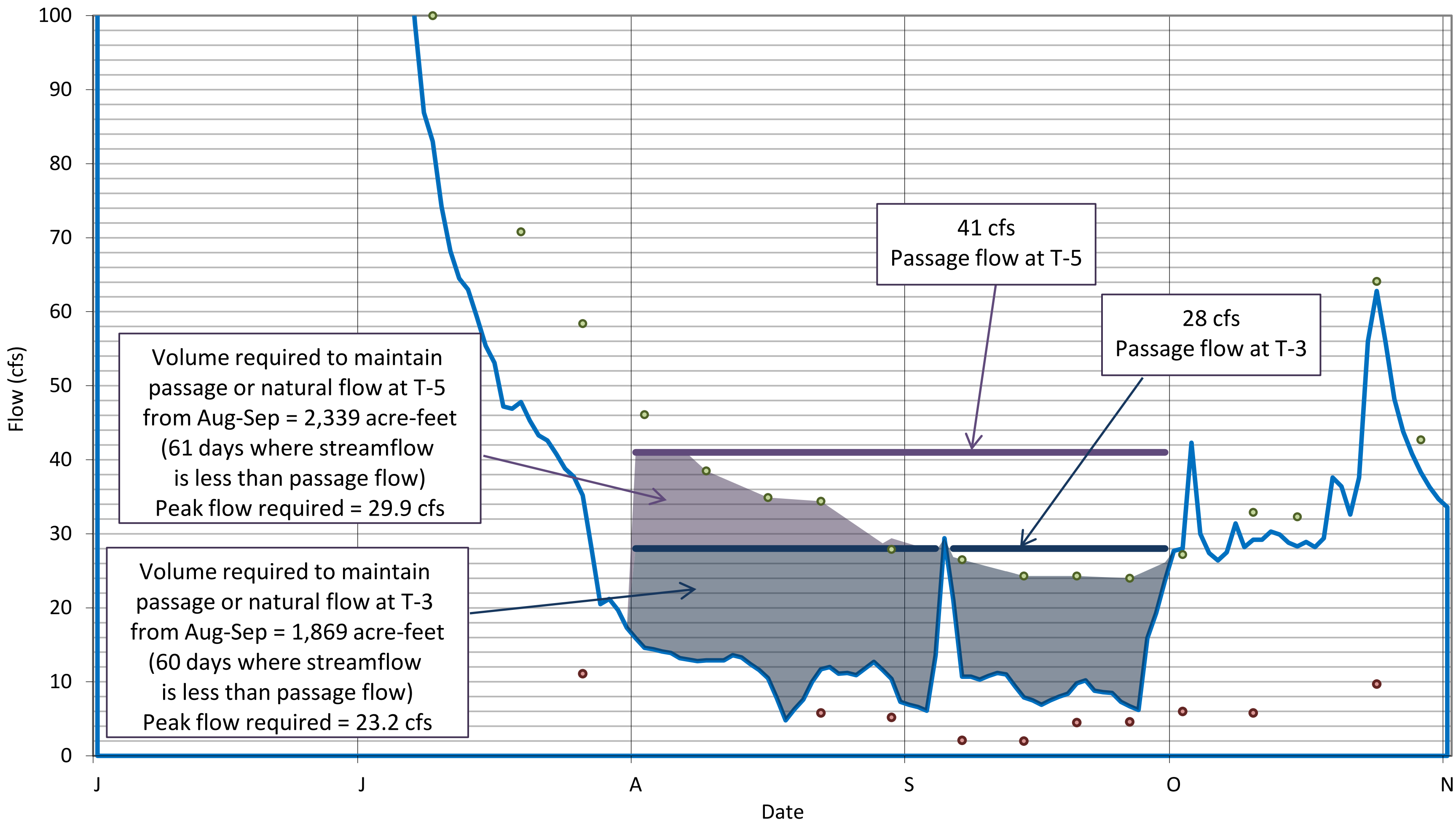


Figure 3-7
Comparison of Flows to Fish Passage Flows
Calendar Year 2006
PID Pump Exchange Appraisal Study



Legend:

- ECY 45F070; Peshastin Creek at Green Bridge Road
- Volume Required to Maintain Passage or Natural Flow at Transect T-3
- Volume Required to Maintain Passage or Natural Flow at Transect T-5
- ECY 45F100; Peshastin Creek Below Ingalls Creek
- ECY 45F110; Peshastin Creek Above Ingalls Creek
- Flow Required for Chinook Passage at Transect T-3
- Flow Required for Chinook Passage at Transect T-5

Figure 3-8
Comparison of Flows to Fish Passage Flows
Calendar Year 2007
PID Pump Exchange Appraisal Study

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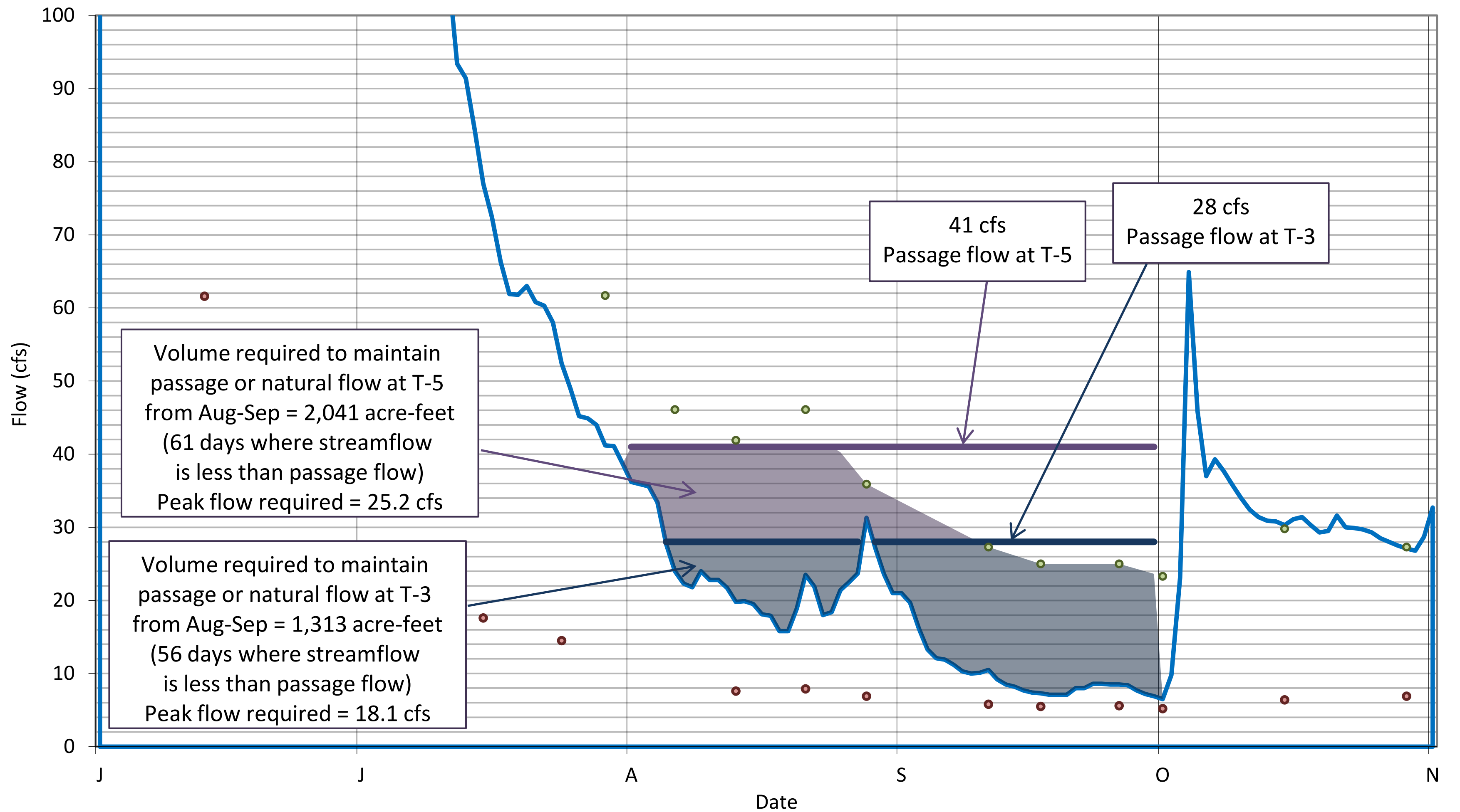

Legend:

- ECY 45F070; Peshastin Creek at Green Bridge Road
- Volume Required to Maintain Passage or Natural Flow at Transect T-3
- Volume Required to Maintain Passage or Natural Flow at Transect T-5
- ECY 45F100; Peshastin Creek Below Ingalls Creek
- ECY 45F110; Peshastin Creek Above Ingalls Creek
- Flow Required for Chinook Passage at Transect T-3
- Flow Required for Chinook Passage at Transect T-5

Figure 3-9
Comparison of Flows to Fish Passage Flows
Calendar Year 2008
PID Pump Exchange Appraisal Study

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4 DESCRIPTION OF PRELIMINARY ALTERNATIVES

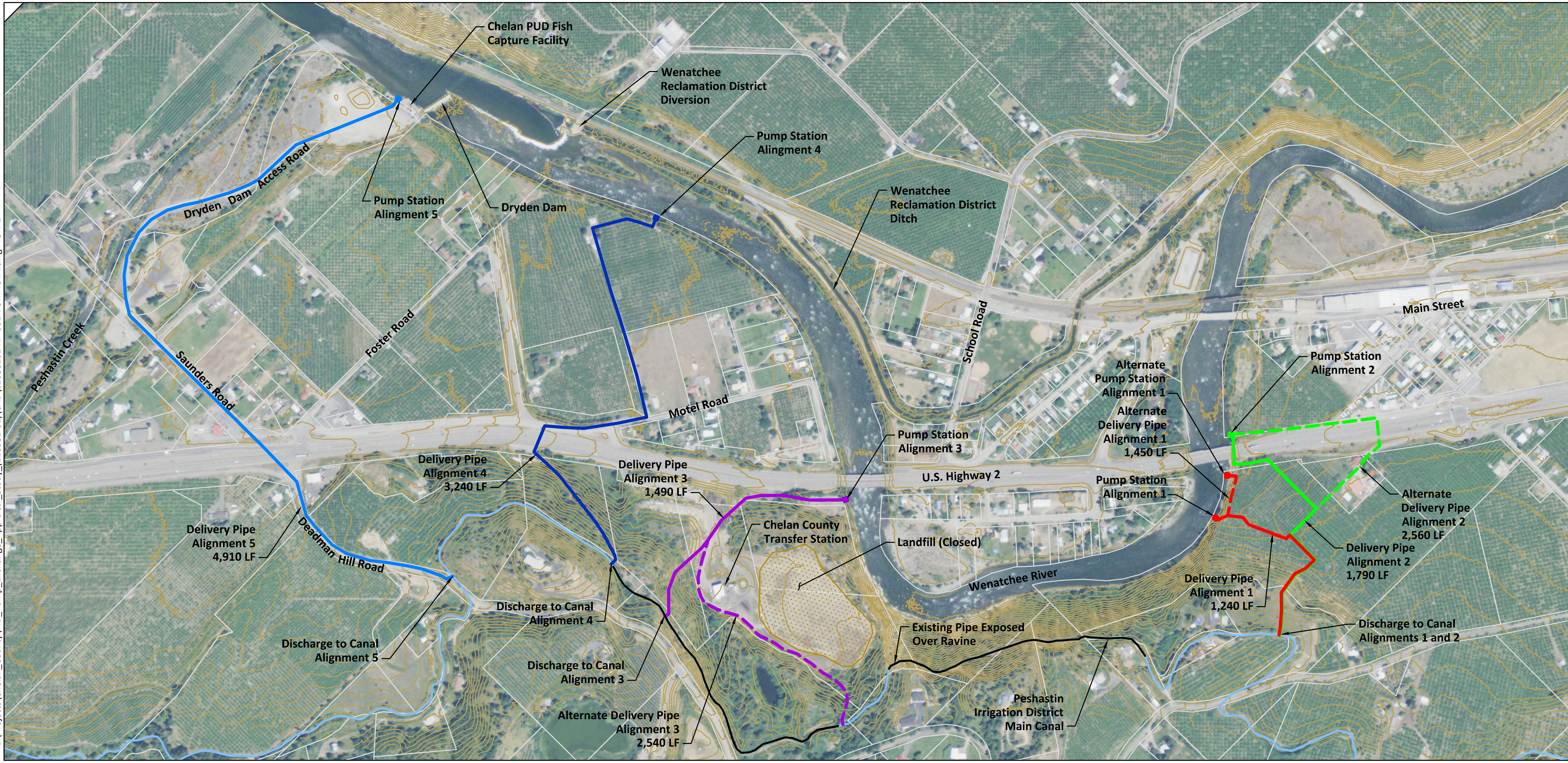
As part of an initial analysis of the pump exchange project completed as part of the *Campbell Creek Reservoir Feasibility Study* (Anchor QEA 2010), five alternatives were developed by identifying five potential pump station locations on the right bank of the Wenatchee River, with corresponding delivery pipeline alignments and delivery locations at the PID Canal. Those alternatives have been reviewed and refined as part of the work done for this study. This section provides a brief summary of each of the proposed alternatives and outlines potential alternate facility locations and alignments that may be considered. Photographs of the proposed pump station locations, pipeline alignments, and delivery locations associated with the alternatives are included in Appendix A. The major components of each alternative are shown on a map in Figure 4-1.

4.1 Alternative 1

Alternative 1 would include the following:

- A pump station located on the right bank of the Wenatchee River, just southwest (upstream) of U.S. Highway 2, approximately 7,250 feet downstream of the confluence of Peshastin Creek with the Wenatchee River (approximately RM 16.5)
- A 1,240-foot delivery pipeline that would extend south and east through an existing orchard, and then south and west up a steep hillside to the PID Canal
- A delivery structure at the PID Canal approximately 19,560 feet downstream of the diversion at Peshastin Creek

The pump station would be located along a portion of the river with a relatively steep, high bank. The bank has been prone to erosion and movement, as evidenced by an existing wood structure that is propped up by wood supports over a portion of the bank that has eroded. The geomorphic analysis in Section 5 recommends locating the pump station adjacent to a portion of the river bank where bedrock is exposed. The pipeline alignment would cross private property and ascend a steep hill at an average slope of approximately 30 percent. The delivery structure would need to be designed to transition flow from the outlet of the pressurized delivery pipeline to an open, concrete-lined section of the PID Canal.



L:\Projects\Chelan_County\PID_Pump_Exchange_Appraisal_Study_(110382-01)\CAD\110382-RP-001-PUMP STA.dwg FIG 4-1

Aug 20, 2012 3:46pm drice

SOURCE: Basemap with 2006 NAIP Aerial Photography and 10-foot contours generated from LIDAR.

HORIZONTAL DATUM: Washington State Plane North, NAD83.

VERTICAL DATUM: NAVD 88.

LEGEND:

	Pump Station	Delivery Pipeline
Alternative 1		
Alternative 2		
Alternative 3		
Alternative 4		
Alternative 5		
	Proposed / Potential Alternate	Proposed / Potential Alternate

Existing PID Ditch
Existing Pipe
Contour (10-foot)
Parcels
Existing Landfill

0 600
Scale in Feet

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Figure 4-1
Preliminary Alternatives
Peshastin Irrigation District Pump Exchange Appraisal Study
Chelan County Natural Resources Department

If the proposed pump station location shown will not work due to access or bank stability issues, an alternate pump station location could be considered closer to the U.S. Highway 2 bridge. A total of 1,450 feet of delivery pipe would be required if the pump station was located adjacent to the U.S. Highway 2 bridge.

4.2 Alternative 2

Alternative 2 would include the following:

- A pump station located on the right bank of the Wenatchee River, just north (downstream) of U.S. Highway 2, approximately 7,800 feet downstream of the confluence of Peshastin Creek with the Wenatchee River (approximately RM 16.4)
- A 1,790-foot delivery pipeline that would extend south under the U.S. Highway 2 bridge, south and east through an existing orchard, and then south and west up a steep hillside to the PID Canal
- A delivery structure at the PID Canal approximately 19,560 feet downstream of the diversion at Peshastin Creek

The pump station would be located along a portion of the river with a relatively steep bank, adjacent to an existing orchard. The proposed pipeline alignment would cross WSDOT right-of-way adjacent to the existing U.S. Highway 2 bridge abutment, extend through private property, and ascend a steep hill at an average slope of approximately 30 percent. The delivery structure would need to be designed to transition flow from the outlet of the pressurized delivery pipeline to an open, concrete-lined section of the PID Canal.

If crossing U.S. Highway 2 under the existing bridge is not acceptable to WSDOT, an alternate alignment could be considered that would extend east from the pump station, along the edge of the U.S. Highway 2 right-of-way and cross the U.S. Highway 2 right-of-way via directional drilling, boring, or jacking at a location closer to the center of Dryden. This alternate alignment would require a total of 2,560 feet of delivery pipeline.

4.3 Alternative 3

Alternative 3 would include the following:

- A pump station located on the right bank of the Wenatchee River, just south (downstream) of U.S. Highway 2, approximately 4,650 feet downstream of the confluence of Peshastin Creek with the Wenatchee River (approximately RM 17.0)
- A 1,490-foot delivery pipeline that would extend south and west, crossing the access road to the Dryden Transfer Station (former Dryden Landfill), and extending up a steep hill to the PID Canal
- A delivery structure at the PID Canal, which is in a welded-steel pipe through this area, approximately 14,720 feet downstream of the diversion at Peshastin Creek

The pump station would be located along a portion of the river with riparian foliage. The proposed pipeline alignment would extend west along the edge of the U.S. Highway 2 right-of-way, then up the hillside and across the access road to the Dryden Transfer Station. The alignment would ascend a steep hillside from the Dryden Transfer Station to the PID Canal at an average slope of approximately 24 percent. The delivery structure would need to be designed to transition flow from the outlet of the pressurized delivery pipeline to a gravity flow, welded-steel pipeline that comprises the PID Canal at the proposed delivery location.

An alternate alignment and delivery location could be considered for this alternative that would consist of extending the delivery pipeline around the west and south edge of the former Dryden Landfill, near the toe of the hillside above the landfill, and ascending a gentler slope to the Canal near the south end of the landfill. This alignment would require a total of 2,540 feet of delivery pipeline.

4.4 Alternative 4

Alternative 4 would include the following:

- A pump station located on the right bank of the Wenatchee River, adjacent to a private orchard, approximately 2,560 feet downstream of the confluence of Peshastin Creek with the Wenatchee River (approximately RM 17.4)

- A 3,240-foot delivery pipeline that would extend south, through the private orchard to Motel Road, west on Motel Road to U.S. Highway 2, across U.S. Highway 2, and up a steep driveway to the PID Canal
- A delivery structure at the PID Canal, which transitions from an open, concrete-lined Canal to a welded-steel pipe through this area, approximately 14,240 feet downstream of the diversion at Peshastin Creek

The pump station would be located along a portion of the river with riparian foliage and a relatively steep, high bank. The proposed pipeline alignment would extend through a private orchard to public right-of-way; cross U.S. Highway 2 via directional drilling, boring, or jacking; and ascend a relatively steep driveway at an average slope of approximately 18 percent to the PID Canal. PID has indicated that it has an easement that allows access to the Canal using this driveway. The delivery structure could be designed to transition flow from the outlet of the pressurized delivery pipeline to an open, concrete-lined Canal or a gravity flow, welded-steel pipeline.

4.5 Alternative 5

Alternative 5 would include the following:

- A pump station located on the right bank of the Wenatchee River, just upstream of the Dryden Dam and Chelan PUD fish facility, approximately 700 feet downstream of the confluence of Peshastin Creek with the Wenatchee River (approximately RM 17.8)
- A 4,910-foot delivery pipeline that would extend south and west, along the Dryden Dam access road, across U.S. Highway 2, and up Deadman Hill Road to the PID Canal
- A delivery structure or fittings at the PID Canal, which is an open concrete-lined Canal through this area, approximately 12,860 feet downstream of the diversion at Peshastin Creek

The pump station would draw water from the pool of water behind the Dryden Dam. The proposed pipeline alignment would extend along the Dryden Dam access road, cross U.S. Highway 2 via directional drilling, boring, or jacking; and extend up Deadman Hill Road to the PID Canal. The delivery structure could be designed to transition flow from the outlet of the pressurized delivery pipeline to an open, concrete-lined section of the PID Canal.

5 EVALUATION OF PRELIMINARY ALTERNATIVES

Each of the alternatives outlined in Section 4 was evaluated with the intent of identifying fatal flaws or challenges and providing enough background for stakeholders to narrow down the alternatives to one or two preferred alternatives. The evaluation included hydraulic analysis, site visits to observe and document existing conditions, a preliminary geomorphic analysis of the Wenatchee River channel, a geologic review of the delivery pipeline alignments, identification of property impacts, and environmental review and permitting fatal flaw analysis.

5.1 Hydraulic Analysis

Hydraulic analyses were completed to determine the preliminary size of pumps and pipe needed to deliver flows from the Wenatchee River to the PID Canal for each alternative. The analyses were completed for pump station flow rates of 10, 20, and 40 cfs, as outlined in Table 2-2. The results of the analyses are included in Appendix C. A spreadsheet analysis was used to estimate losses through the system, from the pump to the delivery at the Canal. A system curve was developed for each alternative that shows the estimated total dynamic head (TDH), or pumping head, required for pumping at different flow rates.

The Hazen-William formula was used to estimate friction losses through the system. The hydraulic analysis assumed that pump station manifold piping would be steel pipe with a Hazen-Williams coefficient of 110 and that the discharge piping would be plastic (HDPE or PVC) with a Hazen-Williams coefficient of 130. Minor losses were also estimated to account for losses through bends, valves, pipe entrances, pipe exits, and other fittings. The results of the hydraulic analysis are summarized in Table 5-1.

Table 5-1
Summary of Hydraulic Analysis Results

Design Parameter	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Pump Sump Elevation (feet)	923	922	935	953	972
Discharge Elevation (feet)	1,146	1,146	1,152	1,153	1,158
Elevation Gain (feet)	223	224	217	200	186
Delivery Pipe[1] Length (feet)	1,240	1,790	1,490	3,240	4,910
Delivery Pipe[1] Size (inches)					
At 10 cfs P.S. Capacity	20	20	20	20	20
At 20 cfs P.S. Capacity	30	30	30	30	30
At 40 cfs P.S. Capacity	36	36	36	36	36
Total Headloss[2] (feet)					
At 10 cfs P.S. Capacity	21	23	22	28	33
At 20 cfs P.S. Capacity	17	18	18	21	24
At 40 cfs P.S. Capacity	27	28	27	32	36
Pumping Head, TDH (feet)					
At 10 cfs P.S. Capacity	244	247	239	228	219
At 20 cfs P.S. Capacity	240	242	235	221	210
At 40 cfs P.S. Capacity	250	252	244	232	222
Number of Pumps					
At 10 cfs P.S. Capacity	2	2	2	2	2
At 20 cfs P.S. Capacity	3	3	3	3	3
At 40 cfs P.S. Capacity	3	3	3	3	3
Flow Rate per Pump (cfs)					
At 10 cfs P.S. Capacity	5.00	5.00	5.00	5.00	5.00
At 20 cfs P.S. Capacity	6.67	6.67	6.67	6.67	6.67
At 40 cfs P.S. Capacity	13.33	13.33	13.33	13.33	13.33

Notes:
1. Delivery Pipe includes transmission pipeline from the pump station to the delivery at the PID Canal.
2. Total headloss includes both friction and minor losses through the pump station and delivery pipeline.
cfs = cubic feet per second
TDH = Total Dynamic Head, or Pumping Head

The results indicate the following:

- For a design flow rate of 10 cfs, a 20-inch delivery pipeline would be required. Two pumps would be required, each with a capacity of 5.0 cfs. The pumps would be required to deliver that flow rate against a TDH ranging from 219 feet (Alternative 5) to 247 feet (Alternative 2).

- For a design flow rate of 20 cfs, a 30-inch delivery pipeline would be required. Three pumps would be required, each with a capacity of 6.67 cfs. The pumps would be required to deliver that flow rate against a TDH ranging from 210 feet (Alternative 5) to 242 feet (Alternative 2).
- For a design flow rate of 40 cfs, a 36-inch delivery pipeline would be required. Three pumps would be required, each with a capacity of 13.33 cfs. The pumps would be required to deliver that flow rate against a TDH ranging from 222 feet (Alternative 5) to 252 feet (Alternative 2).

The pump station facility would include a fish screen consistent with NMFS and WDFW guidelines. Different types of screens are available for diversions and pumping that meet NMFS and WDFW guidelines, including fixed-plate screens, cylindrical end-of-pipe screens, rotating drum screens, vertical traveling screens, horizontal screens, and infiltration galleries. An inclined fixed-plate screen was identified as the most likely screening option for a pump station diverting water from the bank of the Wenatchee River. Table 5-2 provides a summary of the design parameters and sizes required for a fixed plate screen for the range of design flows that were evaluated as part of this analysis. Fish screen calculations are included in Appendix D.

Table 5-2
Fish Screen Sizing – Inclined Flat-Plate Screen

Maximum Screen Flow (cfs)	Maximum Approach Velocity (fps)	Effective Screen Area (ft^2)	Screen Area with FOS (ft^2)	Proposed Screen Height (ft)	Minimum Required Screen Length (ft)
10	0.4	25.00	31.75	4.0	7.9
20	0.4	50.00	63.50	4.0	15.9
40	0.4	100.00	127.00	4.0	31.8

Notes:
cfs = cubic feet per second
FOS = Factor of Safety
fps = feet per second
ft^2 = square feet

An inclined fixed-plate screen would consist of a flat screen supported by the sump structure, inclined at an angle to generally match the slope of the riverbank. Other types of screens considered included a cylindrical end-of-pipe screen and a rotating drum screen. At the flow rates that were used for the analysis, a cylindrical end-of-pipe screen would have to be very long or have a large diameter and would likely not be practical because of the slope of the river, its shallow depth, and coarse substrate. A rotating drum screen could potentially work in this application if sited appropriately to provide the proper submergence and flow conditions.

In order to minimize maintenance, ensure proper performance, and secure approval by WDFW, the screen would need to be self-cleaning. Typical self-cleaning options for an inclined, fixed plate screen would include a mechanical air-burst system or mechanical brush. Another similar self-cleaning screen option would include an inclined traveling water screen that would rotate on a conveyor. Debris would be lifted out of the water and removed with internal water jets, a brush, or other self-cleaning mechanism.

5.2 Geomorphic Analysis of Wenatchee River Channel

A preliminary geomorphic analysis of the Wenatchee River channel through the study area was completed by visiting the study area, documenting conditions at each of the proposed pump station sites, and reviewing aerial photographs and other available information. A summary of the geomorphic analysis for each of the proposed diversion structure and pump station sites is summarized below. Photographs of the river channel at the proposed pump station sites are included in Appendix A.

5.2.1 Alternative 1

The diversion structure and pump station for Alternative 1 would be placed just upstream of the easternmost U.S. Highway 2 bridge in the study area. Although a pump station location was initially reviewed adjacent to the bridge, the recommended pump station location would be further upstream, just downstream of an exposed bedrock knob in the river. Bank materials at the proposed pump station location are composed of native small to large cobble with some large rock at approximately a 1:1 slope. A significant portion of the main flow is along the right bank and interacts with the bedrock creating and maintaining a large, deep pool. The bedrock knob would help protect the diversion structure during high flows and the deep pool would provide assurance that diversions can occur during low flow time periods. Because of the location on the outside of the bend and the proximity to the bedrock forced pool, it is likely that future channel maintenance at this location would be minimal.

5.2.2 Alternative 2

The diversion and pump station for Alternative 2 would be located just downstream of the easternmost U.S. Highway 2 bridge in the study area. The right bank at this location is primarily composed of large rounded rock at an approximately 1:1 grade. These rocks may be derived from the channel or bank, or may have been imported to provide bank stability in associated with bridge construction or maintenance. The diversion structure would be sheltered from high flows by the bridge. The main flow of the channel is located away from the right bank and some manipulation to the channel bed leading to the diversion site would need to occur to enable water diversion during low flow conditions. During high flows, gravel bed materials would likely be in active transport adjacent to the diversion structure and this dynamic should be considered in design planning. It is likely that some maintenance within the mainstem channel would be necessary to maintain the ability to extract water.

5.2.3 Alternative 3

The diversion and pump station for Alternative 3 would be placed just downstream of the westernmost U.S. Highway 2 bridge in the study area. The right bank at this location is primarily composed of large rounded rock at an approximately 2:1 grade. These rocks are likely native bank materials. The diversion structure would be sheltered from high flows by the bridge. Because of the bank condition, the diversion structure would likely need to be constructed on a greater angle than a structure built at Sites 1 or 2. The main flow of the channel is located near the middle of the river and some manipulation to the channel bed leading to the diversion site would need to occur to enable water diversion during low flow conditions. Because this site is located along the inside of a bend, it is likely that gravel materials will deposit along this bank in the future. Therefore, it is expected that the river channel leading to the diversion would require regular maintenance to provide adequate flow to the diversion.

5.2.4 Alternative 4

The diversion and pump station for Alternative 4 would be located on the right bank of the river channel approximately 1,800 feet downstream of the Dryden Dam. The right bank at this location is primarily composed of large rounded rock at an approximately 2:1 grade. These rocks are likely native bank materials. The diversion structure could be constructed into the bank; however, shelter from high flows would be minimal. Because of the bank condition, the diversion structure would likely need to be constructed on a greater angle than a structure built at Sites 1 or 2. The main flow of the channel is located near the far bank of the river and some manipulation to the channel bed leading to the diversion site would need to occur to enable water diversion during low flow conditions. Because of the distance between the right bank and main flow in the channel at this location, it is likely that gravel materials will deposit along this bank in the future. Future maintenance at this site is uncertain. It is likely that during lower water years deposition would occur in the river adjacent to the diversion site. During high water years, the diversion structure could experience scour if not built carefully into the bank.

5.2.5 Alternative 5

The diversion and pump station for Alternative 5 would be located just upstream of Chelan PUD's fish rearing facilities on the right bank of the river channel upstream of the Dryden Dam. Geomorphic conditions at this site are largely muted because of the presence of the Dryden Dam. Bank materials are largely composed of fill. The river is pooled up behind the Dryden Dam allowing for a high certainty of diversion during low flow periods. It is not expected that manipulation of the river channel would be required to divert water at this location. Chelan PUD has indicated that they have had to remove material from behind the dam. However, future maintenance of the channel directly related to a diversion structure at this location would be unlikely.

5.2.6 Summary

Based on a preliminary review of geomorphic conditions in the study area, pump station locations proposed for Alternatives 1 and 5 appear to be the best suited for diversion placement of the sites evaluated. Both of these sites likely provide a high certainty of diversion during low flows without manipulating the river and future maintenance will likely be minimal compared to the other alternative sites evaluated.

The proposed pump station location for Alternative 2 is feasible, but would likely require greater channel maintenance efforts to maintain diversions during low flows. The proposed pump station locations for Alternatives 3 and 4 are not well suited for a diversion structure because of the likely level of instream manipulation that would be required to successfully extract water during low flow periods and the channel maintenance that would likely be required to allow diversion in the future.

5.3 Geologic Review of Pipeline Alignments

The primary geologic hazard associated with each alternative alignment is the potential for landslides. Once a preferred alignment is selected, a more in-depth site investigation including soil borings and/or test pits should be conducted along with a slope stability analysis. A brief discussion of geological units expected to be encountered, slope stability risk, and geotechnical constructability issues relating to each of the proposed alignments is presented below. This discussion is based on review of the available geologic and subsurface information, as well as a site visit conducted on July 29, 2011. Geology and soils maps for the study are included in Appendix E.

5.3.1 Alternative 1

The pipeline alignment for Alternative 1 would begin along the south side of U.S. Highway 2 adjacent to the existing concrete bridge structure crossing the Wenatchee River. The pump station for this alignment would be located on the outside of a 90-degree river bend and would be located at a steep portion of the river bank that shows signs of severe erosion resulting from high velocity flows and energy causing over-cutting of the bank soils. Excavation for the pump station would encounter the Coarse Grained Alluvium unit and large boulders and cobbles are expected to be encountered. The bank extends about 10 to 15 feet above the existing water surface and some shoring could be required to construct the pump station at this location.

From the pump station, the pipe alignment would extend along a moderately steep (5 to 15 percent) slope through an existing orchard field before turning at a 90 degree bend where it would continue directly up a steep slope (greater than 25 percent) to reach an open portion of the canal. The alignment through the moderately steep and steep portions would likely encounter the Fine Grained Alluvium and Sandstone units. A landslide area is mapped as being present along the west side of this alignment; however, no evidence of recent slide activity was observed along the hillside portion of this alignment and a large portion of the hillside appears to have been terraced in the past for agricultural purposes. A stand of timber along the south side of the hillside alignment showed no indication of tilting or distress.

Slope stability risks associated with this alignment are low to moderate. Construction of this alignment would be more conventional since a highway crossing is not required.

5.3.2 Alternative 2

The pipeline alignment for Alternative 2 would be similar to Alternative 1 but would begin along the north side of U.S. Highway 2 adjacent to the existing concrete bridge structure crossing the Wenatchee River. The pump station for this alignment would be located a few hundred feet downstream from the Alignment 1 pump station at a bank location less prone to erosion and more protected from direct stream flow energy by the bridge structure. Excavation for the pump station would encounter the Coarse Grained Alluvium unit and large boulders and cobbles are expected to be encountered. The bank extends about 10 to 15 feet above the existing water surface and some shoring could be required to construct the pump station and possibly to protect the bridge abutment fill slope.

From the pump station, the pipe alignment would either extend under the bridge and follow Alternative 1, or extend along the east side of U.S. Highway 2 for about 500 feet before crossing underneath the highway and across the orchard field where it would then match Alternative 1. Jacking and boring would be required to install the pipe beneath U.S. Highway 2. It is likely that the jack and bore section would encounter the Coarse Grained Alluvium unit resulting in a challenging installation. For this reason, it would likely be more feasible and cost effective to extend the pipe under the bridge, if allowed by WSDOT. This would require installation of the pipe in low overhead conditions within the abutment fill slope while working under the bridge deck structure. While challenging, this method would likely be feasible provided the bridge abutment foundations are not disturbed or undermined. WSDOT would need to be involved in the design and approval for the pipe section under the bridge or for the jack and bore section under U.S. Highway 2.

Slope stability risks associated with this alignment are low to moderate. Construction of a pipeline along this alignment would be moderately difficult due to the U.S. Highway 2 crossing.

5.3.3 Alternative 3

The pipeline alignment for Alternative 3 would begin along the south side of U.S. Highway 2 adjacent to the westernmost bridge crossing of the Wenatchee River in the study area. The pump station location is about 8 to 10 feet above the water along a steep section of the bank. Excavation for the pump station would encounter the Coarse Grained Alluvium unit and large boulders and cobbles are expected to be encountered.

The pipe alignment would run west along U.S. Highway 2 for about 500 feet. Excavation along this section will likely encounter the Coarse Grained Alluvium unit as well. The pipe alignment would then turn up a short steep section of slope (greater than 25 percent) where exposed surface soils appear to consist of a weathered component of the Sandstone unit. Evidence of recent or past slides was not observed along this shorter section of slope. The short slope crests along the north side of the closed Dryden Landfill and would cross the Dryden Dump Road near the existing Dryden Transfer Station. The ground surface surrounding the landfill is relatively flat and steep slopes border the west and south sides. These steep slopes show signs of recent slope instability. Slope instability is evidenced by undermining of the existing PID Canal pipe along a 20 feet section where it passes along the south side of the landfill. Significant movement was also observed along a section of Deadman Hill Road where it passes along the west side of the landfill. It appears that this section of Deadman Hill Road was constructed with a deep fill section that may be contributing to instability along this steep slope section.

Slope stability risks associated with this alignment are potentially high. Careful routing of the pipeline alignment, along with a detailed slope stability analysis would be required.

5.3.4 Alternative 4

The pipeline alignment for Alternative 4 would begin along a section of the river running along an existing orchard located north of U.S. Highway 2. Excavation for the pump station would encounter the Coarse Grained Alluvium unit and large boulders and cobbles are expected to be encountered. The pipe alignment would follow an existing gravel access road across the orchard until reaching U.S. Highway 2. The alignment from the pump station to U.S. Highway 2 is expected to encounter the Fine Grained Alluvium unit.

Jacking and boring would be required to install the pipe beneath U.S. Highway 2. It is likely that the jack and bore section would encounter the Fine Grained Alluvium unit or fill material previously placed during construction of U.S. Highway 2. It is anticipated that jacking and boring at this location would be easier than the crossing that would be required for the alternative pipeline alignment for Alternative 2.

The pipeline would follow an existing un-paved driveway up a moderately steep (15 to 25 percent) portion of the hillside to a point where the proposed pipeline would tie into an existing piped section of the PID Canal. Evidence of slope instability was not observed along the section of driveway, but the slope is mapped as a Landslide unit.

Slope stability risks associated with this alignment are low to moderate. Construction of this alignment would be moderately difficult due to the U.S. Highway 2 crossing and the limited access along the steep driveway leading to the discharge point.

5.3.5 Alternative 5

The final proposed pipeline alignment, for Alternative 5, would begin just upstream of Dryden Dam and downstream of the mouth of Peshastin Creek. The river bank is near the water surface at this location and would allow for easier installation of the pump station. As with the other alignments, excavation for the pump station would encounter the Coarse Grained Alluvium unit and large boulders and cobbles are expected to be encountered.

The pipeline alignment would follow the existing gravel access to the Dryden Dam and public right-of-way along Saunders Road to U.S. Highway 2. The existing gravel access road between the river and Saunders Road follows the former Peshastin Creek channel and the Coarse Grained Alluvium unit would likely be encountered. The Saunders Road section of the alignment rises out of the former creek channel and the Fine Grained Alluvium unit would likely be encountered. Jacking and boring would be required to install the pipeline under U.S. Highway 2. It is likely that the jack and bore section would encounter the Fine Grained Alluvium unit or fill material previously placed during construction of U.S. Highway 2.

From U.S. Highway 2, the pipeline would follow Deadman Hill Road to an open section of the PID Canal. This section of the alignment is likely to encounter the Fine Grained Alluvium unit overlying the Sandstone unit. The thickness of the Fine Grained Alluvium is expected to vary between U.S. Highway 2 and the discharge point. The alignment does not extend through an area mapped as a Landslide unit, but an area to the south is mapped as being part of a Landslide unit.

Slope stability risks associated with this alignment are low. Construction of a pipeline along this alignment would be moderately difficult due to the U.S. Highway 2 crossing and the limited right-of-way width along Deadman Hill Road.

5.4 Property Ownership and Right-of-Way Investigation

A review of property ownership and rights-of-way in the study area was conducted to identify potential impacts to properties and state or Chelan County rights-of-way that would result from construction of pump station, pipeline, and delivery facilities. Parcels that could potentially be impacted by each alternative are highlighted on Figure 5-1. Aerial photography, photographs from site visits, and Chelan County parcel data were used to identify impacted properties and summarize the potential impacts.

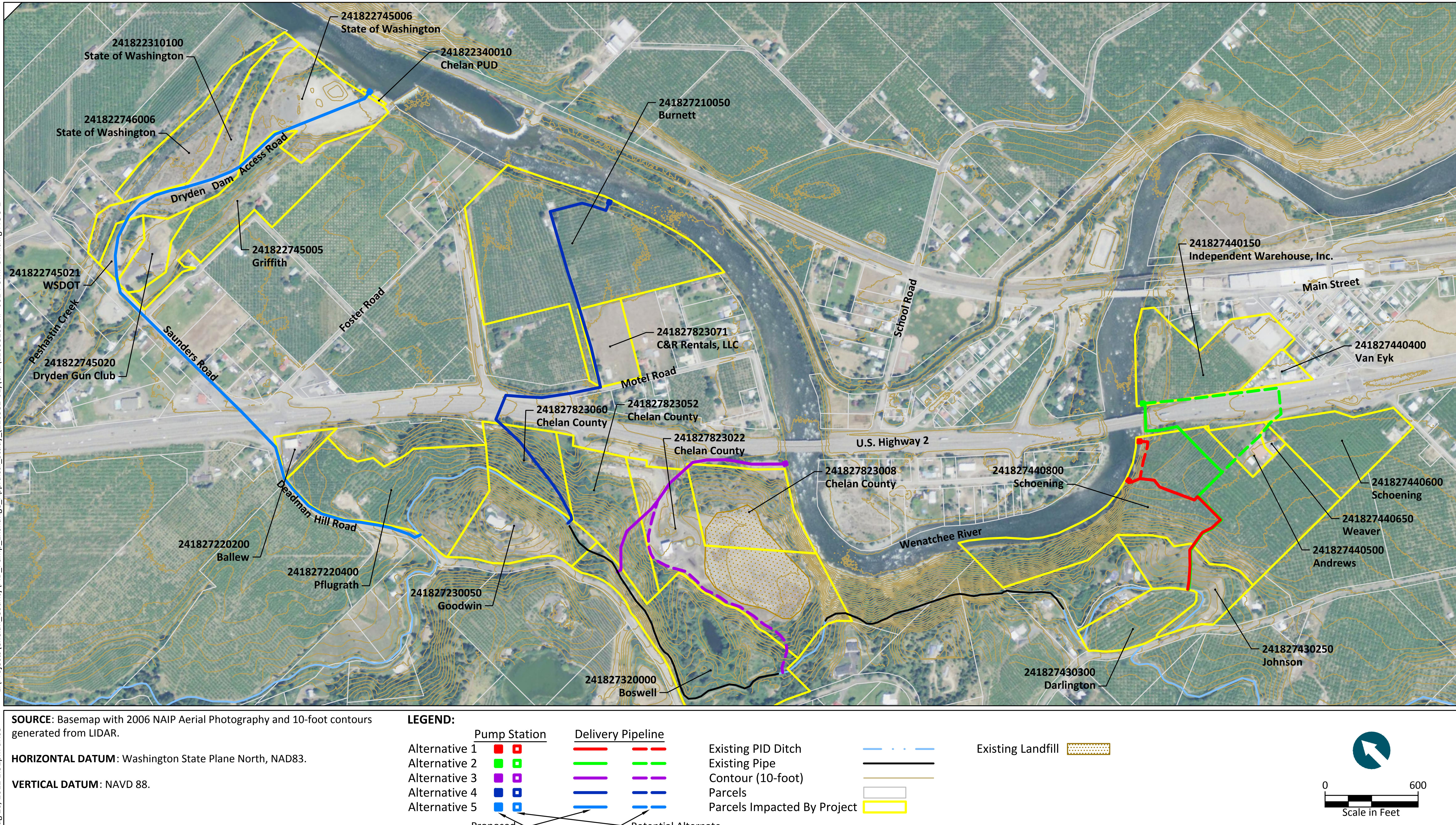

Figure 5-1
Parcel and Right-of-Way Impacts
Peshastin Irrigation District Pump Exchange Appraisal Study
Chelan County Natural Resources Department

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5.4.1 Alternative 1

Construction of the facilities included as part of Alternative 1 would directly impact two private properties and could potentially impact a third property located adjacent to the PID Canal at the delivery location. Table 5-3 lists a summary of the parcels that would be impacted by or are adjacent to Alternative 1.

Table 5-3
Properties Impacted by or Adjacent to Alternative 1

Parcel	Owner	Address	Impacted/Adjacent
241827430250	Frederick Johnson	PO Box 97 Dryden, WA 98821	Impacted
241827440800	Don Schoening TRT	6223 Pine Flats Loop Cashmere, WA 98815	Impacted
241827430300	Loren Darlington	PO Box 45 Dryden, WA 98821	Adjacent

The pump station would be constructed along the boundary of Parcel 241827440800. The proposed delivery pipeline alignment would cross an existing orchard through Parcel 241827440800. The pipeline would be designed to minimize impacts to the orchard as much as possible. However, construction of a large diameter pipeline would require a relatively wide trench and impacts to trees may not be avoidable. The proposed delivery pipeline would ascend a hillside through Parcel 241827430250 to the PID Canal. The alignment through this parcel appears to consist of open pasture. Construction may require access through the ditch easement along the boundary of Parcel 241827430300, which is privately owned, and construction of a delivery structure at the ditch could potentially have an impact on the parcel.

5.4.2 Alternative 2

Construction of the facilities included as part of Alternative 2 would directly impact three private properties and could potentially impact a fourth property located adjacent to the PID Canal at the delivery location. Additional parcels would be impacted if the alternate alignment shown in Figure 5-1 was selected. Table 5-4 lists a summary of the parcels that would be impacted by or are adjacent to Alternative 2.

Table 5-4
Properties Impacted by or Adjacent to Alternative 2

Parcel	Owner	Address	Impacted/Adjacent
241827430250	Frederick Johnson	PO Box 97 Dryden, WA 98821	Impacted
241827440150	Independent Warehouse Inc.	PO Box 60 Dryden, WA 98821	Impacted
241827440500	Frank Andrews	PO Box 451 Dryden, WA 98821	Impacted (Alternate Alignment Only)
241827440600	Donald Schoening	6223 Pine Flats Loop Cashmere, WA 98815	Impacted (Alternate Alignment Only)
241827440800	Don Schoening TRT	6223 Pine Flats Loop Cashmere, WA 98815	Impacted
241827430300	Loren Darlington	PO Box 45 Dryden, WA 98821	Adjacent
241827440400	Jeffrey Van Eyk et al.	900 Front St Ste D Leavenworth, WA 98826	Adjacent (Alternate Alignment Only)
241827440650	Andrew and Michelle Weaver	136 N Chelan Ave Wenatchee, WA 98801	Adjacent (Alternate Alignment Only)

The pump station would be constructed adjacent along the boundary of Parcel 241827440150. Construction of the pump station and access to the pump station could potentially impact the existing orchard on Parcel 241827440150. To the extent possible, the pump station and access road would be constructed along the edge of the orchard to minimize impact to existing trees. The proposed delivery pipeline alignment would then cross WSDOT right-of-way for U.S. Highway 2 under an existing bridge adjacent to the bridge abutment. WSDOT review and a right-of-way permit would be required. From the bridge to the PID Canal, property impacts would be similar to those listed for Alternative 1, including impacts to Parcels 241827440800, 241827430250, and 241827430300.

If the alternate alignment for the delivery pipe was selected, additional parcels would be impacted. Construction of the proposed delivery pipeline along the alternative alignment would extend along the boundary of Parcels 241827440150 and 241827440400 with U.S. Highway 2 right-of-way. The pipe would cross the WSDOT right-of-way at U.S. Highway 2 via directional drilling, jacking, or boring and would require a right-of-way permit. The delivery pipe would also impact the driveway in Parcel 241827440500 and would extend across or near the boundaries of Parcels 241827440650 and 241827440600.

5.4.3 Alternative 3

Construction of the facilities included as part of Alternative 3 would directly impact three Chelan County properties and could potentially impact a private property located adjacent to the PID Canal at the delivery location. Table 5-5 lists a summary of the parcels that would be impacted by or are adjacent to Alternative 3.

Table 5-5
Properties Impacted by or Adjacent to Alternative 3

Parcel	Owner	Address	Impacted/Adjacent
241827320000	Bradford Boswell	4182 1/2 Mississippi St San Diego, CA 92104	Impacted
241827823022	Chelan County Commissioner's Office	400 Douglas St Wenatchee, WA 98801	Impacted
241827823052	Chelan County Commissioner's Office	400 Douglas St Wenatchee, WA 98801	Impacted
241827823008	Chelan County Commissioner's Office	400 Douglas St Wenatchee, WA 98801	Adjacent

The pump station would be constructed near the northeast corner of Parcel 241827823008, owned by Chelan County. The proposed pipeline alignment would extend along the edge of the WSDOT right-of-way at U.S. Highway 2, and would require a right-of-way permit. The pipeline would also cross two additional parcels owned by Chelan County, which comprise the existing Dryden Transfer Station (former Dryden Landfill). The pipeline alignment would likely impact some forested slopes above the landfill and would cross the road to the existing transfer station. The delivery to the PID Canal would be adjacent to Parcel 241827320000, which is privately owned, and construction of the delivery structure could potentially impact that parcel.

5.4.4 Alternative 4

Construction of the facilities included as part of Alternative 4 would directly impact three private properties and could potentially impact a fourth private property located adjacent to the PID Canal at the delivery location. Table 5-6 lists a summary of the parcels that would be impacted by or are adjacent to Alternative 4.

Table 5-6
Properties Impacted by or Adjacent to Alternative 4

Parcel	Owner	Address	Impacted/Adjacent
241827210050	David & Cindy Burnett	1511 Anton St Wenatchee, WA 98801	Impacted
241827823060	Chelan County Commissioner's Office	400 Douglas St Wenatchee, WA 98801	Impacted
241827823071	C&R Rentals, LLC	PO Box 772 Cashmere, WA 98815	Impacted
241827230050	Alice Goodwin TRT	PO Box 74 Dryden, WA 98821	Adjacent

The pump station would be constructed near the boundary of Parcel 241827210050. The proposed delivery pipeline alignment and access to the pump station would impact a private orchard and driveway in Parcel 241827210050. The delivery pipeline would extend along the private driveway adjacent to Parcel 241827823071. The delivery pipeline would extend west in Motel Road and would cross U.S. Highway 2 via directional drilling, jacking, or boring. County and WSDOT right-of-way permits would be required for construction in road rights-of-way. On the south side of U.S. Highway 2, the pipeline alignment would follow an existing gravel driveway up a steep hillside to the PID Canal. The driveway is located on Parcel 241827823060, which is owned by Chelan County. PID has indicated that they may have an existing easement for accessing the canal via this existing driveway. The delivery to the PID Canal would be adjacent to Parcel 241827230050, which is privately owned, and construction of the delivery structure could potentially impact that parcel.

5.4.5 Alternative 5

Construction of the facilities included as part of Alternative 5 would directly impact six properties and could potentially impact three other properties located adjacent to the delivery pipeline. Table 5-7 lists a summary of the parcels that would be impacted by or are adjacent to Alternative 5.

Table 5-7
Properties Impacted by or Adjacent to Alternative 5

Parcel	Owner	Address	Impacted/Adjacent
241822310100	Washington State	PO Box 47014 Olympia, WA 98504	Impacted
241822340010	PUD No 1 of Chelan County	PO Box 1231 Wenatchee, WA 98807	Impacted
241822745006	Washington State	PO Box 47014 Olympia, WA 98504	Impacted
241822745021	Washington State DOT	PO Box 98 Wenatchee, WA 98807	Impacted
241827220400	Robert Pflugrath	PO Box 434 Peshastin, WA 98847	Impacted
241822746006	Washington State	PO Box 47014 Olympia, WA 98504	Adjacent
241822745005	Kerry Griffith	410 S Division Cashmere, WA 98815	Adjacent
241822745020	Dryden Gun Club	PO Box 85 Dryden, WA 98821	Adjacent
241827220200	Stephen Ballew	PO Box 777 Leavenworth, WA 98826	Adjacent

The pump station for Alternative 5 would be constructed adjacent to the Chelan PUD fish collection facility at the Dryden Dam. Access to the pump station and construction of the delivery pipeline would occur in the existing access road to the dam. The pump station and delivery pipeline alignment would impact one parcel owned by Chelan PUD (241822340010) and two parcels owned by the State of Washington (241822745006 and 241822745021).

Recent discussions with representatives from the Yakama Nation indicate that they are targeting this site for a new fish rearing facility. Their proposed project would include a year-round withdrawal of 7 cfs from a diversion facility located adjacent to the Chelan PUD fish collection facility. The hatchery facility would also require groundwater withdrawals to deal with potential icing issues. The Yakama Nation has indicated a willingness to consider a joint diversion facility, which could potentially reduce costs for both the fish rearing facility and a new PID pump station. A potential concern that may need to be addressed is that the combined diversion would create a false attraction to migrating adult fish. In addition, the Yakama Nation has studied the site in some detail and has indicated that there is lead contamination on the property owned by WSDOT (Parcel 241822745006). There would likely be some cleanup costs associated with a new project at this site.

The Yakama Nation also indicated that WDFW has expressed interest in purchasing property along the shoreline of the Wenatchee River, immediately upstream of the Chelan PUD facility, to improve recreational access for portaging of whitewater rafts. Establishing a diversion facility at the site would require additional consultation and coordination with both the Yakama Nation and WDFW.

The existing access road and proposed delivery pipeline alignment would also extend along the boundaries of Parcels 241822310100, 241822745005, and 241822745020. The proposed delivery pipeline alignment would extend south in Saunders Road and would cross U.S. Highway 2 via directional drilling, jacking, or boring. County and WSDOT right-of-way permits would be required for construction in road rights-of-way. On the south side of U.S. Highway 2, the pipeline alignment would follow Deadman Hill Road to the PID Canal. The delivery pipeline alignment proposed for Alternative 5 is almost entirely within gravel or paved roadways or access roads. Chelan County is in the process of paving Deadman Hill Road. Impacts to the newly paved roadway would need to be considered and reviewed with Chelan County.

5.5 Environmental Review and Permitting Fatal Flaw Analysis

Using existing information and professional knowledge of the study area, a preliminary review of environmental resources and permitting requirements was conducted to identify potential impacts or requirement that could be considered “fatal flaws” associated with the pump station alternatives. The analysis included consideration of regulatory requirements associated with constructing and operating a pump station and fish screen along the Wenatchee River at suitable locations, along with construction of water delivery pipelines from the pump station to the PID Canal. Five site alternatives were reviewed (Anchor QEA 2010) and analyzed with specific emphasis on any regulatory issues that would inhibit the project from obtaining needed permits and approvals.

5.5.1 Natural Resources

Natural resources are naturally occurring environmental features that may have material and/or aesthetic and recreational value. They are primarily regulated by local governments and state and federal agencies. Specific natural resources assessed in this evaluation include salmonids, wildlife species, fish and wildlife habitat conservation areas, riparian areas, and wetlands that exist within or, in proximity of, the five proposed alternative pump station sites and associated water delivery pipe alignments.

All five alternative pump station sites being proposed are within a reach of the Wenatchee River that has been designated as Critical Habitat under the Endangered Species Act (ESA) for ESA-listed Upper Columbia River spring-run Chinook salmon (*Oncorhynchus tshawytscha*), Upper Columbia River steelhead trout (*O. mykiss*), and bull trout (*Salvelinus confluentus*). Maps showing designated Critical Habitat for the ESA-listed species are in Appendix F (Figures 1 through 3). Sockeye salmon (*O. nerka*) and summer-run Chinook salmon (*O. tshawytscha*) also occur in this reach of the Wenatchee River, and although not protected under the ESA, these species provide important recreational fisheries. Priority Habitat and Species (PHS) managed by WDFW and known to occur in close proximity (within 1,000 feet) to the proposed pump station sites and water delivery alignments include a spotted owl (*Strix occidentalis*) breeding area[1] (Appendix F, Figure 4). PHS elements managed by WDFW also include habitat features such as snags and logs. The Wenatchee River (riverine) is the only area in close proximity to the proposed pump station sites or to the water delivery pipeline alignments that is mapped on the National Wetlands Inventory (NWI) mapping. Riparian habitat is dominated by cottonwood (*Populus balsamifera*) and willow (*Salix sp.*), although it is fairly limited due to the steep banks at the proposed sites, or as a result of previous disturbance at the proposed sites located at bridge crossings or at the Dryden site as a result of clearing.

Upland habitat above the Wenatchee River is generally representative of species associated with the Columbia Cascade province; vegetation along the banks and on the hillslopes are characterized by shrub-steppe habitat-associated species (*Artemisia sp.* and bunchgrasses) and mixed stands of ponderosa pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga*

[1] Resolution – Township; Accuracy – 1:100,000 feet; Data source/Date – WDFW/April 9, 1991.

menziesii), with tree species composition and stand size a function of increasing elevation and available soil moisture (Franklin and Dryness 1973).

5.5.2 Impacts and Regulatory Requirements

Short-term impacts anticipated from the construction of a pump station, fish screen, and water delivery pipeline include clearing, grading, and excavation in the uplands and excavation and fill below the ordinary high water mark (OHWM). Long-term impacts include operation of the water diversion pump station and maintenance activities for the pump station and water delivery pipeline.

For the purpose of the fatal flaw analysis, a standard permitting process is assumed to be required for the project. This process includes applying for and obtaining all relevant applicable federal, state, and local permits. Table 5-8 lists standard permits that would likely need to be obtained for the project.

As was noted previously, the Yakama Nation has indicated that there is lead contamination on WSDOT property that they have identified for a fish rearing facility at the same location proposed for the pump station site in Alternative 5. Acquisition of the site and development of the site for a fish rearing facility or irrigation pump station will likely require remediation, which could potentially increase the cost of the project.

5.5.3 Mitigation Opportunities

Following best management practices during mobilization and construction will avoid and minimize impacts to the natural environment to the greatest extent practicable. Work within the stream channel will need to be conducted during the fisheries work window consistent with permit requirements. Pump stations will need to be fitted with fish screens that meet NMFS specifications, to avoid impacts to salmonid species. Unavoidable impacts to riparian and upland vegetation will need to be mitigated by reestablishing vegetation using native trees and shrubs.

5.5.4 Conclusions

This environmental resources and permitting requirements fatal flaws analysis is intended to assess the potential at any of the five PID pump station sites being considered, for issues that would inhibit the project from obtaining needed permits and approvals. Based on this preliminary assessment, there are no known existing conditions at any of the five potential sites that would inhibit obtaining permits for construction and operation of a pump station at any of the potential sites as long as appropriate avoidance, minimization, and mitigation measures were employed to offset potential natural resource impacts. A more detailed environmental review and evaluation of permit requirements is recommended as part of a more detailed feasibility study of the preferred alternative(s).

Table 5-8

Standard Federal, State, and Local Permits List

Permit	Agency	Apply with the JARPA (Y/N)	Permits Needed		Notes
			Pump Station Sites	Pipeline Corridors	
Section 10/ Section 404 Permit	Corps	Y	✓		Locating a structure or excavation in navigable waters, or discharging dredged or fill material into waters of the U.S.
ESA Section 7 Concurrence	NMFS	N	✓		Will likely require a Biological Assessment given presence of listed salmonids and designated critical habitat
ESA Section 7 Concurrence	USFWS	N	✓		
EFH Concurrence	NMFS	N	✓		
EFH Concurrence	USFWS	N	✓		
NHPA Section 106 concurrence	DAHP	N	✓	✓	If federal funding, DAHP and tribes must be consulted.
Hydraulic Permit Approval	WDFW	Y	✓		For work below the OHWM in waters of the state
Section 401 Water Quality Certification	Ecology	Y	✓		For projects that require excavation in or discharge dredge or fill material into water or isolated wetlands
NPDES Construction General Permit	Ecology	N	✓		Required if more than 1 acre is disturbed during construction
Shoreline Substantial Development Permit	County	Y	✓	✓	Per the County Shoreline Management Plan, possible exemption for construction of irrigation structures
SEPA Determination	County	Y	✓	✓	
Critical Areas Ordinance Compliance	County	Y	✓	✓	Per the County Shoreline Management Plan, possible exemption for construction of irrigation structures
Floodplain Development Permit	County	Y	✓	✓	If within the 100-year floodplain
Fill and Grade Permit	County		✓	✓	

6 OPINIONS OF PROBABLE COST

As part of an initial analysis of the pump exchange project completed as part of the *Campbell Creek Reservoir Feasibility Study* (Anchor QEA 2010), preliminary opinions of probable project implementation costs and long-term operational costs were developed for each alternative. Those opinions of cost have been reviewed and updated as part of this Appraisal Study. An analysis was also completed as part of this Appraisal Study of the cost to replace the facility at the end of the design life cycle.

6.1 Assumptions

Opinions of project implementation costs were developed for each of the alternatives based on the following assumptions:

- A 10 percent allowance was included for mobilization/demobilization.
- A 30 percent contingency was included.
- A 20 percent allowance was included for engineering, permitting, and construction administration.
- The total project cost includes 8.0 percent sales tax.
- An allowance of $50,000 was included for land acquisition for pump station and pipeline easements.

Opinions of long-term annual operating costs were also developed for each alternative (in 2011 dollars) based on the following assumptions:

- Annual operations and maintenance (O&M) would include the following:
  - Salaries – Assumed for 1/12 full-time equivalent (FTE) to help operate and maintain the new facilities, or one person for about 8 hours per week during the irrigation season.
  - Benefits – Estimated at 40 percent of the salary amount.
  - Transportation Costs – An allowance for trips to and from the pump station.
  - Maintenance and Small Repairs – Estimated as 0.3 percent of the total project implementation cost.
  - Administration, Insurance, Accounting – An allowance for added administrative work and insurance required for the new facilities.

- Pumping power costs are based on Chelan PUD Rate Schedule 5, for irrigation service.
- Power costs are also based on the estimated horsepower required for pumping under each alternative.
- The energy charge portion of the power cost was estimated for pumping durations of 2, 4, 6, and 8 weeks.
- The power costs assume that the monthly basic charge and demand charge would only apply during the irrigation season. It is assumed that the power service would be shut down during the off season.

An analysis of replacement costs was also developed to determine the annual deposit that would be required in an account to fund replacement of the facilities at the end of the design life cycle of the project. The life cycle replacement cost analysis was based on the following assumptions:

- A 50-year design life cycle would apply to all of the facilities.
- The replacement cost would be equal to the current opinion of the implantation cost of the project plus an assumed removal cost inflated through the life of the project.
- No loan would be required to fund the initial project, and no loan repayment costs would be incurred during the life cycle of the project.
- The long-term inflation rate was assumed to be 3 percent.
- The interest rate on a replacement fund account was assumed to be 3 percent.

Unit costs and quantities should be considered approximate, in accordance with the preliminary nature of this Appraisal Study. Overall, the costs should be considered as order-of-magnitude costs.

6.2 Opinions of Probable Project Implementation Costs

Tables 6-1, 6-2, and 6-3 summarize the opinions of probable project implementation costs for facilities designed to pump from the Wenatchee River to the PID Canal. These include construction costs, engineering and administration costs, a contingency, taxes, and an allowance for land acquisition. The total opinion of costs for the pump exchange project ranges from $1.86 million (Alternative 3) to $3.17 million (Alternative 5) for a 10-cfs design flow rate; $2.68 million (Alternative 3) to $4.40 million (Alternative 5) for a 20-cfs design flow rate; and $3.90 million (Alternative 1) to $6.15 million (Alternative 5) for a 40-cfs design flow rate. More detailed cost information, including a list of major items, estimated quantities, and unit costs used to develop the opinions of cost is included in Appendix G.

Table 6-1
Opinion of Probable Costs (10-cfs)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Miscellaneous Site Work	$80,989	$63,668	$71,053	$70,248	$57,592
Earthwork	$35,197	$46,714	$40,432	$77,079	$112,050
Pump Station	$724,600	$664,600	$684,600	$664,600	$639,600
Pipeline	$180,830	$388,910	$215,020	$701,180	$933,880
Outlet Structure	$5,000	$5,000	$5,000	$5,000	$5,000
Construction Subtotal	**$1,027,000**	**$1,169,000**	**$1,016,000**	**$1,518,000**	**$1,748,000**
Mobilization/Demobilization (10%)	$102,700	$116,900	$101,600	$151,800	$174,800
Contingency (30%)	$338,910	$385,770	$335,280	$500,940	$576,840
Engineering and Administration (20%)	$225,940	$257,180	$223,520	$333,960	$384,560
Tax (8%)	$135,564	$154,308	$134,112	$200,376	$230,736
Land Acquisition	$50,000	$50,000	$50,000	$50,000	$50,000
Total Project Costs	**$1,880,000**	**$2,133,000**	**$1,861,000**	**$2,755,000**	**$3,165,000**

Table 6-2

Opinion of Probable Costs (20-cfs)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Miscellaneous Site Work	$83,989	$66,668	$74,053	$73,248	$60,592
Earthwork	$49,799	$66,115	$57,216	$109,128	$158,668
Pump Station	$1,094,200	$1,024,200	$1,044,200	$1,024,200	$994,200
Pipeline	$246,207	$521,439	$292,758	$906,222	$1,223,052
Outlet Structure	$6,000	$6,000	$6,000	$6,000	$6,000
Construction Subtotal	**$1,480,000**	**$1,684,000**	**$1,474,000**	**$2,119,000**	**$2,443,000**
Mobilization/Demobilization (10%)	$148,000	$168,400	$147,400	$211,900	$244,300
Contingency (30%)	$488,400	$555,720	$486,420	$699,270	$806,190
Engineering and Administration (20%)	$325,600	$370,480	$324,280	$466,180	$537,460
Tax (8%)	$195,360	$222,288	$194,568	$279,708	$322,476
Land Acquisition	$50,000	$50,000	$50,000	$50,000	$50,000
Total Project Costs	**$2,687,000**	**$3,051,000**	**$2,677,000**	**$3,826,000**	**$4,403,000**

Table 6-3

Opinion of Probable Costs (40-cfs)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Miscellaneous Site Work	$62,989	$70,668	$63,053	$78,248	$76,592
Earthwork	$64,629	$83,464	$72,808	$134,965	$194,280
Pump Station	$1,698,400	$1,618,400	$1,668,400	$1,618,400	$1,588,400
Pipeline	$324,103	$677,431	$385,382	$1,139,038	$1,556,108
Outlet Structure	$10,000	$10,000	$10,000	$10,000	$10,000
Construction Subtotal	**$2,160,000**	**$2,460,000**	**$2,200,000**	**$2,981,000**	**$3,425,000**
Mobilization/Demobilization (10%)	$216,000	$246,000	$220,000	$298,100	$342,500
Contingency (30%)	$712,800	$811,800	$726,000	$983,730	$1,130,250
Engineering and Administration (20%)	$475,200	$541,200	$484,000	$655,820	$753,500
Tax (8%)	$285,120	$324,720	$290,400	$393,492	$452,100
Land Acquisition	$50,000	$50,000	$50,000	$50,000	$50,000
Total Project Costs	**$3,899,000**	**$4,434,000**	**$3,970,000**	**$5,362,000**	**$6,153,000**

6.3 Opinions of Probable Operating Costs

Tables 6-4, 6-5, and 6-6 summarize the opinions of probable annual operating costs for facilities designed to pump from the Wenatchee River to the PID Canal. The costs include O&M and an opinion of probable power costs. The ranges of projected annual operational costs are as follows:

- 10-cfs pump exchange project
  - $20,400 (Alternative 3) to $23,900 (Alternative 5) for 2 weeks of pumping
  - $25,200 (Alternative 3) to $28,300 (Alternative 5) for 8 weeks of pumping
- 20-cfs pump exchange project
  - $30,700 (Alternative 3) to $34,200 (Alternative 5) for 2 weeks of pumping
  - $40,200 (Alternative 3) to $42,600 (Alternative 5) for 8 weeks of pumping
- 40-cfs pump exchange project
  - $52,500 (Alternative 3) to $55,900 (Alternative 5) for 2 weeks of pumping
  - $72,100 (Alternative 3) to $75,200 (Alternative 2) for 8 weeks of pumping

Table 6-4
Opinion of Probable Operating Costs (10-cfs)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Annual O&M Costs[1]	**$11,920**	**$12,820**	**$11,920**	**$14,720**	**$16,120**
Pumping Power Costs[2]					
2-Week Annual Pumping Duration	$8,658	$8,767	$8,484	$8,093	$7,789
4-Week Annual Pumping Duration	$10,292	$10,421	$10,085	$9,619	$9,257
6-Week Annual Pumping Duration	$11,925	$12,075	$11,685	$11,145	$10,725
8-Week Annual Pumping Duration	$13,559	$13,730	$13,286	$12,671	$12,193
Total Annual Operating Costs[3]					
2-Week Annual Pumping Duration	$20,600	$21,600	$20,400	$22,800	$23,900
4-Week Annual Pumping Duration	$22,200	$23,200	$22,000	$24,300	$25,400
6-Week Annual Pumping Duration	$23,800	$24,900	$23,600	$25,900	$26,800
8-Week Annual Pumping Duration	$25,500	$26,500	$25,200	$27,400	$28,300

Notes:
1. Annual Operations and Maintenance Costs include estimated salaries, benefits, transportation, maintenance, repairs, administration, insurance, and accounting in 2012 dollars.
2. Pumping costs are based on Chelan PUD Electrical Rate Schedule 5 (Irrigation Service).
3. Total Annual Operating Costs are rounded to the nearest $100.

Table 6-5
Opinion of Probable Operating Costs (20-cfs)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Annual O&M Costs[1]	**$14,220**	**$15,320**	**$14,120**	**$17,620**	**$19,320**
Pumping Power Costs[2]					
2-Week Annual Pumping Duration	$17,026	$17,157	$16,613	$15,635	$14,853
4-Week Annual Pumping Duration	$20,252	$20,408	$19,761	$18,597	$17,665
6-Week Annual Pumping Duration	$23,478	$23,658	$22,908	$21,558	$20,478
8-Week Annual Pumping Duration	$26,704	$26,909	$26,056	$24,519	$23,290
Total Annual Operating Costs[3]					
2-Week Annual Pumping Duration	$31,200	$32,500	$30,700	$33,300	$34,200
4-Week Annual Pumping Duration	$34,500	$35,700	$33,900	$36,200	$37,000
6-Week Annual Pumping Duration	$37,700	$39,000	$37,000	$39,200	$39,800
8-Week Annual Pumping Duration	$40,900	$42,200	$40,200	$42,100	$42,600

Notes:
See notes for Table 6-4.

Table 6-6
Opinion of Probable Operating Costs (40-cfs)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Annual O&M Costs[1]	**$17,820**	**$19,420**	**$18,020**	**$22,220**	**$24,620**
Pumping Power Costs[2]					
2-Week Annual Pumping Duration	$35,219	$35,567	$34,480	$32,698	$31,307
4-Week Annual Pumping Duration	$41,907	$42,321	$41,027	$38,906	$37,250
6-Week Annual Pumping Duration	$48,595	$49,075	$47,574	$45,114	$43,193
8-Week Annual Pumping Duration	$55,282	$55,829	$54,121	$51,322	$49,136
Total Annual Operating Costs[3]					
2-Week Annual Pumping Duration	$53,000	$55,000	$52,500	$54,900	$55,900
4-Week Annual Pumping Duration	$59,700	$61,700	$59,000	$61,100	$61,900
6-Week Annual Pumping Duration	$66,400	$68,500	$65,600	$67,300	$67,800
8-Week Annual Pumping Duration	$73,100	$75,200	$72,100	$73,500	$73,800

Notes:
See notes for Table 6-4.

6.4 Life Cycle Replacement Cost Analysis

Replacement costs were evaluated to determine the annual deposit that would need to be made to an account to fund replacement of the facilities at the end of the assumed life cycle for the project. It's likely that components of the project will have longer or shorter design life cycles; however, to simplify the analysis, an overall design life cycle of 50 years was assumed. It is also unlikely that the all of the facilities would need to be completely replaced at the end of the assumed life cycle. For this reason, the analysis was performed for three levels of replacement: 25, 50, and 100 percent. The life cycle replacement cost analysis is also included in Appendix G.

Two methods of annual deposit to a replacement fund were evaluated. The first would be a constant annual deposit through the life of the project. The second would be an increasing annual deposit, escalated at the assumed annual inflation rate of 3 percent. Tables 6-7, 6-8, and 6-9 summarize the estimated annual replacement fund costs at project years 1, 25, and 50.

Table 6-7

Estimated Annual Replacement Fund Costs – 10-cfs Pump Station

Year	Level of Replacement	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
With Constant Annual Deposit:						
1-50	25%	$18,733	$21,269	$18,549	$27,468	$31,559
	50%	$37,466	$42,538	$37,097	$54,936	$63,118
	100%	$74,933	$85,077	$74,194	$109,873	$126,235
With Increasing Annual Deposit:						
1	25%	$9,929	$11,273	$9,831	$14,559	$16,727
	50%	$19,858	$22,547	$19,663	$29,118	$33,454
	100%	$39,717	$45,093	$39,325	$58,236	$66,909
25	25%	$20,184	$22,916	$19,985	$29,596	$34,003
	50%	$40,368	$45,833	$39,970	$59,191	$68,006
	100%	$80,736	$91,666	$79,940	$118,382	$136,012
50	25%	$42,261	$47,982	$41,844	$61,967	$71,195
	50%	$84,522	$95,964	$83,689	$123,933	$142,389
	100%	$169,043	$191,927	$167,378	$247,866	$284,779

Table 6-8

Estimated Annual Replacement Fund Costs – 20-cfs Pump Station

Year	Level of Replacement	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
With Constant Annual Deposit:						
1-50	25%	$26,759	$30,383	$26,662	$38,108	$43,850
	50%	$53,518	$60,766	$53,323	$76,215	$87,700
	100%	$107,036	$121,532	$106,647	$152,430	$175,400
With Increasing Annual Deposit:						
1	25%	$14,183	$16,104	$14,132	$20,198	$23,242
	50%	$28,366	$32,208	$28,263	$40,397	$46,484
	100%	$56,732	$64,416	$56,526	$80,793	$92,968
25	25%	$28,831	$32,736	$28,727	$41,059	$47,246
	50%	$57,663	$65,472	$57,453	$82,118	$94,492
	100%	$115,325	$130,945	$114,907	$164,236	$188,984
50	25%	$60,366	$68,542	$60,147	$85,968	$98,923
	50%	$120,733	$137,085	$120,294	$171,937	$197,846
	100%	$241,466	$274,169	$240,589	$343,874	$395,691

Table 6-9

Estimated Annual Replacement Fund Costs – 40-cfs Pump Station

Year	Level of Replacement	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
With Constant Annual Deposit:						
1-50	25%	$38,836	$44,161	$39,536	$53,401	$61,281
	50%	$77,673	$88,322	$79,072	$106,802	$122,562
	100%	$155,345	$176,644	$158,144	$213,605	$245,125
With Increasing Annual Deposit:						
1	25%	$20,585	$23,407	$20,955	$28,304	$32,481
	50%	$41,169	$46,813	$41,911	$56,609	$64,962
	100%	$82,338	$93,627	$83,821	$113,218	$129,924
25	25%	$41,844	$47,581	$42,598	$57,537	$66,027
	50%	$83,688	$95,162	$85,196	$115,074	$132,055
	100%	$167,377	$190,324	$170,392	$230,148	$264,109
50	25%	$87,612	$99,624	$89,191	$120,470	$138,246
	50%	$175,225	$199,249	$178,381	$240,939	$276,493
	100%	$350,449	$398,497	$356,762	$481,879	$552,986

6.5 Funding for Total Project Costs

The purpose of developing opinions of project costs as part of this Appraisal Study is to help stakeholders identify potential funding opportunities and costs constraints. PID has indicated that funding for both project implementation and long-term power and O&M costs would need to be secured to make the project viable. Total project costs that would need funding, including the project implementation cost and the present value of estimated annual long-term operating costs through the assumed 50-year life cycle of the project, are summarized in Tables 6-10, 6-11 and 6-12. The ranges of the totals of the present values of these projected costs are as follows:

- 10-cfs pump exchange project
  - $2.9 million (Alternative 3) to $4.4 million (Alternative 5) for 2 weeks of pumping
  - $3.2 million (Alternative 3) to $4.6 million (Alternative 5) for 8 weeks of pumping

- 20-cfs pump exchange project
  - $4.2 million (Alternative 3) to $6.1 million (Alternative 5) for 2 weeks of pumping
  - $4.7 million (Alternative 3) to $6.5 million (Alternative 5) for 8 weeks of pumping
- 40-cfs pump exchange project
  - $6.6 million (Alternative 1) to $8.9 million (Alternative 5) for 2 weeks of pumping
  - $7.6 million (Alternative 1) to $9.8 million (Alternative 5) for 8 weeks of pumping

Table 6-10

Total Costs Requiring Funding – 10-cfs Pump Station

Alternative	Annual Pumping Duration	Total Project Implementation Cost[1]	Present Value - O&M Costs[2]	Present Value - Power Costs[3]	Present Value - Total Project Costs[4]
1	2 Weeks	$1,880,000	$596,000	$432,908	**$2,908,908**
	4 Weeks	$1,880,000	$596,000	$514,590	**$2,990,590**
	6 Weeks	$1,880,000	$596,000	$596,273	**$3,072,273**
	8 Weeks	$1,880,000	$596,000	$677,955	**$3,153,955**
2	2 Weeks	$2,133,000	$641,000	$438,341	**$3,212,341**
	4 Weeks	$2,133,000	$641,000	$521,058	**$3,295,058**
	6 Weeks	$2,133,000	$641,000	$603,774	**$3,377,774**
	8 Weeks	$2,133,000	$641,000	$686,491	**$3,460,491**
3	2 Weeks	$1,861,000	$596,000	$424,213	**$2,881,213**
	4 Weeks	$1,861,000	$596,000	$504,241	**$2,961,241**
	6 Weeks	$1,861,000	$596,000	$584,270	**$3,041,270**
	8 Weeks	$1,861,000	$596,000	$664,298	**$3,121,298**
4	2 Weeks	$2,755,000	$736,000	$404,651	**$3,895,651**
	4 Weeks	$2,755,000	$736,000	$480,957	**$3,971,957**
	6 Weeks	$2,755,000	$736,000	$557,263	**$4,048,263**
	8 Weeks	$2,755,000	$736,000	$633,569	**$4,124,569**
5	2 Weeks	$3,165,000	$806,000	$389,436	**$4,360,436**
	4 Weeks	$3,165,000	$806,000	$462,847	**$4,433,847**
	6 Weeks	$3,165,000	$806,000	$536,258	**$4,507,258**
	8 Weeks	$3,165,000	$806,000	$609,669	**$4,580,669**

Notes:
1. Total project implementation cost includes construction, engineering, administration, contingency, and taxes.
2. Present value of annual O&M costs through assumed 50-year project life cycle.
3. Present value of annual power costs through assumed 50-year project life cycle.
4. Sum of total project implementation cost, present value of O&M costs, and present value of power costs.

Table 6-11

Total Costs Requiring Funding – 20-cfs Pump Station

Alternative	Annual Pumping Duration	Total Project Implementation Cost[1]	Present Value - O&M Costs[2]	Present Value - Power Costs[3]	Present Value - Total Project Costs[4]
1	2 Weeks	$2,687,000	$711,000	$851,322	**$4,249,322**
	4 Weeks	$2,687,000	$711,000	$1,012,619	**$4,410,619**
	6 Weeks	$2,687,000	$711,000	$1,173,916	**$4,571,916**
	8 Weeks	$2,687,000	$711,000	$1,335,214	**$4,733,214**
2	2 Weeks	$3,051,000	$766,000	$857,843	**$4,674,843**
	4 Weeks	$3,051,000	$766,000	$1,020,381	**$4,837,381**
	6 Weeks	$3,051,000	$766,000	$1,182,919	**$4,999,919**
	8 Weeks	$3,051,000	$766,000	$1,345,457	**$5,162,457**
3	2 Weeks	$2,677,000	$706,000	$830,673	**$4,213,673**
	4 Weeks	$2,677,000	$706,000	$988,041	**$4,371,041**
	6 Weeks	$2,677,000	$706,000	$1,145,409	**$4,528,409**
	8 Weeks	$2,677,000	$706,000	$1,302,777	**$4,685,777**
4	2 Weeks	$3,826,000	$881,000	$781,767	**$5,488,767**
	4 Weeks	$3,826,000	$881,000	$929,830	**$5,636,830**
	6 Weeks	$3,826,000	$881,000	$1,077,892	**$5,784,892**
	8 Weeks	$3,826,000	$881,000	$1,225,955	**$5,932,955**
5	2 Weeks	$4,403,000	$966,000	$742,643	**$6,111,643**
	4 Weeks	$4,403,000	$966,000	$883,261	**$6,252,261**
	6 Weeks	$4,403,000	$966,000	$1,023,879	**$6,392,879**
	8 Weeks	$4,403,000	$966,000	$1,164,497	**$6,533,497**

Notes:

1. Total project implementation cost includes construction, engineering, administration, contingency, and taxes.
2. Present value of annual O&M costs through assumed 50-year project life cycle.
3. Present value of annual power costs through assumed 50-year project life cycle.
4. Sum of total project implementation cost, present value of O&M costs, and present value of power costs.

Table 6-12
Total Costs Requiring Funding – 40-cfs Pump Station

Alternative	Annual Pumping Duration	Total Project Implementation Cost[1]	Present Value - O&M Costs[2]	Present Value - Power Costs[3]	Present Value - Total Project Costs[4]
1	2 Weeks	$3,899,000	$891,000	$1,760,966	**$6,550,966**
	4 Weeks	$3,899,000	$891,000	$2,095,348	**$6,885,348**
	6 Weeks	$3,899,000	$891,000	$2,429,729	**$7,219,729**
	8 Weeks	$3,899,000	$891,000	$2,764,110	**$7,554,110**
2	2 Weeks	$4,434,000	$971,000	$1,778,355	**$7,183,355**
	4 Weeks	$4,434,000	$971,000	$2,116,045	**$7,521,045**
	6 Weeks	$4,434,000	$971,000	$2,453,735	**$7,858,735**
	8 Weeks	$4,434,000	$971,000	$2,791,425	**$8,196,425**
3	2 Weeks	$3,970,000	$901,000	$1,724,015	**$6,595,015**
	4 Weeks	$3,970,000	$901,000	$2,051,366	**$6,922,366**
	6 Weeks	$3,970,000	$901,000	$2,378,716	**$7,249,716**
	8 Weeks	$3,970,000	$901,000	$2,706,067	**$7,577,067**
4	2 Weeks	$5,362,000	$1,111,000	$1,634,899	**$8,107,899**
	4 Weeks	$5,362,000	$1,111,000	$1,945,292	**$8,418,292**
	6 Weeks	$5,362,000	$1,111,000	$2,255,686	**$8,728,686**
	8 Weeks	$5,362,000	$1,111,000	$2,566,079	**$9,039,079**
5	2 Weeks	$6,153,000	$1,231,000	$1,565,344	**$8,949,344**
	4 Weeks	$6,153,000	$1,231,000	$1,862,503	**$9,246,503**
	6 Weeks	$6,153,000	$1,231,000	$2,159,662	**$9,543,662**
	8 Weeks	$6,153,000	$1,231,000	$2,456,821	**$9,840,821**

Notes:
1. Total project implementation cost includes construction, engineering, administration, contingency, and taxes.
2. Present value of annual O&M costs through assumed 50-year project life cycle.
3. Present value of annual power costs through assumed 50-year project life cycle.
4. Sum of total project implementation cost, present value of O&M costs, and present value of power costs.

Funding would also need to be set aside or secured during the life of the project to enable removal and replacement of facilities at the end of the assumed life cycle, as outlined in Tables 6-7, 6-8, and 6-9.

6.6 Key Cost Factors

The opinions of probable project costs and long-term operating costs will need to be refined as part of a more detailed feasibility study and detailed design of the preferred pump exchange project alternative. At this stage, several key elements of the project that could have a significant impact on project and long-term operating costs have not been well defined. The following key cost factors will need to be reviewed and considered in more detail as part of future efforts to refine opinions of cost:

- Subsurface Materials – No subsurface geological exploration has been done to verify the condition of subsurface soils that will need to be excavated or used to construct the pump station, delivery pipeline, delivery structure, and other improvements.
- Slope Stability – Additional study is needed to more accurately assess slope stability risks and determine mitigation measures, which could be very expensive.
- River Channel Modifications – As indicated by the geomorphic review of the existing river channel, there may be need to modify the river channel to enable diversion to the pump station at low flows at some pump station locations.
- River Channel Maintenance – The geomorphic review also indicated that regular channel maintenance may be required to ensure the long-term ability to divert water.
- Pump Station Design – A more detailed design analysis is needed to determine the size, configuration, and cost of the structure, pumps, and screening facilities.
- Pipeline Alignment – The proposed pipeline alignment selected for the proposed alternative may vary depending on permit requirements, property constraints, locations of existing infrastructure, and other factors. If an alternate pipeline alignment is selected, the cost of the pipeline and pumping requirements will change.
- Easements and Property Acquisition – At this point, property owners have not been contacted and the cost of negotiating and securing easements and property for the facilities has not been evaluated. The location, alignment, and cost of the facilities could be significantly impacted by negotiations with property owners.
- Coordination with Other Projects – Development of the project will require coordination with public agencies and others who are developing projects within the study area. For example, the cost of constructing a pump station at the site proposed for Alternative 5 could be impacted by negotiations with others who are targeting that site for projects, including the Yakama Nation and WDFW. Construction of a shared diversion with a proposed fish rearing facility that the Yakama Nation is proposing to develop at the same site could potentially result in a cost savings for both projects.

- Power Requirements – The extent and magnitude of upgrades and extensions to existing power supply facilities has not been well defined. Project costs could be significantly impacted by the need to extend power from existing infrastructure and upgrade existing power infrastructure to support the new pump station.

7 SUMMARY OF ALTERNATIVES AND FATAL FLAW EVALUATION

This section includes a comparison of the preliminary alternatives evaluated as part of this Appraisal Study and a brief summary of challenges and potential fatal flaws associated with each alternative.

7.1 Comparison of Preliminary Alternatives

Table 7-1 provides a comparison of key characteristics of the five preliminary alternatives that were evaluated as part of this Appraisal Study. The following information is summarized for comparison of the alternatives in Table 7-1:

- Pump Station and Discharge Pipe Location – The proposed pump station sites are located along the right bank of the Wenatchee River from RM 16.4 (Alternative 2), near the town of Dryden, to RM 17.8 (Alternative 5), just upstream of Dryden Dam. Water would be delivered to the ditch within a reach extending from 19,560 feet downstream of the diversion (Alternatives 1 and 2) up to 12,360 feet downstream of the diversion (Alternative 5).
- Pipeline – The proposed delivery pipelines would vary in length from 1,240 feet (Alternative 1) to 4,910 feet (Alternative 5). The size of the pipe would primarily depend on the design flow. A 20-inch pipe is recommended for a 10-cfs flow, a 30-inch pipe is recommended for a 20-cfs flow, and a 36-inch pipe is recommended for a 40-cfs flow.
- Pumping Head – The total pumping head required would vary from 219 feet (Alternative 5) to 247 feet (Alternative 2) for a 10-cfs pump station, and from 222 feet (Alternative 5) to 252 feet (Alternative 2) for a 40-cfs pump station.
- Pump Station Horsepower – The total horsepower required for pumping would vary from 360 horsepower (Alternative 5) to 400 horsepower (Alternative 2) for a 10-cfs pump Station, and from 1,440 horsepower (Alternative 5) pump station to 1,650 horsepower (Alternative 2) for a 40-cfs pump station.
- Project Costs – The estimated cost to design and construct the pump exchange project would vary from $1.86 million (Alternative 3) to $3.17 million (Alternative 5) for a 10-cfs project. The estimated cost to design and construct the pump exchange project would vary from $3.90 million (Alternative 1) to $6.15 million (Alternative 5) for a 40-cfs project.

- Operating Costs – Annual pumping costs would be lowest for Alternative 5 and highest for Alternatives 1, 2, and 3, similar to pumping horsepower requirements. However, O&M costs, which were partially developed based on project costs, would be highest for Alternative 5. The overall opinion of probable annual long-term operating costs for an 8-week pumping duration, which would include both pumping and O&M costs, would range from $25,200 (Alternative 3) to $28,300 (Alternative 5), for a 10-cfs pump station, and from $72,100 (Alternative 3) to $75,200 (Alternative 2), for a 40-cfs pump station.

Table 7-1 also outlines specific challenges identified through the analysis of the key characteristics of each alternative. The following conclusions can be drawn from a comparison of the challenges and benefits listed.

- Configuration/Location – Accessibility of the proposed pump station site would likely be a challenge for Alternatives 1, 3, and 4. For alternatives 3, 4, and 5, the delivery to the canal would be located upstream of the most vulnerable section of the PID Canal, which includes segment of steel pipe suspended above a slide area near the Dryden Transfer Station. Although delivering the water further upstream would increase the number of customers that could potential be served through the pump station, the delivery would still be subject to the reliability of the canal through the slide area. Delivering the water downstream of the slide area, as shown for Alternatives 1 and 2, would improve system reliability by allowing the majority of the PID Canal to operate in the event that a slide damages the canal through this vulnerable section.
- Hydraulics – From a hydraulic perspective, Alternative 5 would require the least pumping head and horsepower, since it would have the smallest elevation gain between the river and the ditch. Alternatives 1, 2, and 3 would have higher pumping heads and horsepower requirements.
- Geomorphology – The geomorphic analysis indicated that the pump station locations designated for Alternative 5 (upstream of Dryden Dam) and Alternative 1 (upstream of easternmost U.S. Highway 2 bridge) would be the most ideal for diversion from the Wenatchee River under a variety of flow conditions. Alternative 5 would take advantage of the pool conditions created by Dryden Dam. Alternative 1 would take advantage of a pool created by exposed bedrock on the right bank of the river.

Alternatives 2, 3, and 4 would require a higher level of channel modification and channel maintenance to maintain diversions under low flow conditions.

- Geology – Alternatives 1, 2, 3, and 4 would likely require excavation of boulders and cobbles for pump station installation. Alternative 5 would probably require less excavation of rock for pump station installation and the slope stability risk along the pipeline route would be lower than for the other alternatives. The slope stability risk would be low to moderate for Alternatives 1, 2, and 4 and high for Alternative 3. The delivery pipelines for Alternatives 1, 2, and 3 would all ascend steep slopes to the PID Canal. If Alternative 2 requires jacking and boring, the preliminary review of geology indicates that jacking and boring could be very challenging.
- Property Issues – Alternative 1 would impact the fewest number of parcels and would not impact WSDOT right-of-way along U.S. Highway 2. However, both Alternatives 1 and 2 would impact a private orchard located south of U.S Highway 2. Alternative 3 would impact Chelan County-owned property, including the access road to the existing Dryden Transfer Station. Alternative 4 would impact a private orchard north of U.S. Highway 2 and would require construction in Chelan County right-of-way and a crossing of WSDOT right-of-way at U.S. Highway 2. Alternative 5 would impact the greatest number of parcels and would cross WSDOT right-of-way at U.S. Highway 2. However, most of Alternative 5 would be constructed in public roadways or driveways, so impacts to private property would be minimal.
- Environmental Impacts and Permitting – No environmental or permitting fatal flaws were identified for any of the alternatives based on the preliminary review that was done for this Appraisal Study. All of the alternatives have the potential to impact ESA-listed species, riparian habitat, and upland habitat features. Alternative 5 would have the least impact on steep slopes, planted areas, and undisturbed areas because the facilities would be mostly located within public rights-of-way or the PID Canal easement. Alternative 5 could face challenges from a right-of-way permit perspective because the proposed alignment extends up Deadman Hill Road, which is currently being resurfaced by Chelan County.

Table 7-1
Comparison of Preliminary Alternatives

Features	Alignment				
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
Pump Station Location	South of Hwy 2; approximately 7,250 ft downstream of Peshastin Creek (approximately RM 16.5)	North of Hwy 2; approximately 7,800 ft downstream of Peshastin Creek (approximately RM 16.4)	South of Hwy 2; approximately 4,650 ft downstream of Peshastin Creek (approximately RM 17.0)	North of Hwy 2; approximately 2,560 ft downstream of Peshastin Creek (approximately RM 17.4)	North of Hwy 2; approximately 700 ft downstream of Peshastin Creek (approximately RM 17.8)
Discharge Location	PID Ditch, approximately 19,560 ft D/S of Diversion, elevation approximately 1,146 ft	PID Ditch, approximately 19,560 ft D/S of Diversion, elevation approximately 1,146 ft	PID Ditch, approximately 14,720 ft D/S of Diversion, elevation approximately 1,152 ft	PID Ditch, approximately 14,240 ft D/S of Diversion, elevation approximately 1,153 ft	PID Ditch, approximately 12,860 ft D/S of Diversion, elevation approximately 1,158 ft
Delivery Pipe Length (ft)	1,240	1,790	1,490	3,240	4,910
Delivery Pipe Size (in)					
10 cfs	20	20	20	20	20
20 cfs	30	30	30	30	30
40 cfs	36	36	36	36	36
Pumping Head, TDH (ft)					
10 cfs	244	247	239	228	219
20 cfs	240	242	235	221	210
40 cfs	250	252	244	232	222
Total Horsepower					
10 cfs	400	400	400	370	360
20 cfs	780	780	780	720	680
40 cfs	1,620	1,650	1,590	1,500	1,440
Number of Pumps Recommended					
10 cfs	2	2	2	2	2
20 cfs	3	3	3	3	3
40 cfs	3	3	3	3	3
Horsepower/Pump					
10 cfs	200	200	200	190	180
20 cfs	260	260	260	240	230
40 cfs	540	550	530	500	480
Opinion of Probable Project Costs (2012 Dollars)					
10 cfs	$1,880,000	$2,133,000	$1,861,000	$2,755,000	$3,165,000
20 cfs	$2,687,000	$3,051,000	$2,677,000	$3,826,000	$4,403,000
40 cfs	$3,899,000	$4,434,000	$3,970,000	$5,362,000	$6,153,000
Opinion of Probable Annual Operating Costs (2 Weeks of Pumping, 2012 Dollars)					
10 cfs	$20,600	$21,600	$20,400	$22,800	$23,900
20 cfs	$31,200	$32,500	$30,700	$33,300	$34,200
40 cfs	$53,000	$55,000	$52,500	$54,900	$55,900

Features	Alignment				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Parcels Impacted	• 2 Private Parcels Directly Impacted • 1 Adjacent Parcel Potentially Impacted	• 3 Private Parcels Directly Impacted • 1 Adjacent Parcel Potentially Impacted • WSDOT R-O-W Impacted	• 1 Private Parcels Directly Impacted • 2 County Parcels Directly Impacted • 1 Adjacent Parcel Potentially Impacted	• 2 Private Parcels Directly Impacted • 1 County Parcel Directly Impacted • 1 Adjacent Parcel Potentially Impacted • WSDOT and County ROW Impacted	• 1 Private Parcel Directly Impacted • 1 County PUD Parcel Directly Impacted • 3 State-Owned Parcels Directly Impacted • 4 Adjacent Parcel Potentially Impacted • WSDOT and County ROW Impacted
Challenges					
Location/Configuration	• Proximity to U.S. Highway 2 • Difficult Access to Pump Station Site	• Proximity to U.S. Highway 2 • Crosses U.S. Highway 2 R-O-W	• Proximity to U.S. Highway 2 • Difficult Access to Pump Station Site • Delivery Upstream of Most Vulnerable Section of PID Canal	• Crosses U.S. Highway 2 R-O-W • Least Accessible Pump Station Site • Long Pipe Length • Delivery Upstream of Most Vulnerable Section of PID Canal	• Crosses U.S. Highway 2 R-O-W • Impact to Newly Resurfaced County Road • Longest Pipe Length • Delivery Upstream of Most Vulnerable Section of PID Canal
Hydraulics	• High Elevation Gain • High TDH, Horsepower Required	• Highest Elevation Gain • Highest TDH, Horsepower Required	• High Elevation Gain • High TDH, Horsepower Required		
Geomorphology	• Steep Bank at Pump Station Site	• Steep Bank at Pump Station Site • Main Flow is Away from Right Bank • Some Channel Modification and Maintenance Would Likely be Required • Gravel Bedload Transport	• Main Flow is at Center of Channel • Channel Modification and Regular Maintenance Would Likely be Required • Gravel Deposits at Right Bank	• Minimal Shelter from High Flows • Main Flow near Far Bank of River • Channel Modification and Regular Maintenance Would Likely be Required • Gravel Deposits at Right Bank	
Geology	• Excavation of Large Rock for Pump Station • Steep Pipeline Alignment • Low to Moderate Slope Stability Risk	• Excavation of Large Rock for Pump Station • Steep Pipeline Alignment • Difficult Jack/Bore Across U.S. Highway 2 • Low to Moderate Slope Stability Risk	• Excavation of Large Rock for Pump Station • Steep Pipeline Alignment • Potentially High Slope Stability Risk	• Excavation of Large Rock for Pump Station • Low to Moderate Slope Stability Risk	
Property Issues	• Impact to Private Orchard • Impact to Private Property for Access	• Impact to Private Orchards • Impact to Private Property for Access • Impact to WSDOT R-O-W	• Impact to Transfer Station Access	• Impact to Private Orchard • Impact to County and WSDOT R-O-W	• Impact to Existing and Planned Fish Rearing Activities at Dryden Dam • Impact to County and WSDOT R-O-W
Environmental/Permit	• ESA-listed Chinook salmon, Steelhead, Bull Trout • Impacts to Riparian Habitat • Impacts to Steep Slopes, Planted Areas	• ESA-listed Chinook salmon, Steelhead, Bull Trout • Impacts to Riparian Habitat • Impacts to Steep Slopes, Planted Areas	• ESA-listed Chinook salmon, Steelhead, Bull Trout • Impacts to Riparian Habitat • Impacts to Steep Slopes, Planted Areas	• ESA-listed Chinook salmon, Steelhead, Bull Trout • Impacts to Riparian Habitat	• ESA-listed Chinook salmon, Steelhead, Bull Trout • Impacts to Riparian Habitat
Benefits					
Location/Configuration	• Shortest Pipe Length • No U.S. Highway 2 Crossing Required • Relatively Accessible Delivery Location • Delivery Downstream of Most Vulnerable Section of PID Canal	• Short Pipe Length • Relatively Accessible Pump Station Site • Relatively Accessible Delivery Location • Delivery Downstream of Most Vulnerable Section of PID Canal	• Short Pipe Length • No U.S. Highway 2 Crossing Required • Relatively Accessible Pump Station Site • Relatively Accessible Delivery Location	• Uses Existing Driveways and Roadways • Relatively Accessible Delivery Location	• Uses Existing Driveways and Roadways • Most Accessible Pump Station Site • Most Accessible Delivery Location
Hydraulics				• Lower Elevation Gain • Lower TDH, Horsepower Required	• Lowest Elevation Gain • Lowest TDH, Horsepower Required

Features	Alignment				
	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Geomorphology	• Exposed Bedrock at Proposed Diversion • Large, Deep Pool Near Exposed Bedrock • Minimal Channel Maintenance	• Protection from High Flows by Bridge	• Less Steep Bank Conditions	• Less Steep Bank Conditions	• Dam Creates Pool • No Channel Modification Needed • No Channel Maintenance Expected • Upstream of Dam, Level Control • Highest Certainty of Diversion at Low Flows
Geology	• No Jack/Bore		• No Jack/Bore	• Less Difficult Jack/Bore	• Easier Excavation for Pump Station • Less Difficult Jack/Bore • Low Slope Stability Risk
Property Issues			• Primarily Impacts County Properties		• Primarily Impacts State Properties
Environmental/Permit	• No Known Permitting Fatal Flaws	• No Known Permitting Fatal Flaws	• No Known Permitting Fatal Flaws	• No Known Permitting Fatal Flaws • Less Impact to Steep Slopes, and Undisturbed or Planted Areas	• No Known Permitting Fatal Flaws • Least Impact to Steep Slopes, and Undisturbed or Planted Areas

Notes:

cfs = cubic feet per second
County = Chelan County
D/S = downstream
ESA = Endangered Species Act
ft = feet
Hwy = U.S. Highway
in = inches
PID = Peshastin Irrigation District
RM = River Mile
R-O-W = right-of-way
TDH = Total Dynamic Head
WSDOT = Washington State Department of Transportation

7.2 Summary of Preliminary Fatal Flaw Evaluation

The preliminary alternatives were reviewed for the purpose of identifying significant challenges, or fatal flaws, that could prevent design and installation of the pump exchange project defined by each alternative. The following lists the most significant challenges associated with each of the alternatives:

- Overall
  - Project Cost – In order for the project to be viable to PID, funding sources will need to be identified for design and construction of the facilities.
  - Long-Term Operating Costs – Funding of long-term operating costs, especially power costs, represents a significant long-term financial commitment. In order to make the project viable to PID, funding assistance or some arrangement will likely need to be made to help PID cover long-term O&M and power costs.
- Alternative 1
  - Access – The ideal pump station site for this alternative would be located near a bedrock outcropping upstream of the U.S. Highway 2 bridge. Constructing temporary and permanent access to the proposed site will be difficult because of property constraints and stability issues.
  - Pump Station Construction – Pump station construction would likely require excavation of material with large boulders and cobbles.
  - Slope Stability – There is low to moderate slope stability risk of the proposed pipeline alignment where it ascends the steep hillside to the ditch. The stability of the hillside above the proposed pump station location could present a significant challenge.
  - Private Property – Construction would impact a private orchard and would require cooperation of private property owners.
- Alternative 2
  - U.S. Highway 2 Crossing – The proposed pipeline would cross U.S. Highway 2 under the bridge adjacent to the east abutment. Construction of a pipeline under the bridge will likely require extensive coordination with WSDOT and may be a challenging installation. An alternate alignment could include boring or jacking under the highway east of the bridge. The preliminary review of geology

indicates that the bore or jack could encounter rock and would likely be a difficult and expensive installation.
- Channel Modifications – The main flow in the channel is located toward the center of the channel, rather than at the right bank where the pump station would be located. Channel modification would be required to enable diversion to the pump station at low flow rates.
- Pump Station Construction – Pump station construction would likely require excavation of material with large boulders and cobbles.
- Slope Stability – There is low to moderate slope stability risk of the proposed pipeline alignment where it ascends the steep hillside to the ditch.
- Property Issues – Construction would impact a private orchard and would require cooperation of private property owners.

- Alternative 3
  - Access – Access to the pump station would likely need to be established directly from U.S. Highway 2 through property owned by Chelan County adjacent to the eastbound bridge approach.
  - Reduced Benefit to PID System Reliability – This alternative would discharge to the PID Canal upstream of the most vulnerable section of the Canal, which is a segment of steel pipeline suspended over a slide area downstream of where the delivery to the Canal would be made.
  - Channel Modifications – The main flow in the channel is located toward the center of the channel, rather than at the right bank where the pump station would be located. Channel modification would be required to enable diversion to the pump station at low flow rates.
  - Pump Station Construction – Pump station construction would likely require excavation of material with large boulders and cobbles.
  - Slope Stability – There is high slope stability risk of the proposed pipeline alignment where it ascends the steep hillside to the ditch.

- Alternative 4
  - U.S. Highway 2 Crossing – The proposed pipeline would cross under U.S. Highway 2 via boring or jacking. The crossing would require coordination with WSDOT and would be an expensive installation.

  - Reduced Benefit to PID System Reliability – This alternative would discharge to the PID Canal upstream of the most vulnerable section of the Canal, which is a segment of steel pipeline suspended over a slide area downstream of where the delivery to the Canal would be made.
  - Channel Modifications – The main flow in the channel is located toward the far side of the channel, rather than at the right bank where the pump station would be located. Channel modification would be required to enable diversion to the pump station at low flow rates.
  - Pump Station Construction – Pump station construction would likely require excavation of material with large boulders and cobbles.
  - Private Property – Construction would impact a private orchard and would require cooperation of private property owners.

- Alternative 5

  - Pump Station Site – The pump station site would be located upstream of Dryden Dam. As noted previously, the site is also being evaluated by the Yakama Nation for fish rearing facilities and Chelan PUD currently operates a fish capture facility adjacent to where the proposed pump station would be constructed. Extensive coordination would be required with the Yakama Nation, Chelan PUD, the State, Wenatchee Reclamation District, and other stakeholders to make this site work for a new pump station.
  - U.S. Highway 2 Crossing – The proposed pipeline would cross under U.S. Highway 2 via boring or jacking. The crossing would require coordination with WSDOT and would be an expensive installation.
  - Reduced Benefit to PID System Reliability – This alternative would discharge to the PID Canal upstream of the most vulnerable section of the Canal, which is a segment of steel pipeline suspended over a slide area downstream of where the delivery to the Canal would be made.
  - Right-of-way Impacts – A portion of the proposed pipeline alignment would follow Deadman Hill Road to the PID Canal from U.S. Highway 2. Chelan County is currently finishing a resurfacing project on Deadman Hill Road. Trenching in the roadway in the near term may not be allowed by the County.

There is a very narrow shoulder, so installation of the pipeline outside the paved roadway would be difficult.

At this point, none of these challenges has been identified as a fatal flaw. It is anticipated that most of these challenges could be addressed with additional engineering analysis, appropriate design elements, coordination with property owners, and coordination with other stakeholders. However, additional review with stakeholders may indicate that some of challenges are effectively fatal flaws because there may not be a reasonable or affordable way to address them. It is recommended that these challenges be reviewed in detail with stakeholders as part of the selection of a preferred alternative, or alternatives, to more clearly determine which challenges cannot be addressed.

8 DESCRIPTION OF PREFERRED ALTERNATIVE(S)

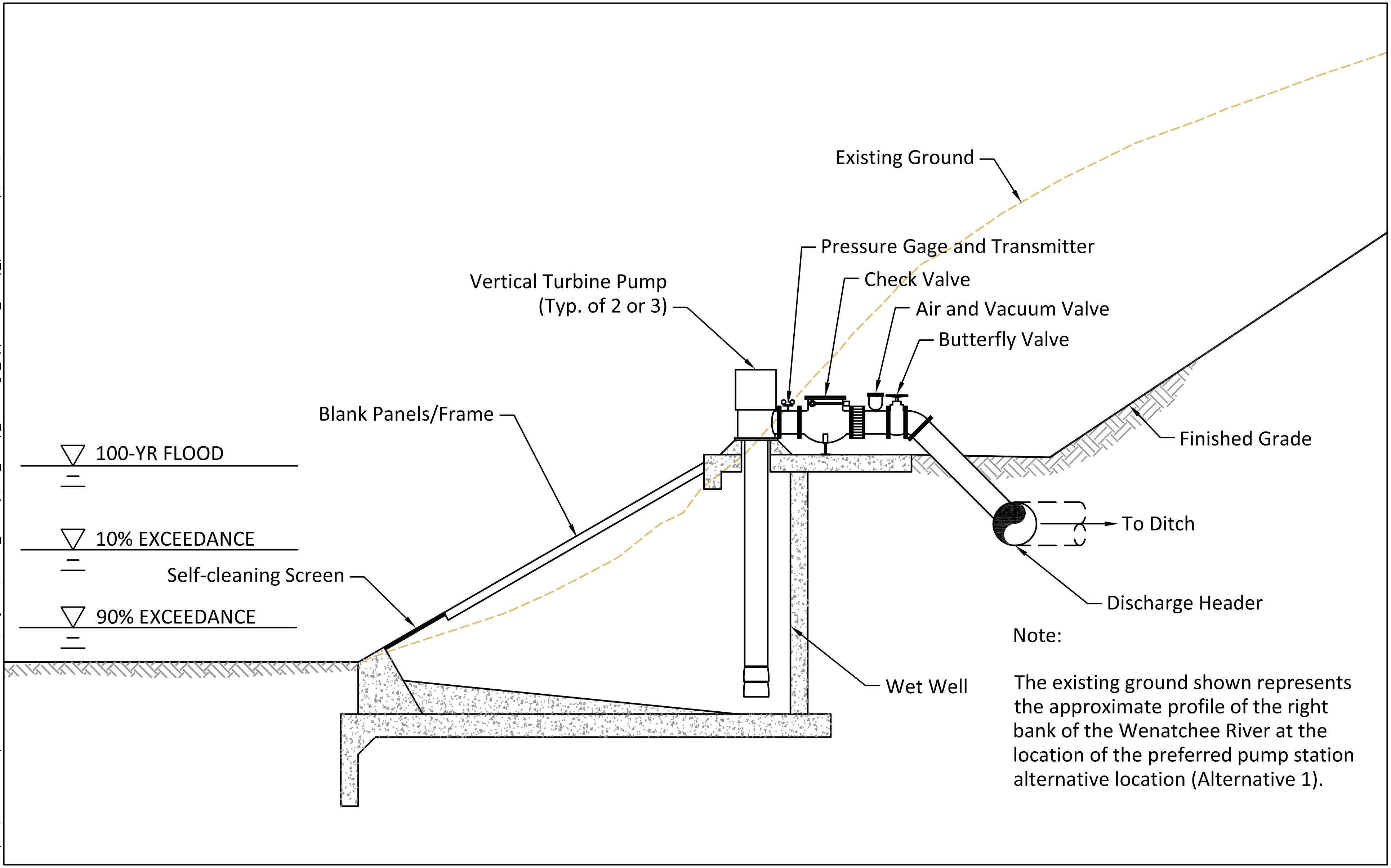
The preliminary alternatives evaluation provided in Sections 1 through 7 of this report were reviewed by PID, Chelan PUD, Chelan County, and Ecology. Based on review of the alternatives with PID and others, Alternative 1 was selected as the preferred project alternative for the following reasons:

- It would provide a connection to the PID system downstream of the slide area, which is probably the most vulnerable section of the PID Canal system. It would increase the reliability of the system by enabling PID to maintain supply to the system in the event that a portion of the ditch or pipeline through the slide area becomes damaged or inoperable.
- It is projected to be one of the less expensive alternatives to construct and maintain.
- Based on the preliminary geomorphic evaluation, the recommended pump station location would likely require little modification and maintenance within the river channel to divert the design flow rate over a range of flow conditions than all of the other alternatives, except Alternative 5.

PID also recommended that Alternative 5 be studied further as a backup to the preferred alternative. Alternative 5 would not provide the same benefit to the PID system's reliability as Alternative 1, because it would discharge to the PID Canal upstream of the most vulnerable section of the canal through the slide area. Alternative 5 would also be the most expensive alternative to construct. However, the pumping costs for Alternative 5 would be the lowest of the alternatives studied. In addition, Alternative 5 would draw water from the pool upstream of Dryden Dam, which would create the most favorable hydraulic conditions for operation.

8.1 Pump Station

Figure 8-1 provides a conceptual section showing what a pump station might look like on the right bank of the Wenatchee River. The following summarizes pump station characteristics for the preferred alternative, Alternative 1, and the backup alternative, Alternative 5.



Note:

The existing ground shown represents the approximate profile of the right bank of the Wenatchee River at the location of the preferred pump station alternative location (Alternative 1).

ANCHOR QEA

Figure 8-1
Conceptual Pump Station Section
Peshastin Irrigation District Pump Exchange Appraisal Study
Chelan County Natural Resources Department

8.1.1 Alternative 1

As indicated in Section 4.1, the pump station for Alternative 1 would be constructed on the right bank of the Wenatchee River, just southwest (upstream) of U.S. Highway 2, approximately 7,250 feet downstream of the confluence of Peshastin Creek with the Wenatchee River (approximately RM 16.5). The pump station would be constructed just downstream of an exposed bedrock outcropping at the right bank of the river. Pump station characteristics would be as follows:

- Pump station elevation – Approximately 922 feet (NAVD 88)
- Pumping head:
  - 244 feet if designed to deliver 10 cfs
  - 240 feet if designed to deliver 20 cfs
  - 250 feet if designed to deliver 40 cfs
- Total horsepower requirement:
  - 400 horsepower if designed to deliver 10 cfs
  - 780 horsepower if designed to deliver 20 cfs
  - 1,620 horsepower if designed to deliver 40 cfs
- Type of pumps – Vertical turbine
- Number of pumps – Two or three pumps, depending on design flow rate
- Pump station structure – Reinforced concrete with screened intake and sump
- Electrical and controls – VFDs on each pump, three-phase power service, and a small building to house control panels and equipment
- Other equipment – Steel or ductile iron discharge pipe and fittings, a check valve or pump control valve on each pump discharge line, pressure transmitters and switches, air release valves, butterfly valves on each discharge line for isolation, a flow meter, and other appurtenances
- Other notable design constraints and opportunities include:
  - The recommended pump station location would be located just downstream of a bedrock outcropping that extends into the river, creating a pool at the proposed pump station location that should allow for diversion of water over a range of flows with little or no modification to the river.

  - Temporary and permanent access to the pump station location will be challenging. The recommended location is along a relatively steep, high river bank and would need to be accessed by crossing an existing orchard. The river bank downstream of the pump station has been eroding.
  - Construction of the pump station may require excavation of large rock.
  - The pump station would be located downhill of a potential slide area.

8.1.2 Alternative 5

As indicated in Section 4.5, the pump station for Alternative 5 would be constructed on the right bank of the Wenatchee River, just upstream of the Dryden Dam and Chelan PUD fish facility, approximately 700 feet downstream of the confluence of Peshastin Creek with the Wenatchee River (approximately RM 17.8). Pump station characteristics would be as follows:

- Pump station elevation – Approximately 971 feet (NAVD 88)
- Pumping head:
  - 219 feet if designed to deliver 10 cfs
  - 210 feet if designed to deliver 20 cfs
  - 222 feet if designed to deliver 40 cfs
- Total horsepower requirement:
  - 360 horsepower if designed to deliver 10 cfs
  - 680 horsepower if designed to deliver 20 cfs
  - 1,440 horsepower if designed to deliver 40 cfs
- Type of pumps – Vertical turbine
- Number of pumps – Two or three pumps, depending on design flow rate
- Pump station structure – Reinforced concrete with screened intake and sump
- Electrical and controls – VFDs on each pump, three-phase power service, and a small building to house control panels and equipment
- Other equipment – Steel or ductile iron discharge pipe and fittings, a check valve or pump control valve on each pump discharge line, pressure transmitters and switches, an air release valve and butterfly valves on each discharge line for isolation, a flow meter, and other appurtenances

- Other notable design constraints and opportunities include:
  - The recommended pump station location would draw from the pool created by the Dryden Dam. Water levels would be more consistent and very little in river modifications or maintenance would be needed.
  - Permanent access is already available to the site.
  - Extensive coordination would be required with Chelan PUD, which currently operates a fish rearing facility at the site, the Yakama Nation, which has plans for an additional fish rearing facility at the site, and WDFW, which would like to improve portage conditions for recreational rafting at the site.
  - The pump station could potentially share intake facilities with fish rearing facilities currently being planned by the Yakama Nation.
  - The pump station would need to be designed to minimize adverse impacts to current fish operations and passage.

8.2 Fish Screening

Fish screening facilities would be designed to meet the most current requirements for screening of diversions from the WDFW and the NMFS *Anadromous Salmonid Passage Facility Design Guidelines* (NMFS 2008), developed by the NMFS Northwest Region. Those criteria are outlined in Section 2.2.3.

Sizing of fish screening facilities was outlined in Section 5.1 and summarized in Table 5-2. Fish screen calculations are included in Appendix D. An inclined fixed-plate screen was identified as the most likely screening option for all project alternatives. The sizing would depend on the design flow rate and would be the same for either Alternative 1 or Alternative 5. However, Alternative 5 has the potential for sharing intake facilities with a fish rearing facility proposed by the Yakama Nation. If screening and intake facilities were shared, the sizing would need to accommodate flows for both facilities.

For either alternative, fish screen facilities would likely include:

- An inclined fixed-plate screen, consisting of a flat screen supported by the sump structure, inclined at an angle to generally match the slope of the riverbank
- Non-corrosive stainless steel or plastic screen material

- A self-cleaning mechanism, such as an air-burst system or mechanical brush, or an inclined traveling water screen that would rotate on a conveyor to lift debris out of the water for removal from the screen with internal jets or a brush

8.3 Pipeline

Figure 5-1 provides a conceptual illustration of the proposed pipeline alignments for each alternative. The delivery pipeline would be designed according to the criteria outlined in Section 2.2.4. The following summarizes pipeline characteristics for the preferred alternative, Alternative 1, and the backup alternative, Alternative 5.

8.3.1 Alternative 1

As indicated in Section 4.1, the delivery pipeline constructed as part of Alternative 1 would consist of approximately 1,240 feet of pipe. The pipeline would extend from the pump station south and east through an existing orchard, then west up a relatively steep hill to a delivery location at the existing PID Canal. The pipeline characteristics would be as follows:

- Size:
  - 20-inch nominal diameter if designed to deliver 10 cfs
  - 30-inch nominal diameter if designed to deliver 20 cfs
  - 36-inch nominal diameter if designed to deliver 40 cfs
- Pipe material – HDPE (for installation on steep slope), ductile iron, or PVC
- Maximum slope – Approximately 30 percent
- Minimum recommended cover – 30 inches
- Backfill – Imported bedding to 6 inches above pipe, native material above bedding
- Other notable design constraints and opportunities include:
  - The exact alignment would need to be selected to minimize impact to the existing orchard.
  - Trenching for pipeline installation could potentially encounter rock. Additional geotechnical exploration is needed to verify subsurface soil conditions.
  - This alternative would require pipeline construction on a steep slope. Construction would be challenging.

- A slide area is mapped west of the pipeline alignment. Slope stability risk would be low to moderate.

8.3.2 Alternative 5

As indicated in Section 4.5, the delivery pipeline constructed as part of Alternative 5 would consist of approximately 4,910 feet of pipe. The pipeline would extend south and west from the pump station along the Dryden Dam access road, across U.S. Highway 2, and up Deadman Hill Road to the PID Canal. The pipeline characteristics would be as follows:

- Size:
  - 20-inch nominal diameter if designed to deliver 10 cfs
  - 30-inch nominal diameter if designed to deliver 20 cfs
  - 36-inch nominal diameter if designed to deliver 40 cfs
- Pipe material – HDPE, ductile iron, or PVC
- Maximum slope – Less than 10 percent
- Minimum recommended cover – 30 inches
- Backfill – Imported bedding to 6 inches above pipe, native material above bedding
- Other notable design constraints and opportunities include:
  - The alignment would be almost entirely within public roadways or the Dryden Dam Access Road.
  - Trenching for pipeline installation could potentially encounter rock, especially in the Dryden Dam Access Road near Peshastin Creek. Additional geotechnical exploration is needed to verify subsurface soil conditions.
  - Directional drilling, jacking, or boring would likely be required for pipeline installation at U.S. Highway 2.
  - The pipeline would follow Deadman Hill Road from U.S. Highway 2 to the delivery location at the PID Canal. There is limited right-of-way along Deadman Hill Road and the roadway was recently resurfaced by Chelan County.
  - Slope stability risk would be low.

8.4 Delivery to PID Canal

Delivery facilities at the PID Canal would be designed to deliver the design flow conveyed by the pipeline to PID Canal while preventing erosion or damage to canal facilities. For both Alternatives 1 and 5, the delivery location would be at an open section of concrete-lined canal. Delivery facilities would likely include a baffled reinforced concrete structure, constructed within the existing ditch easement.

The reinforced concrete structure for either alternative would feature the following:

- Baffles, diffusers, or a riser designed to dissipate energy and reduce the velocity of water discharged from the end of the pipeline
- A stilling well with a water level transmitter or other device designed to accurate measure the water level for hydraulic control of pump operation
- Access for maintenance and cleaning

8.5 Project Costs

Opinions of probable project costs for each alternative were outlined in Section 6. Opinions of probable costs were developed for project implementation, long-term operating costs, and replacement costs. Table 8-1 summarizes those costs for Alternatives 1 and 5.

Table 8-1
Summary of Opinions of Project Costs – Alternatives 1 and 5

Item	Alternative 1			Alternative 5		
	10-cfs	20-cfs	40-cfs	10-cfs	20-cfs	40-cfs
Project Implementation Costs:						
Construction Subtotal	$1,027,000	$1,480,000	$2,160,000	$1,748,000	$2,443,000	$3,425,000
Other Costs	$853,000	$1,207,000	$1,739,000	$1,417,000	$1,960,000	$2,728,000
Total Project Cost	**$1,880,000**	**$2,687,000**	**$3,899,000**	**$3,165,000**	**$4,403,000**	**$6,153,000**
Annual Operating Costs:						
Annual O&M	$11,920	$14,220	$17,820	$16,120	$19,320	$24,620
Annual Power Costs						
2-Week Pumping	$8,658	$17,026	$35,219	$7,789	$14,853	$31,307
8-Week Pumping	$13,559	$26,704	$55,282	$12,193	$23,290	$49,136
Total Annual Operating Cost:						
2-Week Pumping	**$20,600**	**$31,200**	**$53,000**	**$23,900**	**$34,200**	**$55,900**
8-Week Pumping	**$25,500**	**$40,900**	**$73,100**	**$28,300**	**$42,600**	**$73,800**
Present Value of Project Implementation and Annual Operating Costs Through 50-Year Design Life Cycle:						
Total Project Cost	$1,880,000	$2,687,000	$3,899,000	$3,165,000	$4,403,000	$6,153,000
Total Operating Cost						
2-Week Pumping	$1,028,908	$1,562,322	$2,651,966	$1,195,436	$1,708,643	$2,796,344
8-Week Pumping	$1,273,955	$2,046,214	$3,655,110	$1,415,669	$2,130,497	$3,687,821
Total						
2-Week Pumping	**$2,908,908**	**$4,249,322**	**$6,550,966**	**$4,360,436**	**$6,111,643**	**$8,949,344**
8-Week Pumping	**$3,153,955**	**$4,733,214**	**$7,554,110**	**$4,580,669**	**$6,533,497**	**$9,840,821**
Annual Replacement Fund Costs (50% Replacement)[1]:						
Fixed Deposit	$37,466	$53,518	$77,673	$63,118	$87,700	$122,562
Increasing Deposit						
Year 1	$19,858	$28,366	$41,169	$33,454	$46,484	$64,962
Year 25	$40,368	$57,663	$83,688	$68,006	$94,492	$132,055
Year 50	$84,522	$120,733	$175,225	$142,389	$197,846	$276,493

Notes:
1. These costs assume only 50 percent replacement of the system, as it is not likely that all of the facilities would need to be replaced with the 50-year life cycle.

9 OTHER CONSIDERATIONS

The scope of this appraisal study is limited to the tasks outlined in Section 1.2.1. Other improvements that may warrant consideration as part of the pump exchange project or as part of an overall approach to improving management of water resources within the Peshastin Creek Subbasin include:

- Other potential improvements to the Peshastin Creek channel and floodplain to further improve fish habitat, spawning, and passage.
- Design of pump exchange facilities to also deliver water to IID to reduce late summer diversions from Icicle Creek.

9.1 Fish Habitat and Passage Improvements

An instream flow benefit analysis was completed by Hydrology Northwest as part of the development of this Appraisal Study (see Appendix B). The analysis focused primarily on the benefit of increased late summer flows in Peshastin Creek to fish passage for ESA-listed bull trout and Chinook salmon. The analysis also evaluated WUA, a measure of habitat abundance, versus flow in lower Peshastin Creek. The results indicate that the increased late summer flow resulting from reduced diversions made possible by the proposed pump exchange project would improve passage and habitat abundance in lower Peshastin Creek. The analysis also notes that channel modifications may be needed, in conjunction with increased late summer flows, to improve passage at the worst transects.

Comments provided by WDFW following their review of the draft of this Appraisal Study indicate that a more detailed evaluation of the long-term biological benefits of the proposed pump exchange project may be warranted. WDFW indicated that channel improvements need to be evaluated in the context of existing and potential floodplain values, surface flow connectivity, side channel values, riparian connectivity, and channel meandering values.

It is recommended that additional coordination and discussion with WDFW, CCNRD, Ecology, irrigators, and other stakeholders be included as part of future phases of study for the pump exchange project to develop a more comprehensive strategy for improvements in lower Peshastin Creek. As part of that larger strategy, stakeholders should consider a more detailed evaluation of channel and floodplain improvements designed to further improve fish passage, add habitat complexity, and restore floodplain functions.

9.2 Pumping to Icicle Irrigation District

CCNRD, irrigators, and other stakeholders may also want to give consideration to designing the pump exchange project to reduce late summer diversions from Icicle Creek. The PID pump exchange project could potentially be designed to reduce late summer diversions from Icicle Creek by replacing flows delivered to PID at the bifurcation on the IID Division 2 Canal and/or expanding the pump exchange project to include facilities that would deliver water directly to the IID Division 3A Canal from the Wenatchee River.

As was noted previously, IID diverts water for irrigation from lower Icicle Creek. PID also has a water right on Icicle Creek and jointly operates the diversion facilities at Icicle Creek and the IID Division 1 and 2 Canals with IID. Up to 14 cfs has historically been conveyed from the bifurcation structure at the downstream end of the IID Division 2 Canal to the PID Canal to supplement PID's diversions from Peshastin Creek. PID relies on the additional supply from the bifurcation to meet irrigation demands during the late summer when low flows limit PID's diversions from Peshastin Creek. In addition to reducing diversions from Peshastin Creek, the pump exchange project could also be used to replace water delivered to PID from the bifurcation, which would reduce diversions from Icicle Creek.

9.2.1 Description of Potential IID Pump Exchange

The IID Division 3A and 3B Canals run parallel to the PID Canal along the hillsides south of the Wenatchee River Valley and are approximately 160 to 170 feet higher than the PID Canal. IID conveys up to 30 cfs from the bifurcation at the downstream end of the Division 2 Canal through the Peshastin Siphon to the Division 3A Canal. The PID pump exchange project could be expanded to also deliver flows to the IID Division 3A Canal directly from the Wenatchee River, reducing the flow that would need to be diverted from Icicle Creek. The following provides a preliminary analysis of the additional facilities that would be required.

9.2.1.1 Pumping Location and System Configuration

Because the IID Division 3A Canal is approximately 160 to 170 feet higher in elevation than the PID Canal, delivery of water to the IID Canal from a pump station along the Wenatchee River would require additional pumping. Three potential pumping configurations were identified for delivering water to the IID Canal:

- Install a pump station on the Wenatchee River with pumps sized (in terms of pumping head) to deliver water to the elevation of the PID Canal, as described in Section 8.1. Install a booster pump station adjacent to the PID Canal sized to deliver water from the PID Canal up to the IID Division 3A Canal.
- Install a pump station on the Wenatchee River that would deliver water to both the PID Canal and the IID Division 3A Canal. The pumps would be sized (in terms of pumping head) to deliver water through a single discharge pipeline to the elevation of the IID Canal.
- Install a pump station on the Wenatchee River with two sets of pumps and two separate, parallel discharge pipelines. One set of pumps and discharge pipeline would be sized (in terms of pumping head) to deliver water to the elevation of the PID Canal and the other would be sized to deliver water to the elevation of the IID Canal.

The first configuration would be the most efficient. The pumps and pipe would not have to be oversized and less power would be required than for the other configurations. However, three phase power would have to be extended to both the booster pump station and the river pump station site. Operating pumps at different locations could also be a challenge.

The second configuration would result in over sizing of pumps and wasted pumping energy. For example, if the system had to deliver water to both canals at the same time, the deliveries to PID would have to be pumped (in terms of pumping head) more than 170 feet higher than needed to deliver water to the elevation of the PID Canal. The benefit of this configuration is that it would include a consolidated pump station location and a single discharge line.

The third configuration would essentially result in two separate systems built adjacent to one another. This approach would keep all of the pumping in one location and would minimize the over sizing and inefficiencies noted for the second configuration. However, the cost of two parallel discharge pipelines would be high.

This analysis assumes that pumping to IID would match the first configuration. The initial cost of extending three-phase power to the pump stations would be higher than for the other potential configurations, but the cost of pumps, piping, and power would be lower.

9.2.1.2 Flow Rates

In order to evaluate a range of potential pumping and delivery conditions, the pump station evaluation in Section 5.1 of this study was completed for pump station flow rates of 10, 20, and 40 cfs. A more detailed operational evaluation would be needed as part of future study to more clearly define pump station flow rates as they relate to water supply needs and late summer flows in Peshastin and Icicle Creeks. For the sake of completing this preliminary analysis, the following pump station flow rates were evaluated:

- A 10-cfs Wenatchee River Pump Station with a 10-cfs booster pump station at the PID Canal. The maximum combined delivery to PID Canal and IID Division 3A would be 10 cfs. The system would be capable of delivering up to 10 cfs to either canal, or some combination of deliveries that total 10 cfs.
- A 20-cfs Wenatchee River Pump Station with a 20-cfs booster pump station at the PID Canal. The maximum combined delivery to PID Canal and IID Division 3A would be 20 cfs. The system would be capable of delivering up to 20 cfs to either canal, or some combination of deliveries that total 20 cfs.
- A 40-cfs Wenatchee River Pump Station with a 40-cfs booster pump station at the PID Canal. The maximum combined delivery to PID Canal and IID Division 3A would be 40 cfs. The system would be capable of delivering up to 40 cfs to either canal, or some combination of deliveries that total 40 cfs.

9.2.1.3 Hydraulic Analysis

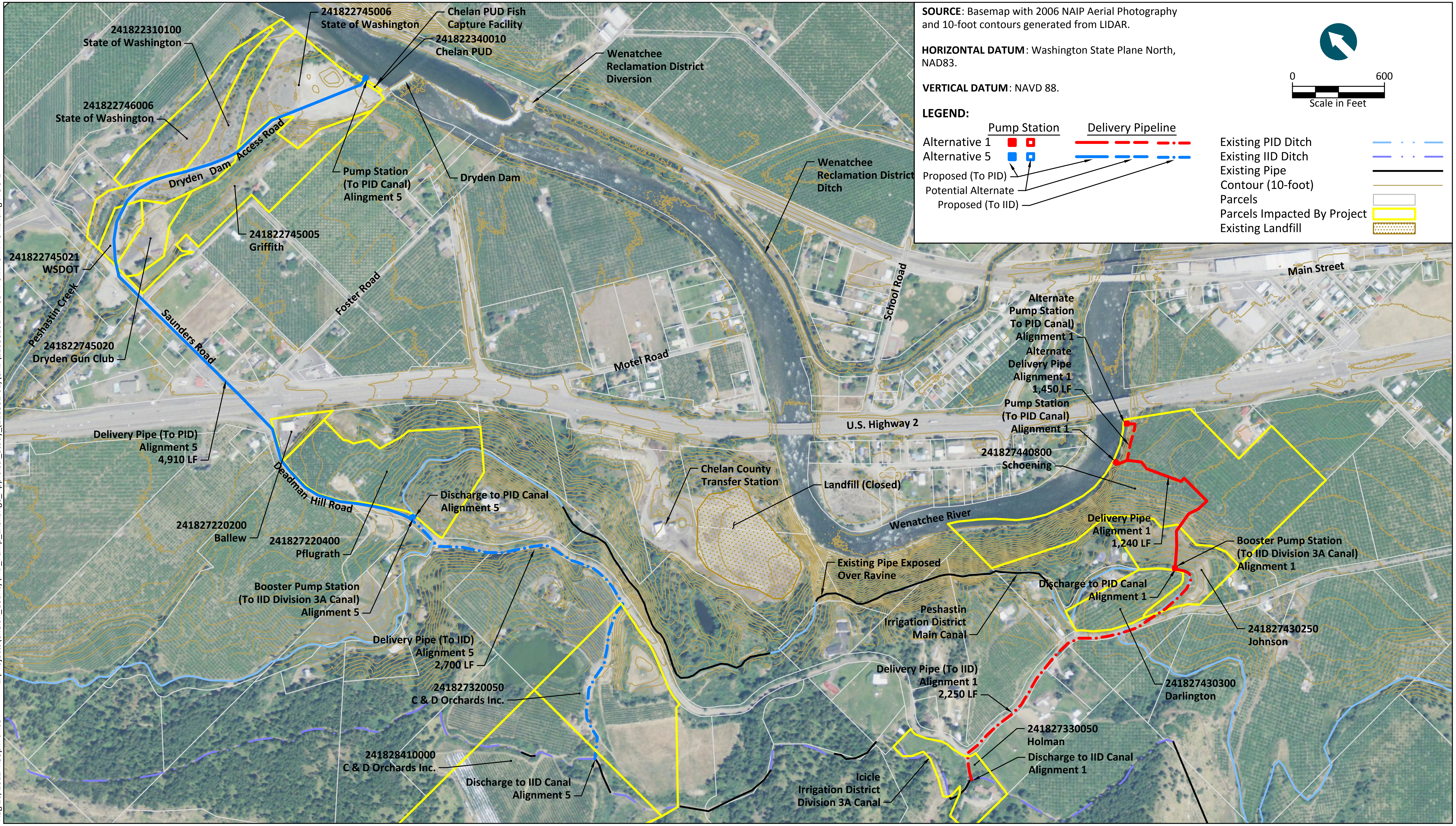
A preliminary hydraulic analysis was completed to determine the size of pumps, pipe, and other facilities needed to deliver water to the IID Division 3A Canal from the PID Canal. The analysis was completed for the preferred alternative (Alternative 1) and the backup preferred alternative (Alternative 5) as outlined in Section 8. The conceptual layout of the additional facilities that would be needed for these alternatives is shown in Figure 9-1. The detailed results of the analysis are included in Appendix H. The same assumptions and method were used for this analysis as was used for the evaluation of preliminary alternatives described in Section 5.1. The results are summarized in Table 9-1.

Table 9-1

Summary of Hydraulic Analysis Results – Pumping to IID Canal

Design Parameter	Alternative 1	Alternative 5
Pump Sump Elevation (feet)	1,146	1,158
Discharge Elevation (feet)	1,318	1,320
Elevation Gain (feet)	172	162
Delivery Pipe[1] Length (feet)	2,250	2,700
Delivery Pipe[1] Size (inches)		
At 10 cfs P.S. Capacity	20	20
At 20 cfs P.S. Capacity	30	30
At 40 cfs P.S. Capacity	36	36
Total Headloss[2] (feet)		
At 10 cfs P.S. Capacity	24	25
At 20 cfs P.S. Capacity	19	19
At 40 cfs P.S. Capacity	28	29
Pumping Head, TDH (feet)		
At 10 cfs P.S. Capacity	196	187
At 20 cfs P.S. Capacity	191	181
At 40 cfs P.S. Capacity	200	191
Number of Pumps		
At 10 cfs P.S. Capacity	2	2
At 20 cfs P.S. Capacity	3	3
At 40 cfs P.S. Capacity	3	3
Flow Rate per Pump (cfs)		
At 10 cfs P.S. Capacity	5.00	5.00
At 20 cfs P.S. Capacity	6.67	6.67
At 40 cfs P.S. Capacity	13.33	13.33

Notes:
1. Delivery Pipe includes transmission pipeline from the pump station to the delivery at the PID Canal.
2. Total headloss includes both friction and minor losses through the pump station and delivery pipeline.
cfs = cubic feet per second
TDH = Total Dynamic Head, or Pumping Head



L:\Projects\Chelan_County\PID_Pump_Exchange_Appraisal_Study_(110382-01)\CAD\11038201-RP-004-PUMP STA-TO IID.dwg FIG 9-1

Aug 20, 2012 4:33pm drice

Figure 9-1

Preferred Alternatives With Pumping to IID Division 3A Canal
Peshastin Irrigation District Pump Exchange Appraisal Study
Chelan County Natural Resources Department

ANCHOR QEA

9.2.1.4 Description of Additional Facilities Required

The conceptual layout of additional facilities needed to deliver water from the PID Canal to the IID Division 3A Canal for Alternatives 1 and 5 is shown in Figure 9-1. Additional facilities would include a booster pump station at the PID Canal, additional discharge pipeline to connect to the IID Division 3A Canal, and a delivery facility at the IID Canal.

ALTERNATIVE 1

The following is a more detailed description of the major facilities needed to extend deliveries to the IID Division 3A Canal for Alternative 1.

Pump Station

- Elevation – Approximately 1,146 feet (NAVD 88)
- Location – On PID Canal approximately 19,560 feet downstream of the diversion on Peshastin Creek, adjacent to the delivery to the PID Canal
- Pumping head, or TDH – As indicated in Table 9-1
- Total horsepower requirement
  - 320 horsepower if designed to deliver 10 cfs
  - 620 horsepower if designed to deliver 20 cfs
  - 1,300 horsepower if designed to deliver 40 cfs
- Type of pumps – Vertical turbine or centrifugal
- Number of pumps – 2 or 3 pumps, depending on design flow rate
- Configuration – In-line boosters with hydraulic connection on suction side to delivery structure to PID Canal.
- Electrical and controls – VFDs on each pump, 3-phase power service, and a small building to house control panels and equipment
- Other equipment – Steel or ductile iron suction and discharge pipe and fittings, a check valve or pump control valve on each pump discharge line, pressure transmitters and switches, air release valves, butterfly valves on each discharge line for isolation, a flow meter, and other appurtenances
- Discharge Pipeline
  - Length – Approximately 2,250 feet

- Alignment – South and west along PID Canal to Deadman Hill Road, west in Deadman Hill Road, and up a private driveway to the IID Division 3A Canal
- Diameter – As shown in Table 9-1
- Pipe material – HDPE, ductile iron, or PVC
- Maximum slope – Approximately 23 percent
- Minimum recommended Cover – 30 inches
- Backfill – Imported bedding to 6 inches above pipe, native material above bedding

Delivery at IID Division 3A Canal

- Baffled reinforced concrete structure constructed within the ditch easement or other device designed to dissipate energy prior to discharging to the open canal

ALTERNATIVE 5

The following is a more detailed description of the major facilities needed to extend deliveries to the IID Division 3A Canal for Alternative 5.

Pump Station

- Elevation – Approximately 1,158 feet (NAVD 88)
- Location – On PID Canal approximately 12,860 feet downstream of the diversion on Peshastin Creek, adjacent to the delivery to the PID Canal
- Pumping head, or TDH – As indicated in Table 9-1
- Total horsepower requirement
    - 305 horsepower if designed to deliver 10 cfs
    - 590 horsepower if designed to deliver 20 cfs
    - 1,240 horsepower if designed to deliver 40 cfs
- Type of pumps – Vertical turbine or centrifugal
- Number of pumps – 2 or 3 pumps, depending on design flow rate
- Configuration – In-line boosters with hydraulic connection on suction side to delivery structure to PID Canal.
- Electrical and controls – VFDs on each pump, 3-phase power service, and a small building to house control panels and equipment

- Other equipment – Steel or ductile iron suction and discharge pipe and fittings, a check valve or pump control valve on each pump discharge line, pressure transmitters and switches, air release valves, butterfly valves on each discharge line for isolation, a flow meter, and other appurtenances

Discharge pipeline

- Length – Approximately 2,700 feet
- Alignment – Southeast along Deadman Hill Road and southwest up a private driveway to the IID Division 3A Canal
- Diameter – As shown in Table 9-1
- Pipe material – HDPE, ductile iron, or PVC
- Maximum slope – Approximately 50 percent
- Minimum recommended cover – 30 inches
- Backfill – imported bedding to 6 inches above pipe, native material above bedding

Delivery at IID Division 3A Canal

- Baffled reinforced concrete structure constructed within the ditch easement or other device designed to dissipate energy prior to discharging to the open canal

ALTERNATIVES 1 AND 5

The following design constraints, opportunities, and limitations apply to both alternatives:

- Temporary and permanent access to the pump station location will require improvement of existing access along ditch bank.
- Construction of the discharge pipeline may require excavation of large rock.
- The discharge pipeline would mostly be constructed within public roadways.
- There is limited right-of-way along Deadman Hill Road and the roadway was recently resurfaced by Chelan County.
- The site has not been reviewed to determine whether the pump station location, pipeline alignment, and delivery location are feasible. Additional geotechnical exploration and other site investigations are needed to verify site constraints.

9.2.1.5 Additional Property Impacts

Extension of the project to deliver water to the IID Division 3A Canal would impact additional properties. In addition to those properties listed in Table 5-3, extending Alternative 1 to deliver water to the IID Canal would also impact one private parcel listed in Table 9-2. In addition to the properties listed in Table 5-7, extending Alternative 5 to deliver water to the IID Canal would also impact two private properties listed in Table 9-3. For both alternatives, installation of a discharge pipeline from the PID Canal to the IID Division 3A Canal would impact the Deadman Hill Road right-of-way. As was noted previously, Deadman Hill Road was recently resurfaced.

Table 9-2
Properties Impacted by Alternative 1 – Extension to IID

Parcel	Owner	Address	Impacted/Adjacent
241827330050	Don Holman	90732 Deadman Hill Road Cashmere, WA 98815	Impacted

Table 9-3
Properties Impacted by Alternative 5 – Extension to IID

Parcel	Owner	Address	Impacted/Adjacent
241827320050	C & D Orchards, Inc.	PO Box 578 Peshastin, WA 98847	Impacted
241828410000	C & D Orchards, Inc.	PO Box 578 Peshastin, WA 98847	Impacted

9.2.1.6 Description of Additional Costs

The additional costs for the facilities needed to extend deliveries to the IID Division 3 A Canal are included in Table 9-4. The totals for pumping to both PID (from Table 8-1) and IID (Table 9-4) are summarized in Table 9-5. The same assumptions and methodology were used to develop these costs as were outlined in Section 6. More detailed cost information, including a list of major items, estimated quantities, and unit costs used to develop the opinions of cost is included in Appendix H.

Table 9-4
Summary of Additional Costs for Delivery to IID – Alternatives 1 and 5

Item	Alternative 1			Alternative 5		
	10-cfs	20-cfs	40-cfs	10-cfs	20-cfs	40-cfs
Project Implementation Costs:						
Construction Subtotal	$897,000	$1,354,000	$1,843,000	$969,000	$1,451,000	$2,382,000
Other Costs	$751,000	$1,109,000	$1,491,000	$808,000	$1,185,000	$1,913,000
Total Project Cost	**$1,648,000**	**$2,463,000**	**$3,334,000**	**$1,777,000**	**$2,636,000**	**$4,295,000**
Annual Operating Costs:						
Annual O&M	$11,920	$14,220	$17,820	$16,120	$19,320	$24,620
Annual Power Costs						
2-Week Pumping	$7,028	$13,549	$28,329	$6,702	$12,897	$27,025
8-Week Pumping	$10,998	$21,241	$44,459	$10,486	$20,217	$42,410
Total Annual Operating Cost:						
2-Week Pumping	**$18,900**	**$27,800**	**$46,100**	**$22,800**	**$32,200**	**$51,600**
8-Week Pumping	**$22,900**	**$35,500**	**$62,300**	**$26,600**	**$39,500**	**$67,000**
Present Value of Project Implementation and Annual Operating Costs Through 50-Year Design Life Cycle:						
Total Project Cost	$1,648,000	$2,463,000	$3,334,000	$1,777,000	$2,636,000	$4,295,000
Total Operating Cost						
2-Week Pumping	$947,398	$1,388,436	$2,307,454	$1,141,096	$1,610,832	$2,582,246
8-Week Pumping	$1,145,918	$1,773,067	$3,113,939	$1,330,310	$1,976,852	$3,351,509
Total						
2-Week Pumping	**$2,595,398**	**$3,851,436**	**$5,641,454**	**$2,918,096**	**$4,246,832**	**$6,877,246**
8-Week Pumping	**$2,793,918**	**$4,236,067**	**$6,447,939**	**$3,107,310**	**$4,612,852**	**$7,646,509**
Annual Replacement Fund Costs (50% Replacement)[1]:						
Fixed Deposit	$32,958	$49,165	$66,693	$36,145	$53,362	$86,456
Increasing Deposit						
Year 1	$17,469	$26,059	$35,350	$19,158	$28,284	$45,825
Year 25	$35,510	$52,973	$71,858	$38,944	$57,495	$93,152
Year 50	$74,351	$110,913	$150,456	$81,541	$120,382	$195,040

Notes:

1. These costs assume only 50 percent replacement of the system, as it is not likely that all of the facilities would need to be replaced with the 50-year life cycle.

Table 9-5
Summary of Costs for Delivery to Both PID and IID – Alternatives 1 and 5

Item	Alternative 1			Alternative 5		
	10-cfs	20-cfs	40-cfs	10-cfs	20-cfs	40-cfs
Project Implementation Costs:						
Construction Subtotal	$1,924,000	$2,834,000	$4,003,000	$2,717,000	$3,894,000	$5,807,000
Other Costs	$1,604,000	$2,316,000	$3,230,000	$2,225,000	$3,145,000	$4,641,000
Total Project Cost	**$3,528,000**	**$5,150,000**	**$7,233,000**	**$4,942,000**	**$7,039,000**	**$10,448,000**
Annual Operating Costs:						
Annual O&M	$23,840	$28,440	$35,640	$32,240	$38,640	$49,240
Annual Power Costs						
2-Week Pumping	$15,686	$30,575	$63,548	$14,491	$27,750	$58,332
8-Week Pumping	$24,557	$47,945	$99,741	$22,679	$43,507	$91,546
Total Annual Operating Cost:						
2-Week Pumping	**$39,500**	**$59,000**	**$99,100**	**$46,700**	**$66,400**	**$107,500**
8-Week Pumping	**$48,400**	**$76,400**	**$135,400**	**$54,900**	**$82,100**	**$140,800**
Present Value of Project Implementation and Annual Operating Costs Through 50-Year Design Life Cycle:						
Total Project Cost	$3,528,000	$5,150,000	$7,233,000	$4,942,000	$7,039,000	$10,448,000
Total Operating Cost						
2-Week Pumping	$1,976,306	$2,950,758	$4,959,420	$2,336,532	$3,319,475	$5,378,590
8-Week Pumping	$2,419,873	$3,819,281	$6,769,049	$2,745,979	$4,107,349	$7,039,330
Total						
2-Week Pumping	**$5,504,306**	**$8,100,758**	**$12,192,420**	**$7,278,532**	**$10,358,475**	**$15,826,590**
8-Week Pumping	**$5,947,873**	**$8,969,281**	**$14,002,049**	**$7,687,979**	**$11,146,349**	**$17,487,330**
Annual Replacement Fund Costs (50% Replacement)[2]:						
Fixed Deposit	$70,424	$102,683	$144,366	$99,263	$141,062	$209,018
Increasing Deposit						
Year 1	$37,327	$54,425	$76,519	$52,612	$74,768	$110,787
Year 25	$75,878	$110,636	$155,546	$106,950	$151,987	$225,207
Year 50	$158,873	$231,646	$325,681	$223,930	$318,228	$471,533

Notes:
1. Includes total of costs from Table 8-1 and Table 9-4.
2. These costs assume only 50 percent replacement of the system, as it is not likely that all of the facilities would need to be replaced with the 50-year life cycle.

10 SUMMARY AND RECOMMENDATIONS

10.1 Preliminary Alternatives Evaluation

The purpose of this Appraisal Study is to provide a preliminary evaluation of project alternatives to pump water from the Wenatchee River to the PID Canal, assess whether the alternatives are viable, select one or two preferred project alternatives, and recommend steps for additional study and implementation of the project. Five alternatives were identified and evaluated as part of this appraisal study, each including a pump station on the right bank of the Wenatchee River, a delivery pipeline from the pump station to the PID Canal, and delivery facilities at the PID Canal. The alternatives were evaluated by completing preliminary hydraulic analyses, geomorphic evaluations of proposed pump station sites, geologic reviews of pipeline alignments, reviews of property impacts, environmental and permitting reviews, and opinions of probable cost. The five preliminary alternatives for pumping from the Wenatchee River to the PID Canal were characterized as follows:

- Alternative 1 would have the lowest cost ($1.88 to $3.90 million depending on pump capacity). The pump station site is more suitable for diverting flows under low flow conditions than the other alternatives, except Alternative 5. However, pump station access would be a challenge, a private orchard would be impacted, and the pipeline would be steep and difficult to construct.
- Alternative 2 would have the third lowest cost ($2.13 to $4.43 million depending on pump capacity). The pump station site would be more accessible than Alternative 1. However, channel modifications would likely be required for diversion from the river, the pipeline would cross U.S. Highway 2 and a private orchard, and the pipeline would be steep and difficult to construct.
- Alternative 3 would have the second lowest cost ($1.86 to $3.97 million depending on pump capacity). This alternative would have little impact to private property. However, the Dryden Transfer Station would be impacted, channel modifications would likely be required for diversion from the river, the pipeline would be steep and difficult to construct, and slope stability risk would be high.
- Alternative 4 would have the second highest cost ($2.76 to $5.36 million depending on pump capacity). The pipeline alignment is more favorable from a construction standpoint. However, channel modifications would likely be required for diversion from the river, pump station access could be challenging, a private orchard would be

impacted, the pipeline would have to cross U.S. Highway 2, and the overall cost would be relatively high.

- Alternative 5 offers the most favorable pumping conditions, best pump station access, lowest power requirements, and least impact to private property. However, this alternative would have the highest cost ($3.17 to $6.15 million depending on pump capacity), would require coordination with other existing and proposed uses of the pump station site, the delivery pipeline would need to cross U.S. Highway 2, and pipeline construction would impact a newly paved roadway.

10.2 Preferred Alternative

Following the evaluation of the proposed alternatives, the evaluation was presented to PID, Chelan PUD, Chelan County, and Ecology. Based on the review of preliminary alternatives with PID and others, Alternative 1 was selected as the preferred project alternative because of more favorable hydraulic conditions at the proposed diversion location, a lower projected project cost, and the potential for improving the reliability of the PID system by providing an alternate source of supply downstream of the most vulnerable part of the system.

PID also recommended that Alternative 5 be studied further as a backup to the preferred alternative. Alternative 5 would not provide the same benefit to the PID system's reliability as Alternative 1 and would have the highest implementation costs of the project alternatives evaluated. However, Alternative 5 would provide the most favorable hydraulic conditions at the proposed diversion location and would likely have the least impact on private property.

10.3 Other Considerations

Two additional items that were not included initially in the scope of this study that may warrant future consideration include:

- Other potential improvements to the Peshastin Creek channel and floodplain to further improve fish habitat, spawning, and passage
- Design of pump exchange facilities to also deliver water to IID to reduce late summer diversions from Icicle Creek

A preliminary evaluation of additional facilities that would be needed to also delivery water to the IID Division 3A Canal was completed. The evaluation indicated that additional facilities would likely include a booster pump station on the PID Canal, additional discharge pipeline between the PID Canal and the IID Diversion 3A Canal, and a delivery facility at the IID Canal. The system could be designed with the flexibility to deliver a combination of flow rates to the PID and IID canals. For Alternative 1, the additional facilities would add $1.65 million to $3.33 million to the total project implementation costs, depending on pump capacity. For Alternative 5, the additional facilities would add $1.77 million to $4.30 million to the total project implementation costs, depending on pump capacity. The additional facilities would also increase the operating costs. Additional analysis is recommended to determine the need for reducing diversions from Icicle Creek, identify the most efficient method of reducing diversions, and refine the preliminary analysis and opinions of cost presented in this report.

10.4 Data Gaps

The evaluation of preliminary project alternatives completed as part of this appraisal study is based on visual observations of site conditions made during brief site visits, experience with similar projects, geology mapping, LiDAR data, stream flow data, diversion data, and other available data. No detailed site investigations were completed as part of this study. Additional data would need to be collected as part of further study and detailed design of the preferred project alternative, including:

- Topographic survey data
- River stage and flow data specific to preferred pump station locations
- Geotechnical field data and subsurface soil test results
- Field surveys of aquatic and terrestrial habitat

10.5 Recommendations for Additional Study and Implementation

It is recommended that Alternatives 1 and 5 be studied in more detail by gathering the additional information noted in Section 9.3 and completing a detailed feasibility study of these alternatives. Completion of the following tasks is recommended as part of the feasibility study:

- Detailed evaluation of pump station operations - Prepare a detailed evaluation of pump station operations and more clearly define operating conditions (design flow rate, timing, and duration). Provide analysis of operational implications on irrigation supplies from other sources, including diversions from Icicle Creek conveyed through the IID Canal. Hold meetings with PID and IID to discuss operations and narrow down design flows and operating conditions to be used for design of the project.
- Property owner coordination - Work with CCNRD to schedule and carry out meetings for project review and coordination with private property owners that will be impacted by the project, both as a group and individually.
- Additional evaluation of habitat improvements in Peshastin Creek – Provide further evaluation of the benefits of the proposed project on fish passage and habitat. Coordinate with regulatory agencies to develop a more comprehensive strategy for improving habitat in the Peshastin Creek Subbasin, which would include increasing flow s and also improving channel and floodplain functions.
- Additional site investigations – Complete detailed site investigations including:
  - Topographic Survey – Complete a topographic survey of the preferred pump station location. Survey river levels during the course of an irrigation season to obtain a rating curve of the water surface elevation versus discharge.
  - Geotechnical Exploration – Complete geotechnical field investigations and prepare a report documenting soil conditions for the proposed pump station site and pipeline alignment.
- Detailed environmental and permitting review – Complete a more detailed review of permit requirements and environmental resources. Complete field surveys of critical aquatic and terrestrial habitat, as well as a cultural resources survey.
- Additional engineering analyses and cost estimates – Develop the engineering design analysis, drawings, and cost estimates to the level of detail needed to support the feasibility study. The work should include:
  - Engineering analyses – Refine sizing calculations and identify major materials required, including structures, fish screens, pumps, piping, valves, appurtenances, electrical power supply, and control equipment. Develop feasibility-level (approximately 30 percent complete) drawings.

- Refined cost analysis – Refine the preliminary opinions of probable costs for the preferred alternative based on the additional engineering analyses.
- Prepare a Feasibility Study report – Prepare a report to summarize the detailed analysis of the detailed operational evaluation, property owner coordination issues, detailed site investigations, detailed environmental and permitting review, additional engineering analyses, and refined opinions of probable cost. Include feasibility-level (30 percent complete) drawings and applicable design information.

It is anticipated that this additional work will provide a basis for determining whether the preferred alternative (Alternative 1) can be implemented, or if the backup alternative, such as Alternative 5, should be pursued. It is also anticipated that the recommended feasibility study will provide the information needed to pursue funding for detailed design, permitting, construction, and operation of the project.

In conclusion, the proposed pump exchange project has the potential to reduce later summer diversions from Peshastin Creek and improve overall management of water in the Peshastin Creek subbasin. With additional pumping and conveyance facilities, the project could be expanded to also reduce diversions from Icicle Creek. The project also has the potential to add reliability to the PID system and improve management of supply to the PID system from Icicle Creek via the Icicle Irrigation District system. The alternatives evaluation summarized in this report led to the selection of a preferred project alternative, Alternative 1. It is also recommended that a backup project alternative, Alternative 5, be carried forward for further consideration.

11 REFERENCES

Anchor Environmental, LLC, 2007. *Peshastin Subbasin Needs and Alternatives Study.* Prepared for Chelan County Natural Resources Department under Washington State Department of Ecology Grant G0700003. January.

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Thompson, K., 1972. *Determining Stream Flows for Fish*. Presented at Instream Flow Requirement Workshop, Pacific Northwest River Basins Commission, March 1972.

APPENDIX A
PHOTOGRAPHS OF EXISTING SITE

Alternative 1 – Pump Station Location

Alternative 1 – Alternate Pump Station Location

Alternative 2 – Pump Station Location

Alternative 1 and 2 – Pipeline Alignment

Alternative 1 and 2 – Pipeline Alignment

Alternative 2 – Pipeline Alignment (Under U.S. Highway 2)

Alternative 3 – Pump Station Location

Alternative 3 – Pipeline Alignment

Alternative 3 – Closed Landfill

Alternative 3 – PID Canal Delivery Location

Alternative 4 – Pump Station Location

Alternative 4 – Pump Station Location

Alternative 4 – PID Canal Delivery Location

Alternative 4 – PID Canal Delivery Location

Alternative 5 – Pump Station Location

Alternative 5 – Pipeline Alignment

Alternative 5 – Pipeline Alignment

Alternative 5 – PID Canal Delivery Location

APPENDIX B
INSTREAM FLOW ANALYSIS

LOWER PESHASTIN CREEK FISH HABITAT AND PASSAGE ASSESSMENT 2011

1.0 INTRODUCTION

This report presents an analysis of potential flow benefits for selected salmonid species of the proposed Peshastin Irrigation District (PID) pump exchange project. The project would provide an alternate supply of water for PID by pumping water to the PID Canal from the Wenatchee River. PID provides water for irrigation and diverts up to 40 cubic feet per second (cfs) from Peshastin Creek, approximately 2.4 miles upstream of its confluence with the Wenatchee River. This Appraisal Study was funded under Grant No. G1100240 from the Columbia Basin Water Development Account administered by the Washington Department of Ecology's Office of the Columbia River.

Increased flows during the summer months may be beneficial to salmonids due to increased rearing habitat and could improve upstream fish passage conditions in mid to late summer. An initial analysis of flow requirements for adult fish passage in Lower Peshastin Creek was presented in *Peshastin subbasin needs and alternatives study* (Anchor Environmental and EES Consulting, 2007).

1.1 Study Purpose

The purpose of this study is to provide data on the benefits of increasing flows to assess habitat and provide upstream passage for migrating Chinook salmon, bull trout, and steelhead in lower Peshastin Creek.

2.0 Methods

Two methods were used to complete the information needs for this study. First, the "Oregon method" was used to estimate preferred upstream passage stream flows for Chinook salmon and Bull trout. After 10 years of research on depth and velocity in streams in Oregon, Thompson (1972) concluded that the depth over "the shallow bars most critical of adult passage" was the feature that determined the likelihood of successful migration. Thompson's recommended minimum depths of 0.8 feet for Chinook and 0.6 feet for large trout to achieve successful passage, have been used by biologists in the Northwest since the 1970's. The "Oregon method" concludes that the passage flow is adequate when the depth criteria is met on at least 25% of the transect width <u>and</u> on at least a 10% continuous portion. Rather than relying on individual transects Thompson recommends the average flow of all transects.

Secondly, weighted usable area (WUA) was computed for the lower 2.4 miles of Peshastin Creek by utilizing the calibrated transects from the Peshastin Creek Instream flow study a part of the Final Technical Report Lower Wenatchee River PHABSIM Studies (EES Consulting, 2005). Transects from the 2005 study were given a different transect weighting in order to have them represent the frequency of habitat types in the lower 2.4 miles of Peshastin Creek.

2.1 Field Measurements

Fish Passage

In August, 2011 a stream survey was completed on lower Peshastin Creek from the Peshastin irrigation district diversion, downstream to the Wenatchee River. Potential study transects on shallow bars were flagged and noted on a map for inclusion in the passage study. Five transects were selected for field study. The transects were selected on both representative and critical and shallow bars in lower Peshastin Creek. Figure 1 shows the location of all transects.

Cross sections were surveyed at each transect. Head pins on each bank as well as a bench mark were surveyed to establish elevations. A tape was stretched horizontally across the channel and attached to the head pins. With an auto level and stadia rod, elevation of the stream bed and banks were surveyed at regular intervals along the tape and water surface elevations were surveyed at locations where accurate measurements could be obtained at all flows. Water depth was also measured at each station in order to cross check the bed and water surface elevation measurements.

Transects were surveyed at high, medium and low stream flows. At each flow level discharge measurements were taken so a rating curve could be computed for each transect. Discharges were taken above and below significant areas of inflow (e.g. Icicle pipeline) to account for changes in discharge. Recorded stage measurements from the gage on Peshastin Creek at Green Bridge, operated by the Department of Ecology, were examined to determine flow changes during the day of the measurements. Table 1 shows the dates and computed discharges for each transect during the field study.

TABLE 1 DISCHARGES FOR TRANSECTS AT LOWER PESHASTIN CREEK					
Date	T-1	T-2	T-3	T-4	T-5
August 25, 2011	37.4	36.4	36.4	36	36
September 7, 2011	23.5	23.5	24	24	24
September 19, 2011	16	15.5	15.2	14.7	14.7

IFIM Transect Weighting

In September 2011 Lower Peshastin Creek was surveyed from the confluence with the Wenatchee River upstream to the PID diversion dam. The habitat type was evaluated every 100 feet based on the same habitat types used in the original 2005 IFIM report. Transect weighting based on relative frequencies of habitat types are shown in Table 2.

Table 2 Transect Weighting for Lower Peshastin Creek		
Transect No.	**Description**	**Percent**
1	Boulder Run	28.5%
2	Plunge Pool in center 1/3	14.1%
3	Pool Tailout	1.3%
4	Pool	4.7%
5	Narrow Run	3.6%
6	Narrow Run	3.6%
7	Med-width Run	3.6%
8	Riffle	12.0%
9	Wide Boulder run	28.5%

2.2 Computations

Fish Passage

Station location, stream bed elevations, discharges, water surface stage, slope and stage of zero flow were entered into the PHABSIM hydraulic model and depths at each station were simulated for a range of flows between 5 and 50 cfs. Depths equal to or exceeding the passage depth criteria for each species were tallied at each modeled flow. Adjoining cells with depths equal or exceeding the criteria were also tallied. The total width of the cells in each of these categories at each modeled flow was divided by the total wetted width at each flow to compute the percent of the transect passable.

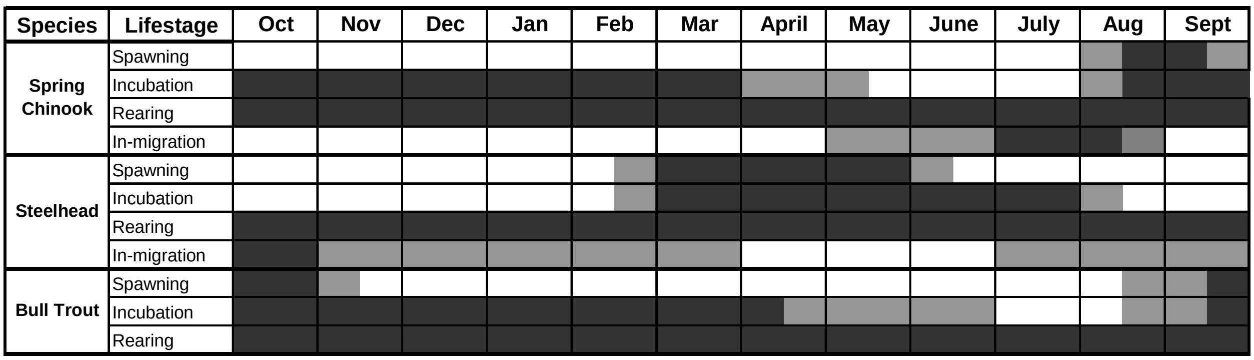
IFIM WUA

Transect weighting for Lower Peshastin Creek was entered into the approved, calibrated Peshastin Creek PHABSIM model and WDFW approved HSI curves were used to output WUA for the selected species and life stages of salmonids.

2.3 Periodicity of Migrating Chinook and Bull Trout in Peshastin Creek

Salmonid periodicity information for Peshastin creek is based on information from Andonaegui, (2001), and local resource agencies. Migration and spawning timing for salmonids using Peshastin creek are shown in Figure 2. No in-migration timing is given for bull trout and this study assumes that in-migration occurs from July through September.

Figure 2. Peshastin Creek Fish Periodicity



Based on:

Andonaegui, C., 2001. *Salmon, Steelhead and Bull Trout Habitat Limiting Factors for the Wenatchee Subbasin (WRIA 45) and Portions of WRIA 40 within Chelan County (Squilchuck, Stemilt and Colockum Drainages).* Washington State Conservation Commission.

Comments from: USFS (Cam Thomas, Cindy Raekes), WDFW (Andrew Murdoch, Bob Vadas, Mark Cookson), USFWS (Kate Terrell) and NOAA-Fisheries (Dale Bambrick)

Key:
Black indicates periods of heaviest use — Grey indicates periods of moderate use — Blank areas indicate periods of little or no use

3.0 RESULTS

3.1 Bull Trout

Figures 3 through 7 show the relationship at each transect between stream discharge and the percent of total width and contiguous width (adjoining cells) that is passable to bull trout at each flow. Table 3 shows that 25 % of total width, the passage depth criteria of 0.6 feet for bull trout, are met on individual transects at 5 to 18 cfs. Discharges for contiguous passage range from 5 to 30 cfs. The discharge at which both passage criteria are met ranges from 5 to 30 cfs with an average of 13.4 cfs.

TABLE 3
DISCHARGES FOR MEETING BULL TROUT PASSAGE CRITERIA (CFS)

Passage Criteria	T-1	T-2	T-3	T-4	T-5	Mean
Total (25%)	6	5	10	5	18	8.8
Contiguous (10%)	6	5	6	4	30	10.2
Both Criteria	6	5	10	5	30	11.2

3.2 Chinook Salmon

Figures 8 through 12 show the relationship between stream discharge and the percent of total width and contiguous width (adjoining cells) at each transect that is passable to Chinook. Table 4 shows that 25 % of total width passage depth criteria of 0.8 feet for Chinook are met on individual transects from 15 to 34 cfs. Discharges for contiguous passage range from 13 to 41 cfs. The discharge at which both passage criteria are met ranges from 15 to 41 cfs with an average of 23.4 cfs.

TABLE 4
DISCHARGES FOR MEETING CHINOOK SALMON PASSAGE CRITERIA (CFS)

Passage Criteria	T-1	T-2	T-3	T-4	T-5	Mean
Total (25%)	15	17	28	16	34	22
Contiguous (10%)	13	13	25	10	41	20.4
Both Criteria	15	17	28	16	41	23.4

3.3 WUA RESULTS

Figure 3 shows that WUA (a relative measure of habitat abundance) increases relatively consistently for all species expect Bull trout. Table 5 shows that WUA for juvenile steelhead rearing is nearly 4 times more abundant at 22 cfs than at 5 cfs and Chinook spawning habitat increases over 20 times at 20 cfs compared to 5 cfs.

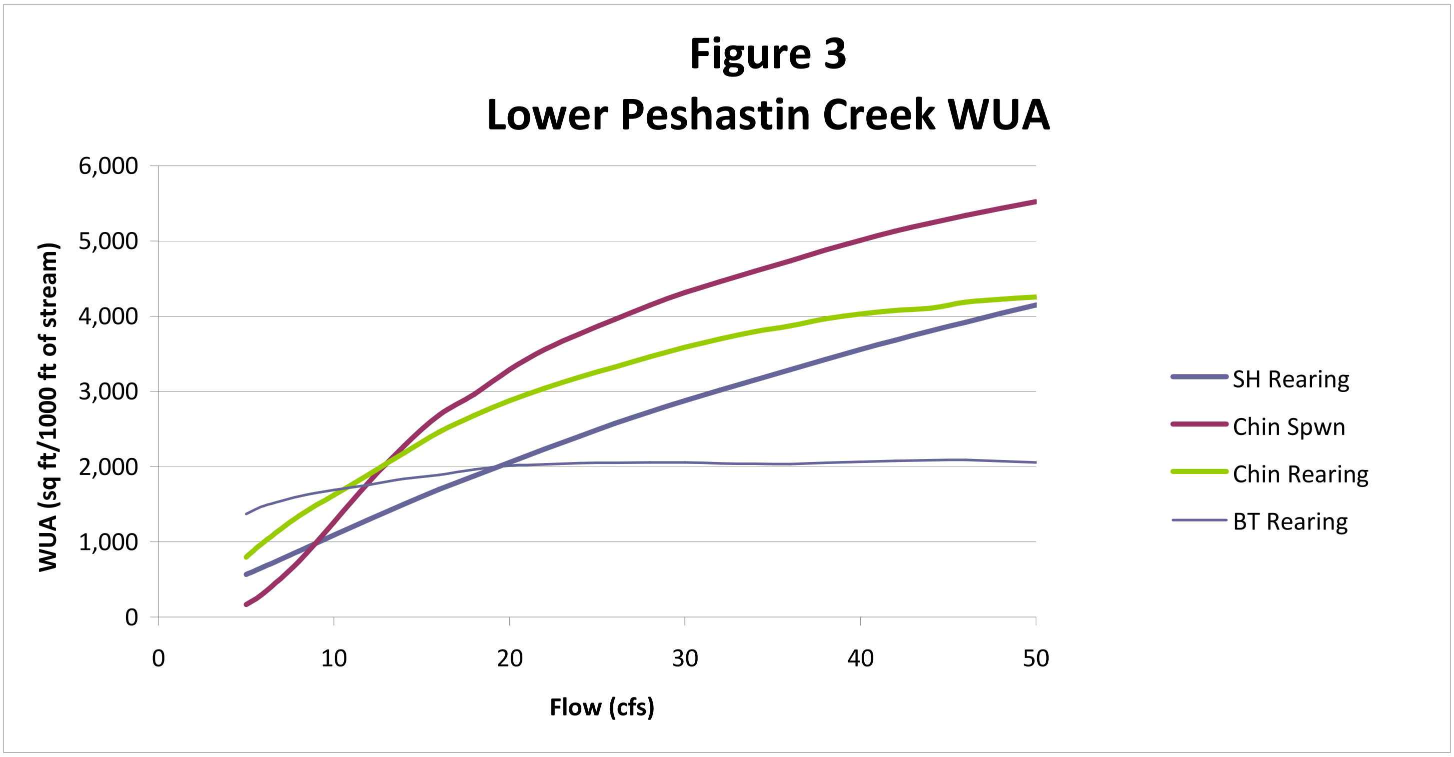


TABLE 5 WUA FOR SELECTED SPECIES						
Flow	Steelhead	% of	Chinook Salmon			Bull Trout
cfs	Juv Rearing	Max	Spawning	% of Max	Rearing	Juv/Ad Rearing
5	567	13.7%	166	3.0%	797	1,370
6	668	16.1%	319	5.8%	994	1,477
8	876	21.1%	740	13.4%	1,346	1,604
10	1,090	26.3%	1,261	22.8%	1,623	1,688
12	1,299	31.3%	1,798	32.5%	1,896	1,759
14	1,500	36.2%	2,276	41.2%	2,182	1,838
16	1,697	40.9%	2,684	48.6%	2,462	1,891
18	1,876	45.2%	2,962	53.6%	2,679	1,963
20	2,056	49.6%	3,288	59.5%	2,877	2,013
22	2,234	53.8%	3,556	64.4%	3,044	2,028
24	2,406	58.0%	3,765	68.2%	3,191	2,048
26	2,574	62.0%	3,957	71.6%	3,325	2,051
28	2,729	65.8%	4,145	75.0%	3,459	2,054
30	2,876	69.3%	4,316	78.1%	3,588	2,054
32	3,018	72.7%	4,460	80.8%	3,699	2,042
34	3,155	76.0%	4,600	83.3%	3,797	2,038
36	3,289	79.3%	4,737	85.8%	3,871	2,032
38	3,425	82.5%	4,879	88.3%	3,965	2,053
40	3,555	85.7%	5,009	90.7%	4,031	2,063
42	3,682	88.7%	5,130	92.9%	4,077	2,076
44	3,803	91.7%	5,240	94.9%	4,106	2,083
46	3,920	94.5%	5,341	96.7%	4,186	2,088
48	4,036	97.3%	5,435	98.4%	4,224	2,074
50	4,149	100.0%	5,524	100.0%	4,256	2,057

4.0 DISSCUSSION

Fish Passage

The results of this study show that the wide gravel bars in lower Peshastin Creek likely pose a significant barrier at low flows. Chinook salmon require higher flows for passage than bull trout. This is due to the greater depth criteria for Chinook passage. Thompson (1972) recommends the average passage flow. For Peshastin Creek the average for the 5 transects was 23.4 cfs. Although a flow of 23.4 cfs would likely pass fish in the majority of lower Peshastin Creek it is also likely that there are some critical areas (Transects 2 and 5) where more than 23.4 cfs or channel modifications would be required for upstream passage of Chinook during the late part of their migration period.

Flow records for water years 2003 through 2011 for Peshastin Creek at Green Bridge indicate that consistent snow melt almost always keeps flows higher than required for minimum depth passage, for the Chinook migration period between May and mid July. Some time between mid July and mid August the flows generally recede to below the flow indicated for Chinook migration. In most years flows stay low through September, except when rainstorms temporarily increased the flow. The timing of the flows at which passage is likely impeded is important because it happens during the time of heaviest use for Chinook in-migration.

Similarly, bull trout migration may be impacted during late July, August and September when prolonged periods of low flow may occur during times of expected in-migration. Since bull trout require less flow for passage than Chinook, a smaller increase in flow may prove beneficial to bull trout migration.

IFIM WUA

In addition to the passage issues discussed above, habitat for rearing juvenile steelhead and spawning Chinook salmon are the two life stages that are most likely impacted by low summer flows in Peshastin Creek. Table 5 shows that higher stream flow can drastically increase habitat for both life stages depending on the base flow selected and how much the stream flow is increased.

The results presented in this report are meant to be tools that can be used by resource agencies to quantify the benefits to fish of additional flow in Peshastin Creek. When used with existing stream flow records this data can be used to address when flow additional flow would be beneficial and the benefits of specific amounts of added flow.

5.0 References

Anchor Environmental, L.L.C. and EES Consulting, Inc., 2007. *Peshastin Subbasin Needs and Alternatives Study.* Prepared for Chelan County Natural Resources Department under Washington State Department of Ecology Grant G0700003. January.

Andonaegui, C., 2001. Salmon, Steelhead and Bull Trout Habitat Limiting Factors for the Wenatchee Subbasin (WRIA 45) and Portions of WRIA 40 within Chelan County (Squilchuck, Stemilt and Colockum Drainages). Washington State Conservation Commission.

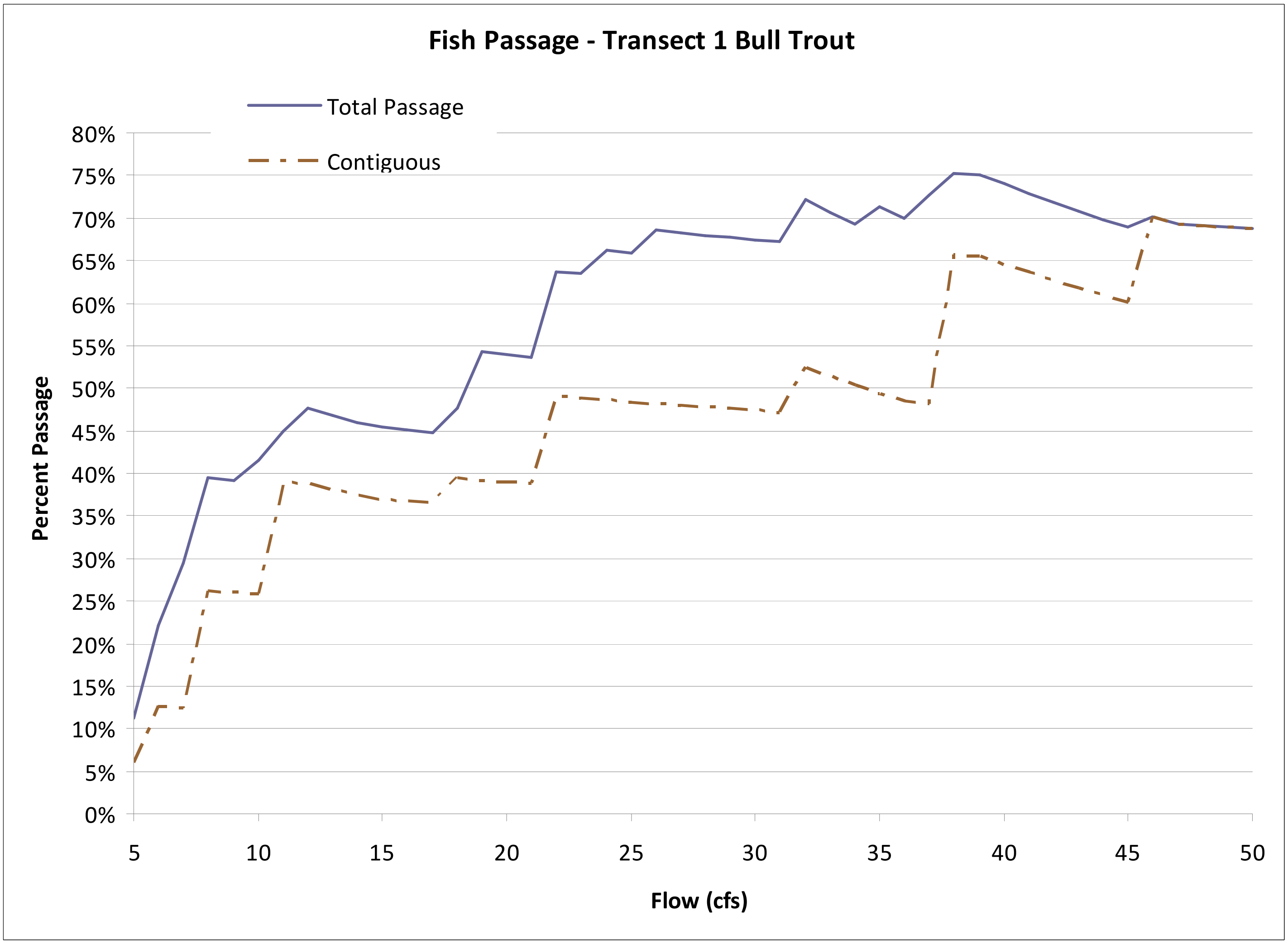
EES Consulting, 2005. *Final Technical Report Lower Wenatchee River PHABSIM Studies* Prepared for Chelan County Natural Resources Department

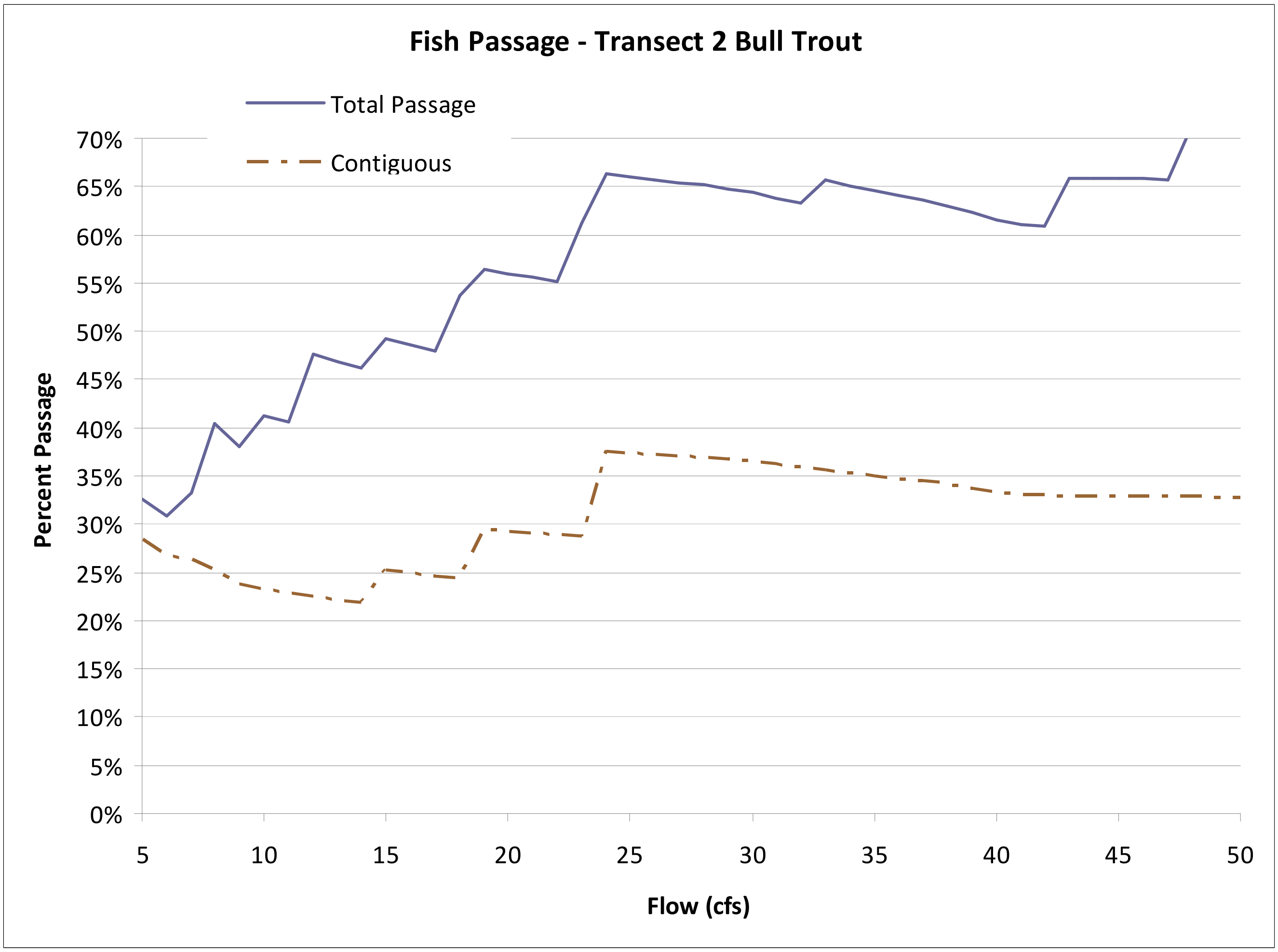
Thompson, K., 1972. Determining Stream Flows For Fish. Presented at Instream Flow Requirement Workshop, Pacific Northwest River Basins Commission, March 1972.

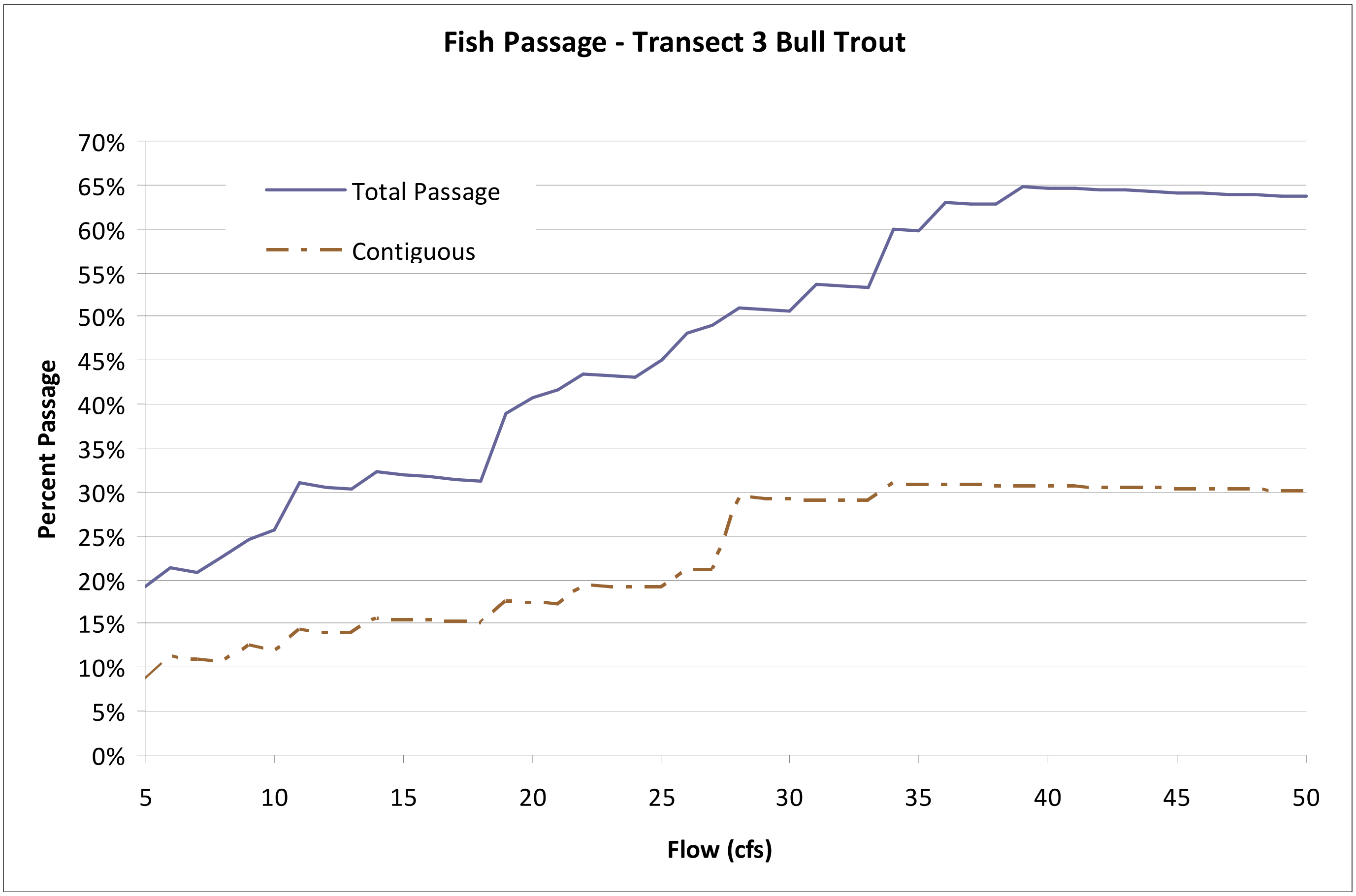
0 0.25 0.5 1 Miles

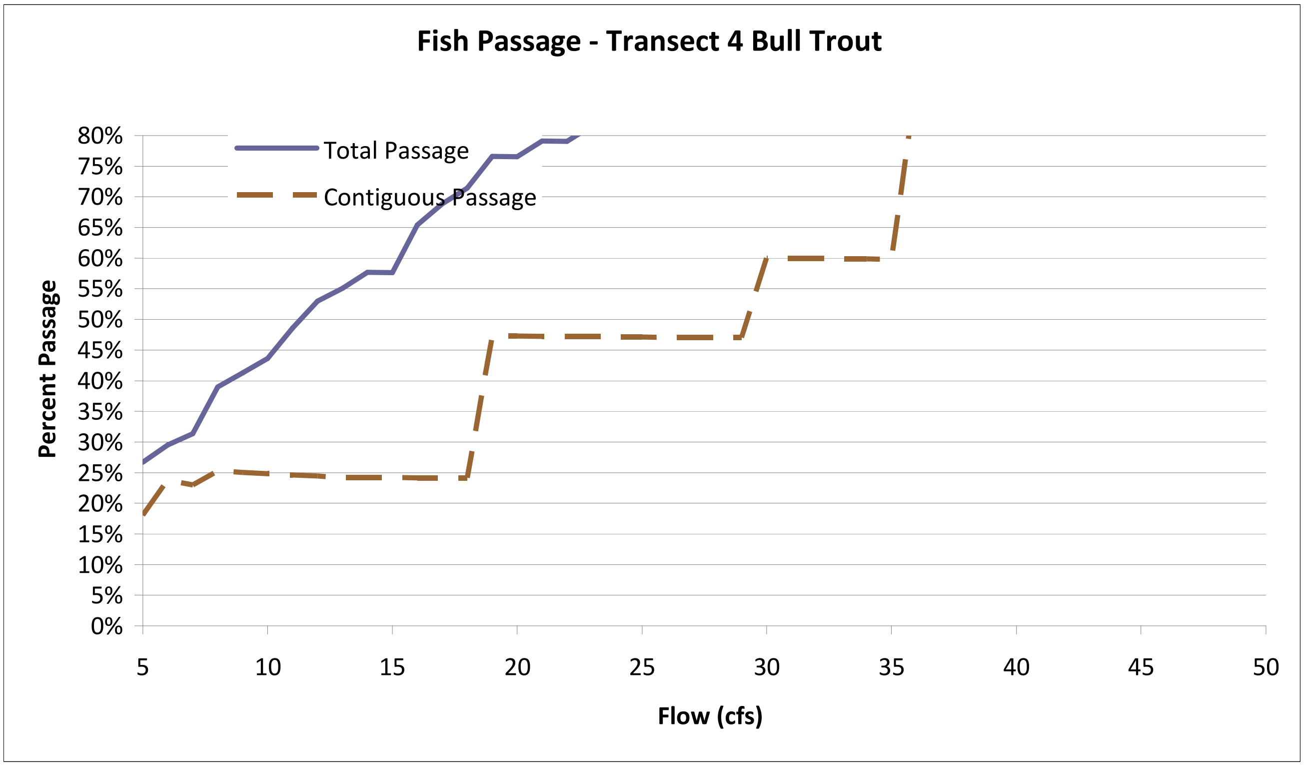
1:24,000

Figure 1
Passage Transect Locations


Fish Passage - Transect 1 Bull Trout
Total Passage
Contiguous
Percent Passage
80%
75%
70%
65%
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
5
10
15
20
25
30
35
40
45
50
Flow (cfs)


Fish Passage - Transect 2 Bull Trout
Total Passage
Contiguous
70%
65%
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Percent Passage
5
10
15
20
25
30
35
40
45
50
Flow (cfs)


Fish Passage - Transect 3 Bull Trout
Percent Passage
70%
65%
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Total Passage
Contiguous
5
10
15
20
25
30
35
40
45
50
Flow (cfs)


Fish Passage - Transect 4 Bull Trout
Total Passage
Contiguous Passage
Percent Passage
80%
75%
70%
65%
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
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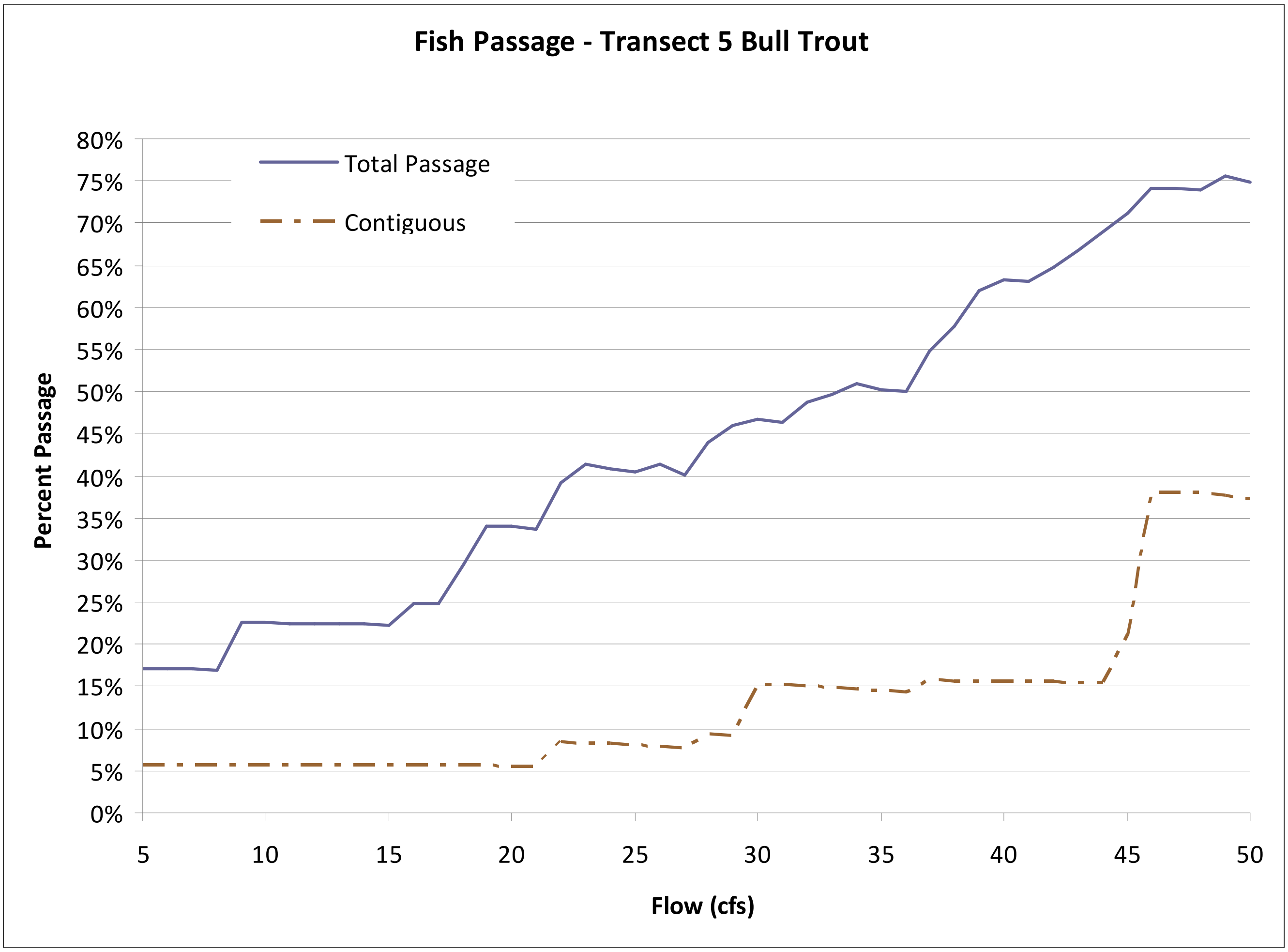
15
20
25
30
35
40
45
50
Flow (cfs)


Fish Passage - Transect 5 Bull Trout
Total Passage
Contiguous
Percent Passage
80%
75%
70%
65%
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
10%
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25
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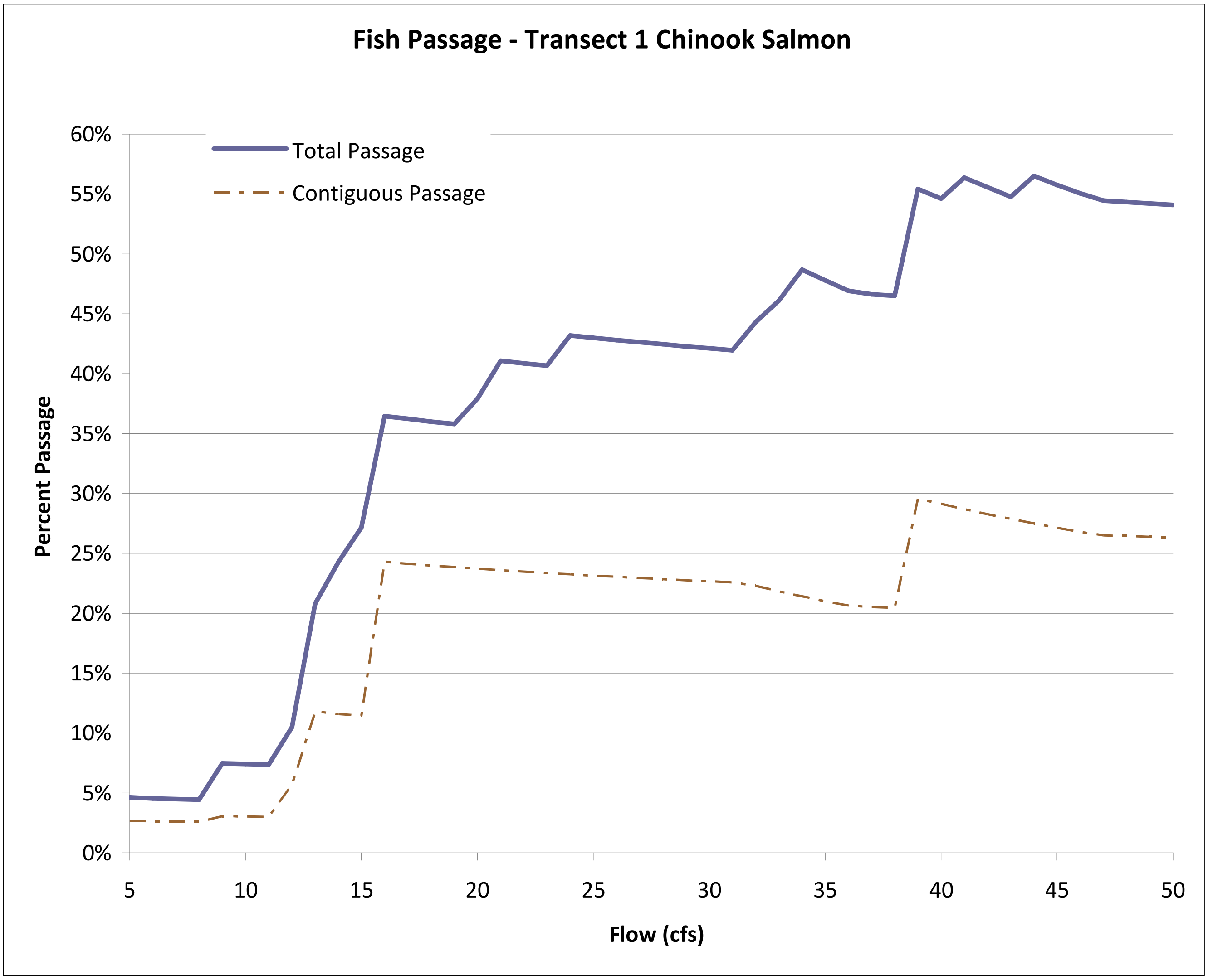
35
40
45
50
Flow (cfs)


Fish Passage - Transect 1 Chinook Salmon
Total Passage
Contiguous Passage
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Percent Passage
5
10
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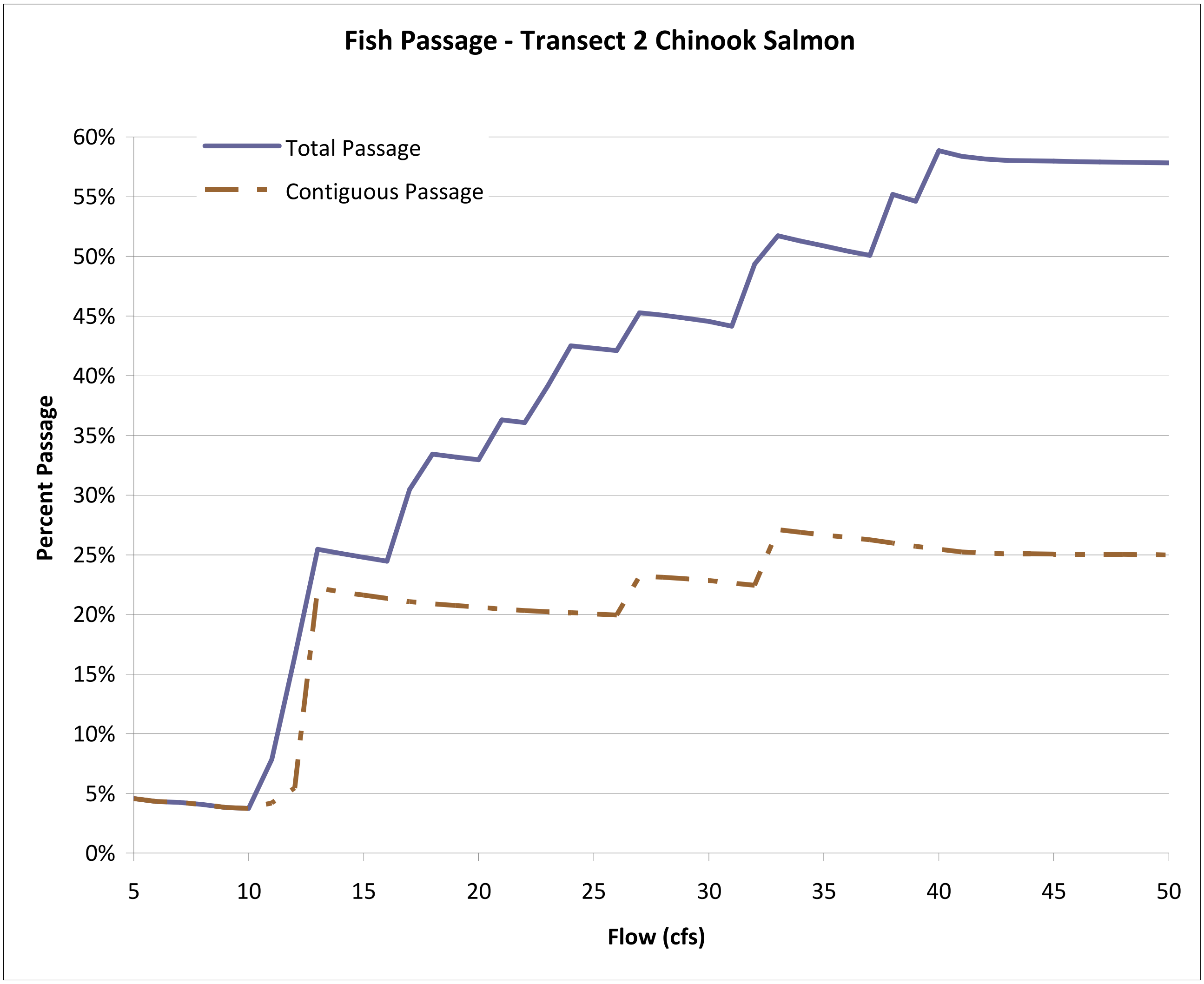
40
45
50
Flow (cfs)


Fish Passage - Transect 2 Chinook Salmon
Total Passage
Contiguous Passage
Percent Passage
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
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5%
0%
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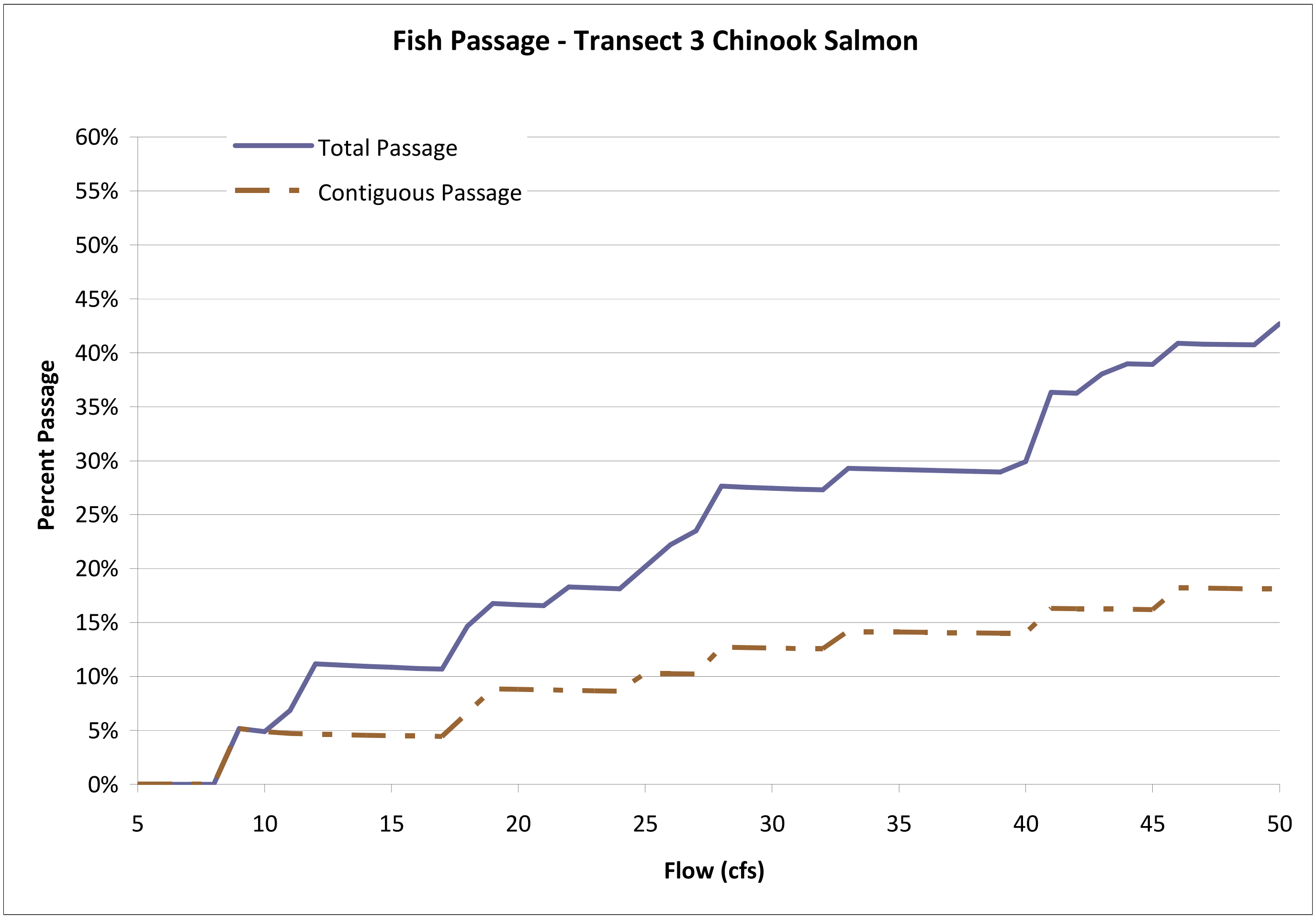
45
50
Flow (cfs)


Fish Passage - Transect 3 Chinook Salmon
Total Passage
Contiguous Passage
Percent Passage
0%
5%
10%
15%
20%
25%
30%
35%
40%
45%
50%
55%
60%
5
10
15
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25
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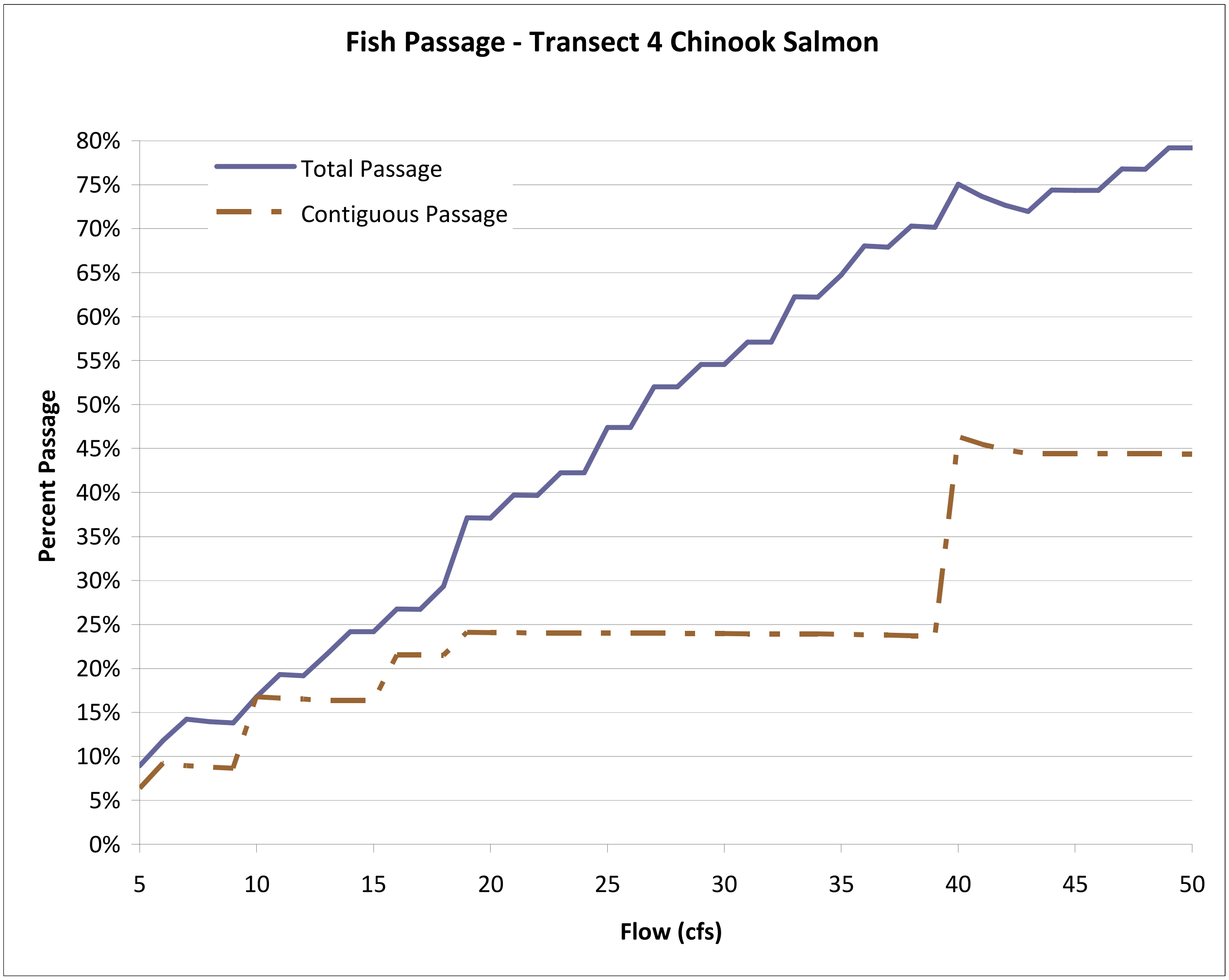
40
45
50
Flow (cfs)



Fish Passage - Transect 4 Chinook Salmon
Total Passage
Contiguous Passage
Percent Passage
80%
75%
70%
65%
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
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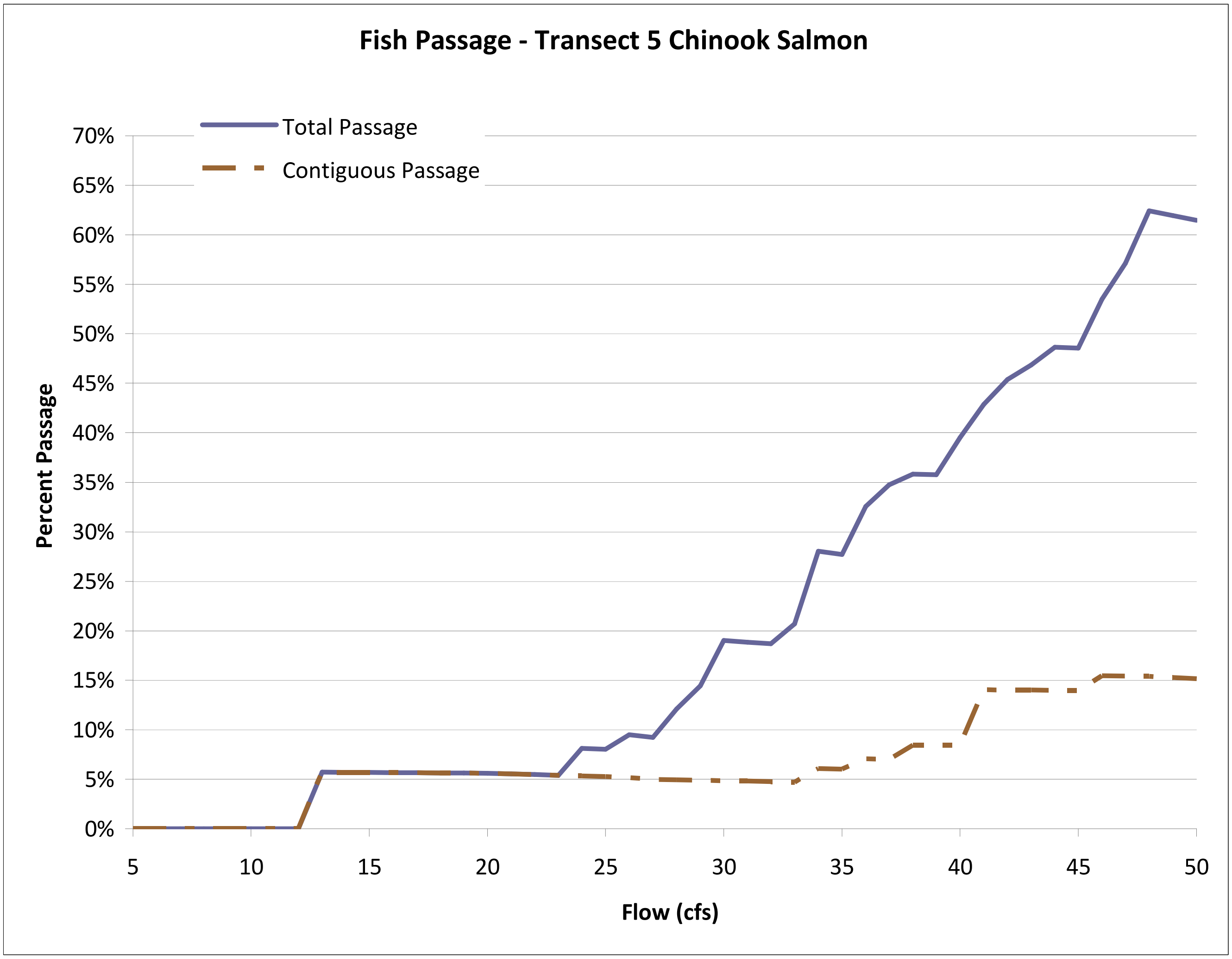
45
50
Flow (cfs)


Fish Passage - Transect 5 Chinook Salmon
Total Passage
Contiguous Passage
Percent Passage
70%
65%
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
5
10
15
20
25
30
35
40
45
50
Flow (cfs)

APPENDIX C
HYDRAULIC CALCULATIONS

SYSTEM CURVE CALCULATION

PROJECT: **PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY**

ALTERNATIVE: **ALTERNATIVE ALIGNMENT 1 - 10 CFS DESIGN FLOW**

BY: David Rice, P.E.

DATE: 13-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	922.0 feet	Invert at Diversion
HWL	927.0 feet	Wet Well (High River)
LWL	923.0 feet	Wet Well (Low River)

DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1146.0 feet	Canal Bottom
HIGH	1148.5 feet	Canal (High Flow)
LWL	1146.5 feet	Canal (Low Flow)

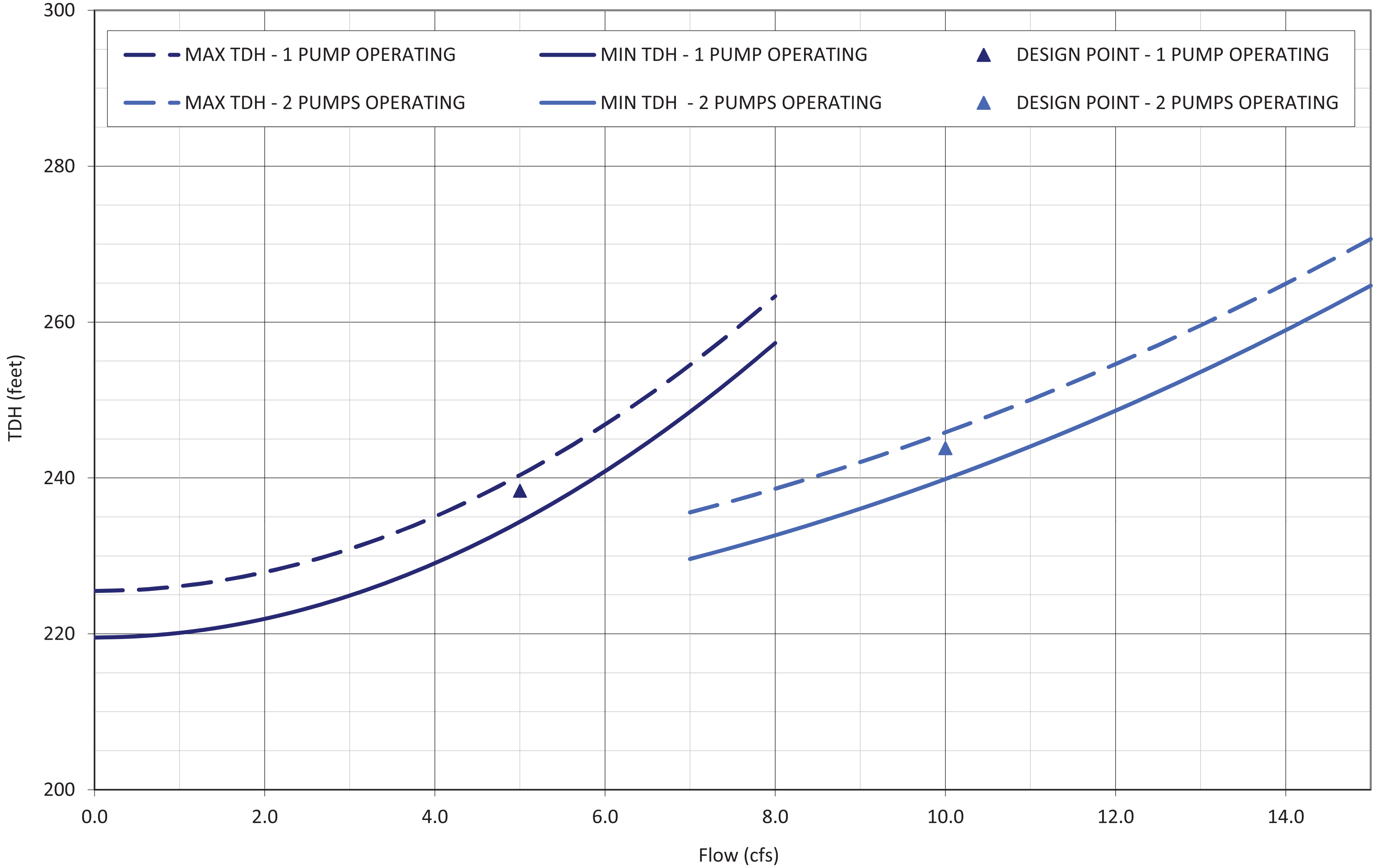
PIPE	**SUCTION PIPING**		**PS PIPING**				**DISCHARGE PIPING**	
PROPERTIES	**TRANS.**	**TRANS.**	**HEADER**	**TO PUMP**	**FR. PUMP**	**HEADER**	**TRANS.**	**TRANS.**
NOM. DIAM. (in)					12	12		20
O.D. (in)					12	12		20
I.D. (in)					12	12		20
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		1,240
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	**FLOW (GPM)**	**FLOW (CFS)**	**TDH (FT)**	**POWER (HP)***
1	2244	5.0	238	193.1
2	4488	10.0	244	395.2
Assumes	*70%*	*Efficiency*		

TOTAL FLOW		**VELOCITIES**				**SUCTION LOSSES**		**DISCHARGE LOSSES**		**PS LOSSES - 1 PUMP**		**PS LOSSES - 2 PUMPS**		**PS LOSSES - 3 PUMPS**		**TOTAL DYNAMIC HEAD - 1 PUMP**			**TOTAL DYNAMIC HEAD - 2 PUMPS**			**TOTAL DYNAMIC HEAD - 3 PUMPS**		
		12-inch	**12-inch**	**-inch**	**20-inch**	**Minor**	**Friction**	**Minor**	**Friction**	**Minor**	**Friction**	**Minor**	**Friction**	**Minor**	**Friction**	**MIN**	**MAX**	**DESIGN**	**MIN**	**MAX**	**DESIGN**	**MIN**	**MAX**	**DESIGN**
(gpm)	**(cfs)**	**(fps)**	**(fps)**	**(fps)**	**(fps)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet)**
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0			219.5	225.5	223.5	219.5	225.5	223.5			
224	0.5	0.64	0.64		0.23			0.0	0.0	0.1	0.0	0.0	0.0			219.7	225.7	223.7	219.6	225.6	223.6			
449	1.0	1.27	1.27		0.46			0.0	0.1	0.5	0.0	0.1	0.0			220.1	226.1	224.1	219.7	225.7	223.7			
673	1.5	1.91	1.91		0.69			0.1	0.1	1.1	0.0	0.3	0.0			220.9	226.9	224.9	220.0	226.0	224.0			
898	2.0	2.55	2.55		0.92			0.1	0.2	2.0	0.1	0.5	0.0			221.9	227.9	225.9	220.4	226.4	224.4			
1122	2.5	3.18	3.18		1.15			0.2	0.3	3.1	0.1	0.8	0.0			223.3	229.3	227.3	220.8	226.8	224.8			
1346	3.0	3.82	3.82		1.37			0.3	0.5	4.5	0.1	1.1	0.0			224.9	230.9	228.9	221.4	227.4	225.4			
1571	3.5	4.46	4.46		1.60			0.4	0.6	6.2	0.2	1.5	0.0			226.8	232.8	230.8	222.1	228.1	226.1			
1795	4.0	5.09	5.09		1.83			0.5	0.8	8.1	0.2	2.0	0.1			229.0	235.0	233.0	222.9	228.9	226.9			
2020	4.5	5.73	5.73		2.06			0.7	1.0	10.2	0.3	2.5	0.1			231.6	237.6	235.6	223.7	229.7	227.7			
2244	**5.0**	**6.37**	**6.37**		**2.29**			**0.8**	**1.2**	**12.6**	**0.3**	**3.1**	**0.1**			**234.4**	**240.4**	**238.4**	**224.7**	**230.7**	**228.7**			
2468	5.5	7.00	7.00		2.52			1.0	1.4	15.2	0.4	3.8	0.1			237.5	243.5	241.5	225.8	231.8	229.8			
2693	6.0	7.64	7.64		2.75			1.2	1.6	18.1	0.4	4.5	0.1			240.9	246.9	244.9	226.9	232.9	230.9			
2917	6.5	8.27	8.27		2.98			1.4	1.9	21.3	0.5	5.3	0.1			244.5	250.5	248.5	228.2	234.2	232.2			
3142	7.0	8.91	8.91		3.21			1.6	2.2	24.7	0.6	6.2	0.2			248.5	254.5	252.5	229.6	235.6	233.6			
3366	7.5	9.55	9.55		3.44			1.8	2.5	28.3	0.6	7.1	0.2			252.8	258.8	256.8	231.1	237.1	235.1			
3590	8.0	10.18	10.18		3.67			2.1	2.8	32.2	0.7	8.1	0.2			257.3	263.3	261.3	232.6	238.6	236.6			
3815	8.5	10.82	10.82		3.90			2.4	3.1	36.4	0.8	9.1	0.2			262.1	268.1	266.1	234.3	240.3	238.3			
4039	9.0	11.46	11.46		4.12			2.6	3.4	40.8	0.9	10.2	0.3			267.3	273.3	271.3	236.0	242.0	240.0			
4264	9.5	12.09	12.09		4.35			2.9	3.8	45.4	1.0	11.4	0.3			272.7	278.7	276.7	237.9	243.9	241.9			
4488	**10.0**	**12.73**	**12.73**		**4.58**			**3.3**	**4.2**	**50.3**	**1.1**	**12.6**	**0.3**			**278.4**	**284.4**	**282.4**	**239.8**	**245.8**	**243.8**			
4712	10.5	13.37	13.37		4.81			3.6	4.6	55.5	1.2	13.9	0.3			284.4	290.4	288.4	241.9	247.9	245.9			
4937	11.0	14.00	14.00		5.04			3.9	5.0	60.9	1.3	15.2	0.4			290.7	296.7	294.7	244.0	250.0	248.0			
5161	11.5	14.64	14.64		5.27			4.3	5.4	66.6	1.4	16.6	0.4			297.2	303.2	301.2	246.3	252.3	250.3			
5386	12.0	15.28	15.28		5.50			4.7	5.9	72.5	1.5	18.1	0.4			304.1	310.1	308.1	248.6	254.6	252.6			
5610	12.5	15.91	15.91		5.73			5.1	6.3	78.6	1.7	19.7	0.5			311.2	317.2	315.2	251.0	257.0	255.0			
5834	13.0	16.55	16.55		5.96			5.5	6.8	85.1	1.8	21.3	0.5			318.7	324.7	322.7	253.6	259.6	257.6			
6059	13.5	17.19	17.19		6.19			5.9	7.3	91.7	1.9	22.9	0.5			326.4	332.4	330.4	256.2	262.2	260.2			
6283	14.0	17.82	17.82		6.42			6.4	7.8	98.7	2.1	24.7	0.6			334.4	340.4	338.4	258.9	264.9	262.9			
6508	14.5	18.46	18.46		6.65			6.9	8.3	105.8	2.2	26.5	0.6			342.7	348.7	346.7	261.7	267.7	265.7			
6732	15.0	19.10	19.10		6.87			7.3	8.9	113.2	2.3	28.3	0.6			351.3	357.3	355.3	264.7	270.7	268.7			

PID Pump Exchange - Appraisal Study - Alternative Alignment 1 - 10 CFS Design Flow



SYSTEM CURVE CALCULATION
PROJECT: **PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY**
ALTERNATIVE: **ALTERNATIVE ALIGNMENT 1 - 20 CFS DESIGN FLOW**

BY: David Rice, P.E.
DATE: 13-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	922.0 feet	Invert at Diversion
HWL	927.0 feet	Wet Well (High River)
LWL	923.0 feet	Wet Well (Low River)

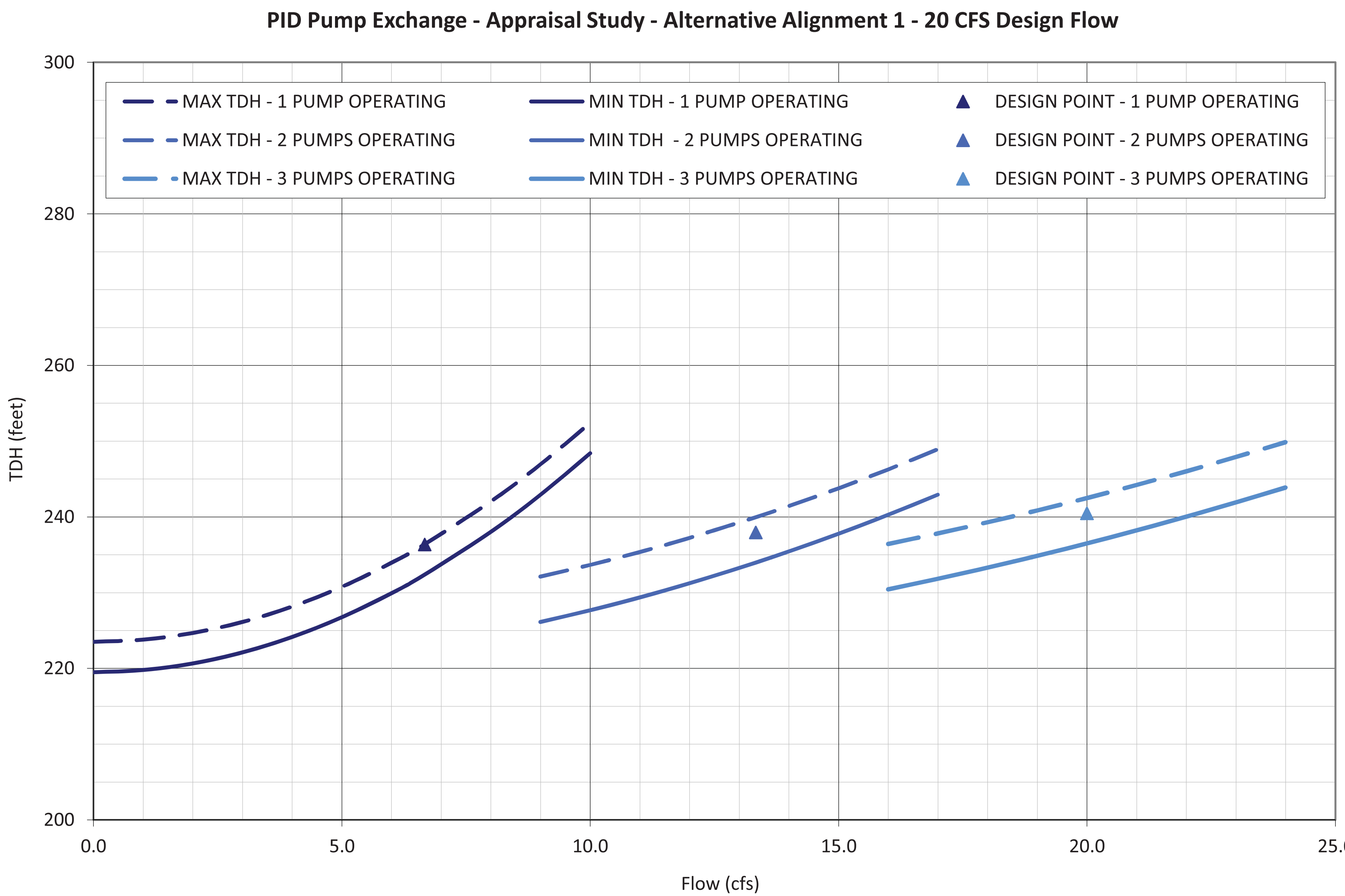
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1146.0 feet	Canal Bottom
HIGH	1148.5 feet	Canal (High Flow)
LWL	1146.5 feet	Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					14	14		30
O.D. (in)					14	14		30
I.D. (in)					14	14		30
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		1,240
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	2992	6.7	236	255.4
2	5984	13.3	238	514.2
3	8976	20.0	240	779.5
**Assumes*	*70%*	*Efficiency*		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		14-inch	14-inch	-inch	30-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	219.5	225.5	223.5	219.5	225.5	223.5	219.5	225.5	223.5
449	1.0	0.94	0.94		0.20			0.0	0.0	0.3	0.0	0.1	0.0	0.0	0.0	219.8	225.8	223.8	219.6	225.6	223.6	219.5	225.5	223.5
898	2.0	1.87	1.87		0.41			0.0	0.0	1.1	0.0	0.3	0.0	0.1	0.0	220.7	226.7	224.7	219.8	225.8	223.8	219.7	225.7	223.7
1346	3.0	2.81	2.81		0.61			0.1	0.1	2.4	0.1	0.6	0.0	0.3	0.0	222.1	228.1	226.1	220.2	226.2	224.2	219.9	225.9	223.9
1795	4.0	3.74	3.74		0.81			0.1	0.1	4.3	0.1	1.1	0.0	0.5	0.0	224.2	230.2	228.2	220.8	226.8	224.8	220.2	226.2	224.2
2244	5.0	4.68	4.68		1.02			0.2	0.2	6.8	0.1	1.7	0.0	0.8	0.0	226.8	232.8	230.8	221.6	227.6	225.6	220.6	226.6	224.6
2693	6.0	5.61	5.61		1.22			0.2	0.2	9.8	0.2	2.4	0.1	1.1	0.0	229.9	235.9	233.9	222.5	228.5	226.5	221.1	227.1	225.1
2992	**6.7**	**6.24**	**6.24**		**1.36**			**0.3**	**0.3**	**12.1**	**0.2**	**3.0**	**0.1**	**1.3**	**0.0**	**232.4**	**238.4**	**236.4**	**223.1**	**229.1**	**227.1**	**221.4**	**227.4**	**225.4**
3590	8.0	7.48	7.48		1.63			0.4	0.4	17.4	0.3	4.3	0.1	1.9	0.0	238.0	244.0	242.0	224.7	230.7	228.7	222.3	228.3	226.3
4039	9.0	8.42	8.42		1.83			0.5	0.5	22.0	0.4	5.5	0.1	2.4	0.1	242.9	248.9	246.9	226.1	232.1	230.1	223.0	229.0	227.0
4488	10.0	9.35	9.35		2.04			0.6	0.6	27.2	0.5	6.8	0.1	3.0	0.1	248.4	254.4	252.4	227.7	233.7	231.7	223.8	229.8	227.8
4937	11.0	10.29	10.29		2.24			0.8	0.7	32.9	0.6	8.2	0.2	3.7	0.1	254.5	260.5	258.5	229.4	235.4	233.4	224.7	230.7	228.7
5386	12.0	11.22	11.22		2.44			0.9	0.8	39.1	0.7	9.8	0.2	4.3	0.1	261.1	267.1	265.1	231.2	237.2	235.2	225.7	231.7	229.7
5984	**13.3**	**12.47**	**12.47**		**2.72**			**1.1**	**1.0**	**48.3**	**0.9**	**12.1**	**0.2**	**5.4**	**0.1**	**270.8**	**276.8**	**274.8**	**234.0**	**240.0**	**238.0**	**227.1**	**233.1**	**231.1**
6283	14.0	13.09	13.09		2.85			1.3	1.1	53.2	1.0	13.3	0.3	5.9	0.1	276.1	282.1	280.1	235.4	241.4	239.4	227.9	233.9	231.9
6732	15.0	14.03	14.03		3.06			1.4	1.2	61.1	1.1	15.3	0.3	6.8	0.1	284.4	290.4	288.4	237.8	243.8	241.8	229.1	235.1	233.1
7181	16.0	14.97	14.97		3.26			1.6	1.4	69.6	1.2	17.4	0.3	7.7	0.2	293.3	299.3	297.3	240.3	246.3	244.3	230.4	236.4	234.4
7630	17.0	15.90	15.90		3.46			1.9	1.6	78.5	1.4	19.6	0.4	8.7	0.2	302.8	308.8	306.8	242.9	248.9	246.9	231.8	237.8	235.8
8078	18.0	16.84	16.84		3.67			2.1	1.7	88.0	1.5	22.0	0.4	9.8	0.2	312.9	318.9	316.9	245.7	251.7	249.7	233.3	239.3	237.3
8527	19.0	17.77	17.77		3.87			2.3	1.9	98.1	1.7	24.5	0.5	10.9	0.2	323.5	329.5	327.5	248.7	254.7	252.7	234.9	240.9	238.9
8976	**20.0**	**18.71**	**18.71**		**4.07**			**2.6**	**2.1**	**108.7**	**1.9**	**27.2**	**0.5**	**12.1**	**0.2**	**334.7**	**340.7**	**338.7**	**251.9**	**257.9**	**255.9**	**236.5**	**242.5**	**240.5**
9425	21.0	19.64	19.64		4.28			2.8	2.3	119.8	2.1	30.0	0.6	13.3	0.3	346.5	352.5	350.5	255.2	261.2	259.2	238.2	244.2	242.2
9874	22.0	20.58	20.58		4.48			3.1	2.5	131.5	2.2	32.9	0.6	14.6	0.3	358.9	364.9	362.9	258.6	264.6	262.6	240.0	246.0	244.0
10322	23.0	21.51	21.51		4.68			3.4	2.7	143.7	2.4	35.9	0.7	16.0	0.3	371.8	377.8	375.8	262.2	268.2	266.2	241.9	247.9	245.9
10771	24.0	22.45	22.45		4.89			3.7	2.9	156.5	2.6	39.1	0.7	17.4	0.3	385.3	391.3	389.3	266.0	272.0	270.0	243.9	249.9	247.9
11220	25.0	23.38	23.38		5.09			4.0	3.2	169.8	2.8	42.5	0.8	18.9	0.4	399.3	405.3	403.3	269.9	275.9	273.9	245.9	251.9	249.9
11669	26.0	24.32	24.32		5.30			4.4	3.4	183.7	3.1	45.9	0.8	20.4	0.4	414.0	420.0	418.0	274.0	280.0	278.0	248.1	254.1	252.1
12118	27.0	25.25	25.25		5.50			4.7	3.6	198.1	3.3	49.5	0.9	22.0	0.4	429.2	435.2	433.2	278.3	284.3	282.3	250.3	256.3	254.3
12566	28.0	26.19	26.19		5.70			5.1	3.9	213.0	3.5	53.2	1.0	23.7	0.5	445.0	451.0	449.0	282.7	288.7	286.7	252.6	258.6	256.6
13015	29.0	27.12	27.12		5.91			5.4	4.2	228.5	3.7	57.1	1.0	25.4	0.5	461.3	467.3	465.3	287.2	293.2	291.2	255.0	261.0	259.0
13464	30.0	28.06	28.06		6.11			5.8	4.4	244.5	4.0	61.1	1.1	27.2	0.5	478.2	484.2	482.2	292.0	298.0	296.0	257.4	263.4	261.4


PID Pump Exchange - Appraisal Study - Alternative Alignment 1 - 20 CFS Design Flow
MAX TDH - 1 PUMP OPERATING
MIN TDH - 1 PUMP OPERATING
DESIGN POINT - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MIN TDH - 2 PUMPS OPERATING
DESIGN POINT - 2 PUMPS OPERATING
MAX TDH - 3 PUMPS OPERATING
MIN TDH - 3 PUMPS OPERATING
DESIGN POINT - 3 PUMPS OPERATING
TDH (feet)
300
280
260
240
220
200
0.0
5.0
10.0
15.0
20.0
25.0
Flow (cfs)

SYSTEM CURVE CALCULATION
PROJECT: **PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY**
ALTERNATIVE: **ALTERNATIVE ALIGNMENT 1 - 40 CFS DESIGN FLOW**

BY: David Rice, P.E.
DATE: 13-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	922.0 feet	Invert at Diversion
HWL	927.0 feet	Wet Well (High River)
LWL	923.0 feet	Wet Well (Low River)

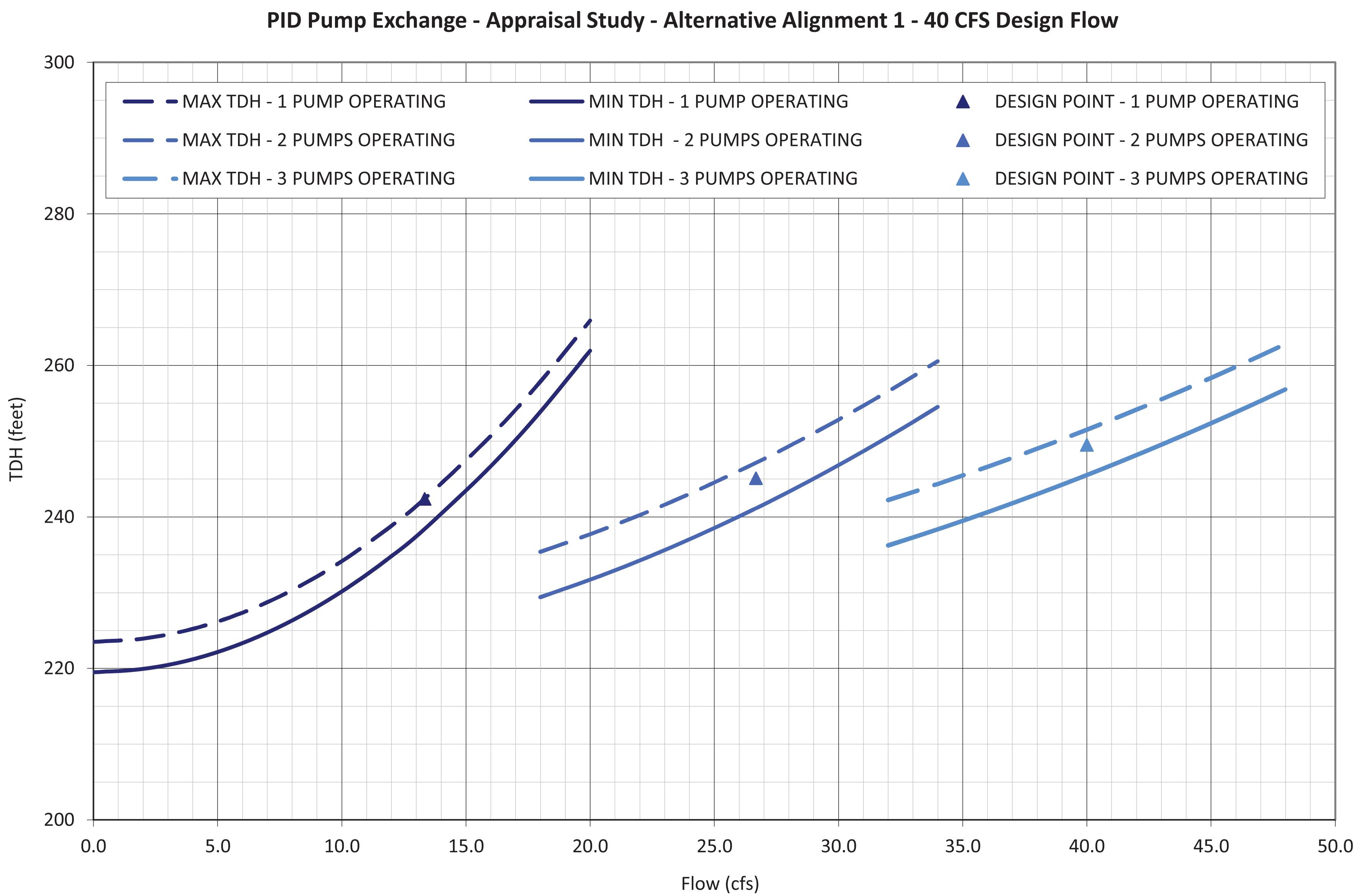
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1146.0 feet	Canal Bottom
HIGH	1148.5 feet	Canal (High Flow)
LWL	1146.5 feet	Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					18	18		36
O.D. (in)					18	18		36
I.D. (in)					18	18		36
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		1,240
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	5985	13.3	242	523.9
2	11970	26.7	245	1059.5
3	17952	40.0	250	1617.4
Assumes	*70%*	*Efficiency*		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		18-inch	18-inch	-inch	36-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	219.5	225.5	223.5	219.5	225.5	223.5	219.5	225.5	223.5
898	2.0	1.13	1.13		0.28			0.0	0.0	0.4	0.0	0.1	0.0	0.0	0.0	219.9	225.9	223.9	219.6	225.6	223.6	219.6	225.6	223.6
1795	4.0	2.26	2.26		0.57			0.0	0.0	1.6	0.0	0.4	0.0	0.2	0.0	221.2	227.2	225.2	220.0	226.0	224.0	219.8	225.8	223.8
2693	6.0	3.39	3.39		0.85			0.1	0.1	3.6	0.1	0.9	0.0	0.4	0.0	223.3	229.3	227.3	220.6	226.6	224.6	220.1	226.1	224.1
3590	8.0	4.53	4.53		1.13			0.2	0.2	6.4	0.1	1.6	0.0	0.7	0.0	226.3	232.3	230.3	221.5	227.5	225.5	220.6	226.6	224.6
4488	10.0	5.66	5.66		1.41			0.3	0.2	9.9	0.2	2.5	0.0	1.1	0.0	230.1	236.1	234.1	222.6	228.6	226.6	221.2	227.2	225.2
5386	12.0	6.79	6.79		1.70			0.4	0.3	14.3	0.2	3.6	0.1	1.6	0.0	234.8	240.8	238.8	223.9	229.9	227.9	221.9	227.9	225.9
5985	**13.3**	**7.55**	**7.55**		**1.89**			**0.6**	**0.4**	**17.7**	**0.3**	**4.4**	**0.1**	**2.0**	**0.0**	**238.4**	**244.4**	**242.4**	**225.0**	**231.0**	**229.0**	**222.5**	**228.5**	**226.5**
7181	16.0	9.05	9.05		2.26			0.8	0.6	25.5	0.4	6.4	0.1	2.8	0.0	246.7	252.7	250.7	227.3	233.3	231.3	223.7	229.7	227.7
8078	18.0	10.18	10.18		2.55			1.0	0.7	32.2	0.5	8.1	0.1	3.6	0.1	253.9	259.9	257.9	229.4	235.4	233.4	224.9	230.9	228.9
8976	20.0	11.32	11.32		2.83			1.2	0.9	39.8	0.6	9.9	0.2	4.4	0.1	261.9	267.9	265.9	231.7	237.7	235.7	226.1	232.1	230.1
9874	22.0	12.45	12.45		3.11			1.5	1.0	48.1	0.7	12.0	0.2	5.3	0.1	270.8	276.8	274.8	234.2	240.2	238.2	227.5	233.5	231.5
10771	24.0	13.58	13.58		3.39			1.8	1.2	57.3	0.8	14.3	0.2	6.4	0.1	280.5	286.5	284.5	237.0	243.0	241.0	229.0	235.0	233.0
11970	**26.7**	**15.09**	**15.09**		**3.77**			**2.2**	**1.5**	**70.7**	**0.9**	**17.7**	**0.3**	**7.9**	**0.1**	**294.8**	**300.8**	**298.8**	**241.1**	**247.1**	**245.1**	**231.2**	**237.2**	**235.2**
12566	28.0	15.84	15.84		3.96			2.4	1.6	77.9	1.0	19.5	0.3	8.7	0.1	302.5	308.5	306.5	243.3	249.3	247.3	232.3	238.3	236.3
13464	30.0	16.97	16.97		4.24			2.8	1.8	89.5	1.2	22.4	0.3	9.9	0.2	314.8	320.8	318.8	246.8	252.8	250.8	234.2	240.2	238.2
14362	32.0	18.11	18.11		4.53			3.2	2.1	101.8	1.3	25.5	0.4	11.3	0.2	327.9	333.9	331.9	250.6	256.6	254.6	236.2	242.2	240.2
15259	34.0	19.24	19.24		4.81			3.6	2.3	114.9	1.5	28.7	0.4	12.8	0.2	341.8	347.8	345.8	254.5	260.5	258.5	238.4	244.4	242.4
16157	36.0	20.37	20.37		5.09			4.0	2.6	128.9	1.6	32.2	0.5	14.3	0.2	356.6	362.6	360.6	258.8	264.8	262.8	240.6	246.6	244.6
17054	38.0	21.50	21.50		5.38			4.5	2.8	143.6	1.8	35.9	0.5	16.0	0.2	372.2	378.2	376.2	263.2	269.2	267.2	243.0	249.0	247.0
17952	**40.0**	**22.63**	**22.63**		**5.66**			**5.0**	**3.1**	**159.1**	**2.0**	**39.8**	**0.6**	**17.7**	**0.3**	**388.6**	**394.6**	**392.6**	**267.9**	**273.9**	**271.9**	**245.5**	**251.5**	**249.5**
18850	42.0	23.76	23.76		5.94			5.5	3.4	175.4	2.2	43.8	0.6	19.5	0.3	405.9	411.9	409.9	272.8	278.8	276.8	248.2	254.2	252.2
19747	44.0	24.90	24.90		6.22			6.0	3.7	192.5	2.4	48.1	0.7	21.4	0.3	424.1	430.1	428.1	278.0	284.0	282.0	250.9	256.9	254.9
20645	46.0	26.03	26.03		6.51			6.6	4.0	210.4	2.6	52.6	0.7	23.4	0.3	443.1	449.1	447.1	283.4	289.4	287.4	253.8	259.8	257.8
21542	48.0	27.16	27.16		6.79			7.2	4.4	229.1	2.8	57.3	0.8	25.5	0.4	462.9	468.9	466.9	289.1	295.1	293.1	256.8	262.8	260.8
22440	50.0	28.29	28.29		7.07			7.8	4.7	248.6	3.0	62.1	0.8	27.6	0.4	483.5	489.5	487.5	294.9	300.9	298.9	260.0	266.0	264.0
23338	52.0	29.42	29.42		7.36			8.4	5.0	268.8	3.2	67.2	0.9	29.9	0.4	505.0	511.0	509.0	301.1	307.1	305.1	263.2	269.2	267.2
24235	54.0	30.55	30.55		7.64			9.1	5.4	289.9	3.5	72.5	1.0	32.2	0.5	527.4	533.4	531.4	307.4	313.4	311.4	266.6	272.6	270.6
25133	56.0	31.69	31.69		7.92			9.7	5.8	311.8	3.7	77.9	1.0	34.6	0.5	550.5	556.5	554.5	314.0	320.0	318.0	270.2	276.2	274.2
26030	58.0	32.82	32.82		8.20			10.5	6.2	334.5	4.0	83.6	1.1	37.2	0.5	574.6	580.6	578.6	320.8	326.8	324.8	273.8	279.8	277.8
26928	60.0	33.95	33.95		8.49			11.2	6.6	357.9	4.2	89.5	1.2	39.8	0.6	599.4	605.4	603.4	327.9	333.9	331.9	277.6	283.6	281.6


PID Pump Exchange - Appraisal Study - Alternative Alignment 1 - 40 CFS Design Flow
MAX TDH - 1 PUMP OPERATING
MIN TDH - 1 PUMP OPERATING
DESIGN POINT - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MIN TDH - 2 PUMPS OPERATING
DESIGN POINT - 2 PUMPS OPERATING
MAX TDH - 3 PUMPS OPERATING
MIN TDH - 3 PUMPS OPERATING
DESIGN POINT - 3 PUMPS OPERATING
TDH (feet)
300
280
260
240
220
200
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
Flow (cfs)

SYSTEM CURVE CALCULATION
PROJECT: **PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY**
ALTERNATIVE: **ALTERNATIVE ALIGNMENT 2 - 10 CFS DESIGN FLOW**

BY: David Rice, P.E.
DATE: 13-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	921.0 feet	Invert at Diversion
HWL	926.0 feet	Wet Well (High River)
LWL	922.0 feet	Wet Well (Low River)

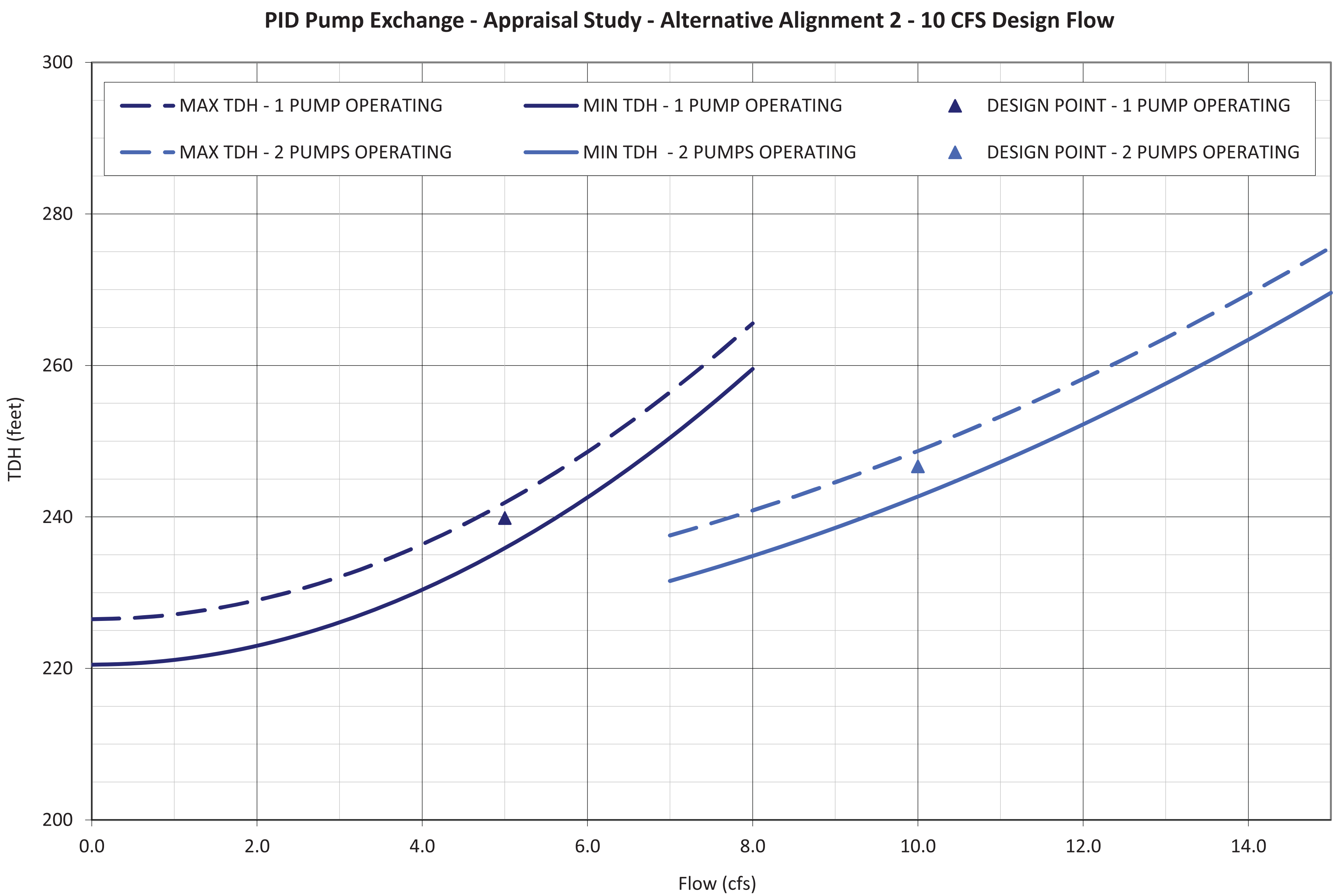
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1146.0 feet	Canal Bottom
HIGH	1148.5 feet	Canal (High Flow)
LWL	1146.5 feet	Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					12	12		20
O.D. (in)					12	12		20
I.D. (in)					12	12		20
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		1,790
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	2244	5.0	240	194.4
2	4488	10.0	247	399.8
Assumes	*70%*	*Efficiency*		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		12-inch	12-inch	-inch	20-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0			220.5	226.5	224.5	220.5	226.5	224.5			
224	0.5	0.64	0.64		0.23			0.0	0.0	0.1	0.0	0.0	0.0			220.7	226.7	224.7	220.6	226.6	224.6			
449	1.0	1.27	1.27		0.46			0.0	0.1	0.5	0.0	0.1	0.0			221.1	227.1	225.1	220.7	226.7	224.7			
673	1.5	1.91	1.91		0.69			0.1	0.2	1.1	0.0	0.3	0.0			221.9	227.9	225.9	221.0	227.0	225.0			
898	2.0	2.55	2.55		0.92			0.1	0.3	2.0	0.1	0.5	0.0			223.0	229.0	227.0	221.5	227.5	225.5			
1122	2.5	3.18	3.18		1.15			0.2	0.5	3.1	0.1	0.8	0.0			224.4	230.4	228.4	222.0	228.0	226.0			
1346	3.0	3.82	3.82		1.37			0.3	0.7	4.5	0.1	1.1	0.0			226.1	232.1	230.1	222.6	228.6	226.6			
1571	3.5	4.46	4.46		1.60			0.4	0.9	6.2	0.2	1.5	0.0			228.1	234.1	232.1	223.4	229.4	227.4			
1795	4.0	5.09	5.09		1.83			0.5	1.1	8.1	0.2	2.0	0.1			230.4	236.4	234.4	224.2	230.2	228.2			
2020	4.5	5.73	5.73		2.06			0.7	1.4	10.2	0.3	2.5	0.1			233.0	239.0	237.0	225.2	231.2	229.2			
2244	**5.0**	**6.37**	**6.37**		**2.29**			**0.8**	**1.7**	**12.6**	**0.3**	**3.1**	**0.1**			**235.9**	**241.9**	**239.9**	**226.2**	**232.2**	**230.2**			
2468	5.5	7.00	7.00		2.52			1.0	2.0	15.2	0.4	3.8	0.1			239.1	245.1	243.1	227.4	233.4	231.4			
2693	6.0	7.64	7.64		2.75			1.2	2.3	18.1	0.4	4.5	0.1			242.6	248.6	246.6	228.7	234.7	232.7			
2917	6.5	8.27	8.27		2.98			1.4	2.7	21.3	0.5	5.3	0.1			246.4	252.4	250.4	230.1	236.1	234.1			
3142	7.0	8.91	8.91		3.21			1.6	3.1	24.7	0.6	6.2	0.2			250.5	256.5	254.5	231.5	237.5	235.5			
3366	7.5	9.55	9.55		3.44			1.8	3.5	28.3	0.6	7.1	0.2			254.8	260.8	258.8	233.1	239.1	237.1			
3590	8.0	10.18	10.18		3.67			2.1	4.0	32.2	0.7	8.1	0.2			259.5	265.5	263.5	234.8	240.8	238.8			
3815	8.5	10.82	10.82		3.90			2.4	4.5	36.4	0.8	9.1	0.2			264.5	270.5	268.5	236.6	242.6	240.6			
4039	9.0	11.46	11.46		4.12			2.6	5.0	40.8	0.9	10.2	0.3			269.8	275.8	273.8	238.6	244.6	242.6			
4264	9.5	12.09	12.09		4.35			2.9	5.5	45.4	1.0	11.4	0.3			275.4	281.4	279.4	240.6	246.6	244.6			
4488	**10.0**	**12.73**	**12.73**		**4.58**			**3.3**	**6.0**	**50.3**	**1.1**	**12.6**	**0.3**			**281.2**	**287.2**	**285.2**	**242.7**	**248.7**	**246.7**			
4712	10.5	13.37	13.37		4.81			3.6	6.6	55.5	1.2	13.9	0.3			287.4	293.4	291.4	244.9	250.9	248.9			
4937	11.0	14.00	14.00		5.04			3.9	7.2	60.9	1.3	15.2	0.4			293.9	299.9	297.9	247.2	253.2	251.2			
5161	11.5	14.64	14.64		5.27			4.3	7.8	66.6	1.4	16.6	0.4			300.6	306.6	304.6	249.7	255.7	253.7			
5386	12.0	15.28	15.28		5.50			4.7	8.5	72.5	1.5	18.1	0.4			307.7	313.7	311.7	252.2	258.2	256.2			
5610	12.5	15.91	15.91		5.73			5.1	9.1	78.6	1.7	19.7	0.5			315.0	321.0	319.0	254.8	260.8	258.8			
5834	13.0	16.55	16.55		5.96			5.5	9.8	85.1	1.8	21.3	0.5			322.7	328.7	326.7	257.6	263.6	261.6			
6059	13.5	17.19	17.19		6.19			5.9	10.5	91.7	1.9	22.9	0.5			330.6	336.6	334.6	260.4	266.4	264.4			
6283	14.0	17.82	17.82		6.42			6.4	11.3	98.7	2.1	24.7	0.6			338.9	344.9	342.9	263.4	269.4	267.4			
6508	14.5	18.46	18.46		6.65			6.9	12.0	105.8	2.2	26.5	0.6			347.4	353.4	351.4	266.4	272.4	270.4			
6732	15.0	19.10	19.10		6.87			7.3	12.8	113.2	2.3	28.3	0.6			356.2	362.2	360.2	269.6	275.6	273.6			


PID Pump Exchange - Appraisal Study - Alternative Alignment 2 - 10 CFS Design Flow
MAX TDH - 1 PUMP OPERATING
MIN TDH - 1 PUMP OPERATING
DESIGN POINT - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MIN TDH - 2 PUMPS OPERATING
DESIGN POINT - 2 PUMPS OPERATING
TDH (feet)
300
280
260
240
220
200
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
Flow (cfs)

SYSTEM CURVE CALCULATION
PROJECT: PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY
ALTERNATIVE: ALTERNATIVE ALIGNMENT 2 - 20 CFS DESIGN FLOW

BY: David Rice, P.E.
DATE: 13-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	921.0 feet	Invert at Diversion
HWL	926.0 feet	Wet Well (High River)
LWL	922.0 feet	Wet Well (Low River)

DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1146.0 feet	Canal Bottom
HIGH	1148.5 feet	Canal (High Flow)
LWL	1146.5 feet	Canal (Low Flow)

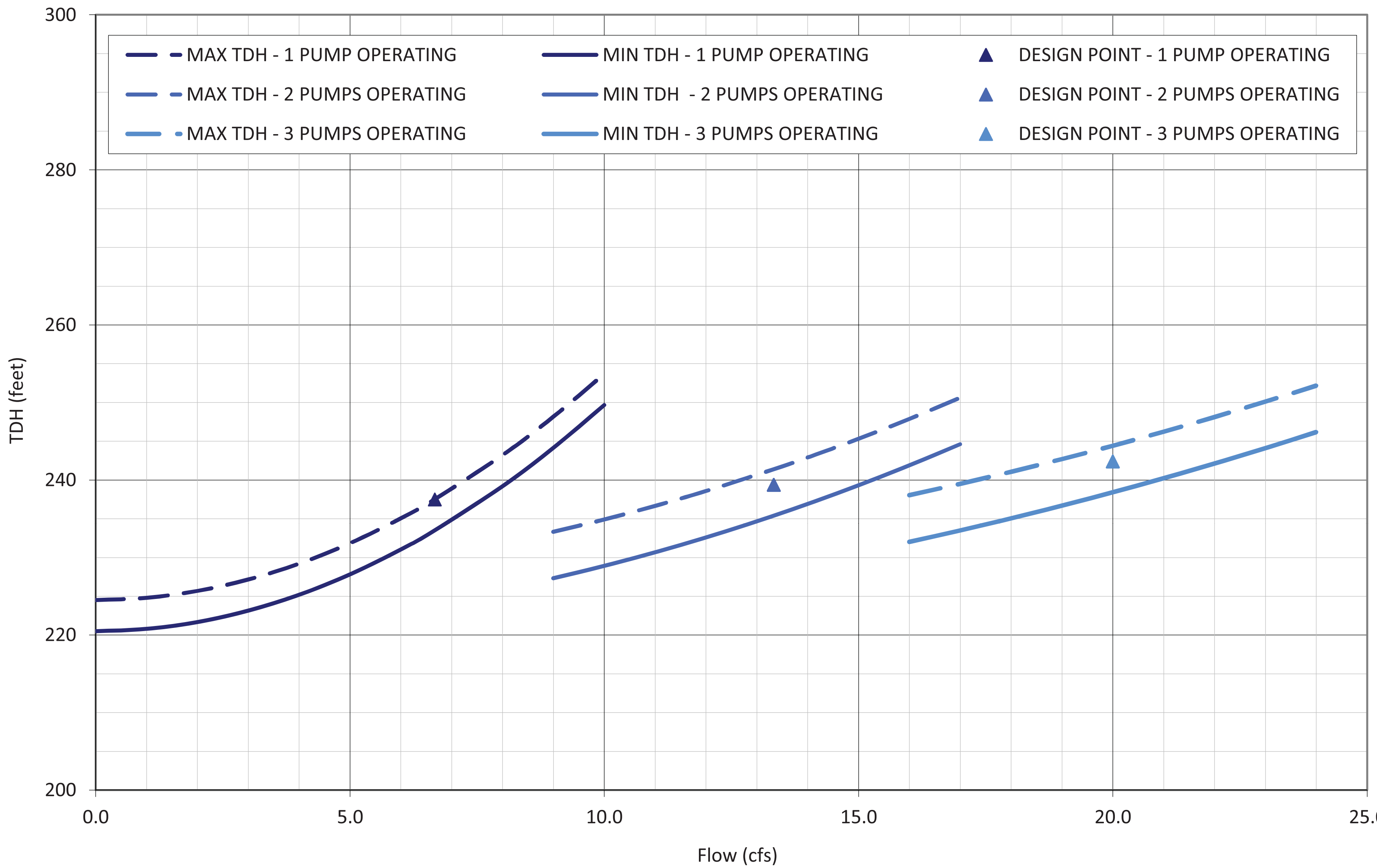
PIPE PROPERTIES	SUCTION PIPING TRANS.	SUCTION PIPING TRANS.	PS PIPING HEADER	PS PIPING TO PUMP	PS PIPING FR. PUMP	PS PIPING HEADER	DISCHARGE PIPING TRANS.	DISCHARGE PIPING TRANS.
NOM. DIAM. (in)					14	14		30
O.D. (in)					14	14		30
I.D. (in)					14	14		30
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		1,790
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	2992	6.7	238	256.6
2	5984	13.3	239	517.3
3	8976	20.0	242	785.7
*Assumes	70%	Efficiency		

TOTAL FLOW (gpm)	TOTAL FLOW (cfs)	VELOCITIES 14-inch (fps)	VELOCITIES 14-inch (fps)	VELOCITIES -inch (fps)	VELOCITIES 30-inch (fps)	SUCTION LOSSES Minor (feet)	SUCTION LOSSES Friction (feet)	DISCHARGE LOSSES Minor (feet)	DISCHARGE LOSSES Friction (feet)	PS LOSSES - 1 PUMP Minor (feet)	PS LOSSES - 1 PUMP Friction (feet)	PS LOSSES - 2 PUMPS Minor (feet)	PS LOSSES - 2 PUMPS Friction (feet)	PS LOSSES - 3 PUMPS Minor (feet)	PS LOSSES - 3 PUMPS Friction (feet)	TDH - 1 PUMP MIN (feet)	TDH - 1 PUMP MAX (feet)	TDH - 1 PUMP DESIGN (feet)	TDH - 2 PUMPS MIN (feet)	TDH - 2 PUMPS MAX (feet)	TDH - 2 PUMPS DESIGN (feet)	TDH - 3 PUMPS MIN (feet)	TDH - 3 PUMPS MAX (feet)	TDH - 3 PUMPS DESIGN (feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	220.5	226.5	224.5	220.5	226.5	224.5	220.5	226.5	224.5
449	1.0	0.94	0.94		0.20			0.0	0.0	0.3	0.0	0.1	0.0	0.0	0.0	220.8	226.8	224.8	220.6	226.6	224.6	220.5	226.5	224.5
898	2.0	1.87	1.87		0.41			0.0	0.0	1.1	0.0	0.3	0.0	0.1	0.0	221.7	227.7	225.7	220.8	226.8	224.8	220.7	226.7	224.7
1346	3.0	2.81	2.81		0.61			0.1	0.1	2.4	0.1	0.6	0.0	0.3	0.0	223.1	229.1	227.1	221.3	227.3	225.3	220.9	226.9	224.9
1795	4.0	3.74	3.74		0.81			0.1	0.2	4.3	0.1	1.1	0.0	0.5	0.0	225.2	231.2	229.2	221.9	227.9	225.9	221.3	227.3	225.3
2244	5.0	4.68	4.68		1.02			0.2	0.2	6.8	0.1	1.7	0.0	0.8	0.0	227.8	233.8	231.8	222.6	228.6	226.6	221.7	227.7	225.7
2693	6.0	5.61	5.61		1.22			0.2	0.3	9.8	0.2	2.4	0.1	1.1	0.0	231.0	237.0	235.0	223.6	229.6	227.6	222.2	228.2	226.2
2992	**6.7**	**6.24**	**6.24**		**1.36**			**0.3**	**0.4**	**12.1**	**0.2**	**3.0**	**0.1**	**1.3**	**0.0**	**233.5**	**239.5**	**237.5**	**224.3**	**230.3**	**228.3**	**222.6**	**228.6**	**226.6**
3590	8.0	7.48	7.48		1.63			0.4	0.6	17.4	0.3	4.3	0.1	1.9	0.0	239.2	245.2	243.2	225.9	231.9	229.9	223.4	229.4	227.4
4039	9.0	8.42	8.42		1.83			0.5	0.7	22.0	0.4	5.5	0.1	2.4	0.1	244.1	250.1	248.1	227.3	233.3	231.3	224.2	230.2	228.2
4488	10.0	9.35	9.35		2.04			0.6	0.8	27.2	0.5	6.8	0.1	3.0	0.1	249.7	255.7	253.7	228.9	234.9	232.9	225.1	231.1	229.1
4937	11.0	10.29	10.29		2.24			0.8	1.0	32.9	0.6	8.2	0.2	3.7	0.1	255.8	261.8	259.8	230.7	236.7	234.7	226.0	232.0	230.0
5386	12.0	11.22	11.22		2.44			0.9	1.2	39.1	0.7	9.8	0.2	4.3	0.1	262.5	268.5	266.5	232.6	238.6	236.6	227.0	233.0	231.0
5984	**13.3**	**12.47**	**12.47**		**2.72**			**1.1**	**1.4**	**48.3**	**0.9**	**12.1**	**0.2**	**5.4**	**0.1**	**272.3**	**278.3**	**276.3**	**235.4**	**241.4**	**239.4**	**228.6**	**234.6**	**232.6**
6283	14.0	13.09	13.09		2.85			1.3	1.6	53.2	1.0	13.3	0.3	5.9	0.1	277.5	283.5	281.5	236.9	242.9	240.9	229.4	235.4	233.4
6732	15.0	14.03	14.03		3.06			1.4	1.8	61.1	1.1	15.3	0.3	6.8	0.1	286.0	292.0	290.0	239.3	245.3	243.3	230.7	236.7	234.7
7181	16.0	14.97	14.97		3.26			1.6	2.0	69.6	1.2	17.4	0.3	7.7	0.2	294.9	300.9	298.9	241.9	247.9	245.9	232.0	238.0	236.0
7630	17.0	15.90	15.90		3.46			1.9	2.2	78.5	1.4	19.6	0.4	8.7	0.2	304.5	310.5	308.5	244.6	250.6	248.6	233.5	239.5	237.5
8078	18.0	16.84	16.84		3.67			2.1	2.5	88.0	1.5	22.0	0.4	9.8	0.2	314.6	320.6	318.6	247.5	253.5	251.5	235.1	241.1	239.1
8527	19.0	17.77	17.77		3.87			2.3	2.7	98.1	1.7	24.5	0.5	10.9	0.2	325.4	331.4	329.4	250.6	256.6	254.6	236.7	242.7	240.7
8976	**20.0**	**18.71**	**18.71**		**4.07**			**2.6**	**3.0**	**108.7**	**1.9**	**27.2**	**0.5**	**12.1**	**0.2**	**336.7**	**342.7**	**340.7**	**253.8**	**259.8**	**257.8**	**238.4**	**244.4**	**242.4**
9425	21.0	19.64	19.64		4.28			2.8	3.3	119.8	2.1	30.0	0.6	13.3	0.3	348.5	354.5	352.5	257.2	263.2	261.2	240.2	246.2	244.2
9874	22.0	20.58	20.58		4.48			3.1	3.6	131.5	2.2	32.9	0.6	14.6	0.3	361.0	367.0	365.0	260.7	266.7	264.7	242.1	248.1	246.1
10322	23.0	21.51	21.51		4.68			3.4	3.9	143.7	2.4	35.9	0.7	16.0	0.3	374.0	380.0	378.0	264.4	270.4	268.4	244.1	250.1	248.1
10771	24.0	22.45	22.45		4.89			3.7	4.2	156.5	2.6	39.1	0.7	17.4	0.3	387.6	393.6	391.6	268.3	274.3	272.3	246.2	252.2	250.2
11220	25.0	23.38	23.38		5.09			4.0	4.6	169.8	2.8	42.5	0.8	18.9	0.4	401.7	407.7	405.7	272.3	278.3	276.3	248.3	254.3	252.3
11669	26.0	24.32	24.32		5.30			4.4	4.9	183.7	3.1	45.9	0.8	20.4	0.4	416.5	422.5	420.5	276.5	282.5	280.5	250.6	256.6	254.6
12118	27.0	25.25	25.25		5.50			4.7	5.3	198.1	3.3	49.5	0.9	22.0	0.4	431.8	437.8	435.8	280.9	286.9	284.9	252.9	258.9	256.9
12566	28.0	26.19	26.19		5.70			5.1	5.6	213.0	3.5	53.2	1.0	23.7	0.5	447.7	453.7	451.7	285.4	291.4	289.4	255.3	261.3	259.3
13015	29.0	27.12	27.12		5.91			5.4	6.0	228.5	3.7	57.1	1.0	25.4	0.5	464.2	470.2	468.2	290.1	296.1	294.1	257.8	263.8	261.8
13464	30.0	28.06	28.06		6.11			5.8	6.4	244.5	4.0	61.1	1.1	27.2	0.5	481.2	487.2	485.2	294.9	300.9	298.9	260.4	266.4	264.4

PID Pump Exchange - Appraisal Study - Alternative Alignment 2 - 20 CFS Design Flow



SYSTEM CURVE CALCULATION
PROJECT: PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY
ALTERNATIVE: ALTERNATIVE ALIGNMENT 2 - 40 CFS DESIGN FLOW

BY: David Rice, P.E.
DATE: 13-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	921.0 feet	Invert at Diversion
HWL	926.0 feet	Wet Well (High River)
LWL	922.0 feet	Wet Well (Low River)

DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1146.0 feet	Canal Bottom
HIGH	1148.5 feet	Canal (High Flow)
LWL	1146.5 feet	Canal (Low Flow)

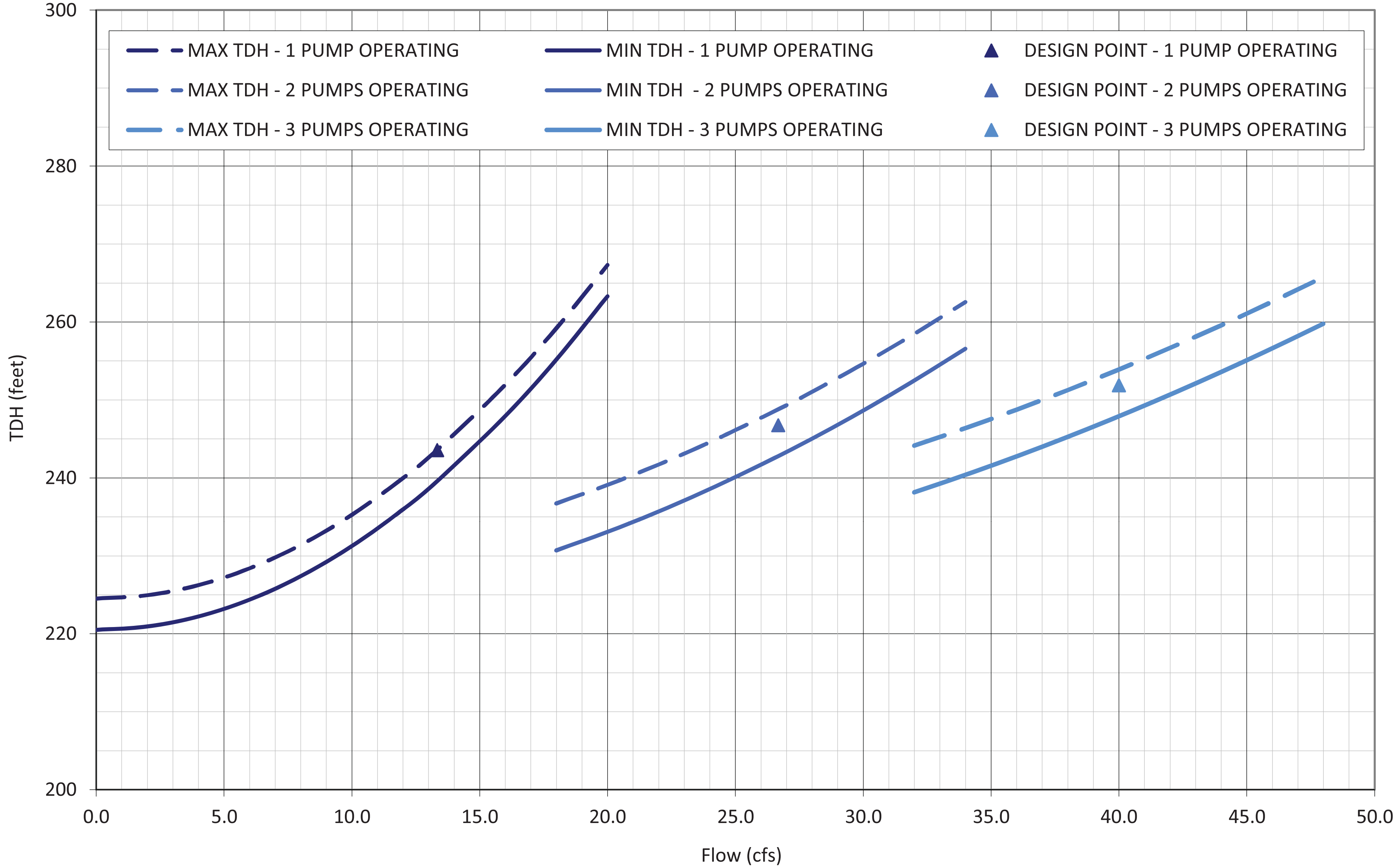
PIPE PROPERTIES	SUCTION PIPING TRANS.	SUCTION PIPING TRANS.	PS PIPING HEADER	PS PIPING TO PUMP	PS PIPING FR. PUMP	PS PIPING HEADER	DISCHARGE PIPING TRANS.	DISCHARGE PIPING TRANS.
NOM. DIAM. (in)					18	18		36
O.D. (in)					18	18		36
I.D. (in)					18	18		36
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		1,790
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	5985	13.3	244	526.4
2	11970	26.7	247	1066.6
3	17952	40.0	252	1632.8
*Assumes	70%	Efficiency		

TOTAL FLOW (gpm)	TOTAL FLOW (cfs)	VELOCITIES 18-inch (fps)	VELOCITIES 18-inch (fps)	VELOCITIES -inch (fps)	VELOCITIES 36-inch (fps)	SUCTION LOSSES Minor (feet)	SUCTION LOSSES Friction (feet)	DISCHARGE LOSSES Minor (feet)	DISCHARGE LOSSES Friction (feet)	PS LOSSES - 1 PUMP Minor (feet)	PS LOSSES - 1 PUMP Friction (feet)	PS LOSSES - 2 PUMPS Minor (feet)	PS LOSSES - 2 PUMPS Friction (feet)	PS LOSSES - 3 PUMPS Minor (feet)	PS LOSSES - 3 PUMPS Friction (feet)	TDH - 1 PUMP MIN (feet)	TDH - 1 PUMP MAX (feet)	TDH - 1 PUMP DESIGN (feet)	TDH - 2 PUMPS MIN (feet)	TDH - 2 PUMPS MAX (feet)	TDH - 2 PUMPS DESIGN (feet)	TDH - 3 PUMPS MIN (feet)	TDH - 3 PUMPS MAX (feet)	TDH - 3 PUMPS DESIGN (feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	220.5	226.5	224.5	220.5	226.5	224.5	220.5	226.5	224.5
898	2.0	1.13	1.13		0.28			0.0	0.0	0.4	0.0	0.1	0.0	0.0	0.0	220.9	226.9	224.9	220.6	226.6	224.6	220.6	226.6	224.6
1795	4.0	2.26	2.26		0.57			0.0	0.1	1.6	0.0	0.4	0.0	0.2	0.0	222.2	228.2	226.2	221.0	227.0	225.0	220.8	226.8	224.8
2693	6.0	3.39	3.39		0.85			0.1	0.1	3.6	0.1	0.9	0.0	0.4	0.0	224.4	230.4	228.4	221.7	227.7	225.7	221.2	227.2	225.2
3590	8.0	4.53	4.53		1.13			0.2	0.2	6.4	0.1	1.6	0.0	0.7	0.0	227.4	233.4	231.4	222.5	228.5	226.5	221.6	227.6	225.6
4488	10.0	5.66	5.66		1.41			0.3	0.3	9.9	0.2	2.5	0.0	1.1	0.0	231.3	237.3	235.3	223.7	229.7	227.7	222.3	228.3	226.3
5386	12.0	6.79	6.79		1.70			0.4	0.5	14.3	0.2	3.6	0.1	1.6	0.0	236.0	242.0	240.0	225.1	231.1	229.1	223.0	229.0	227.0
5985	13.3	7.55	7.55		1.89			0.6	0.6	17.7	0.3	4.4	0.1	2.0	0.0	239.6	245.6	243.6	226.1	232.1	230.1	223.6	229.6	227.6
7181	16.0	9.05	9.05		2.26			0.8	0.8	25.5	0.4	6.4	0.1	2.8	0.0	247.9	253.9	251.9	228.6	234.6	232.6	225.0	231.0	229.0
8078	18.0	10.18	10.18		2.55			1.0	1.0	32.2	0.5	8.1	0.1	3.6	0.1	255.2	261.2	259.2	230.7	236.7	234.7	226.2	232.2	230.2
8976	20.0	11.32	11.32		2.83			1.2	1.2	39.8	0.6	9.9	0.2	4.4	0.1	263.3	269.3	267.3	233.1	239.1	237.1	227.5	233.5	231.5
9874	22.0	12.45	12.45		3.11			1.5	1.5	48.1	0.7	12.0	0.2	5.3	0.1	272.3	278.3	276.3	235.7	241.7	239.7	228.9	234.9	232.9
10771	24.0	13.58	13.58		3.39			1.8	1.7	57.3	0.8	14.3	0.2	6.4	0.1	282.1	288.1	286.1	238.6	244.6	242.6	230.5	236.5	234.5
11970	26.7	15.09	15.09		3.77			2.2	2.1	70.7	0.9	17.7	0.3	7.9	0.1	296.5	302.5	300.5	242.8	248.8	246.8	232.8	238.8	236.8
12566	28.0	15.84	15.84		3.96			2.4	2.3	77.9	1.0	19.5	0.3	8.7	0.1	304.2	310.2	308.2	245.0	251.0	249.0	234.0	240.0	238.0
13464	30.0	16.97	16.97		4.24			2.8	2.6	89.5	1.2	22.4	0.3	9.9	0.2	316.6	322.6	320.6	248.6	254.6	252.6	236.0	242.0	240.0
14362	32.0	18.11	18.11		4.53			3.2	3.0	101.8	1.3	25.5	0.4	11.3	0.2	329.8	335.8	333.8	252.5	258.5	256.5	238.1	244.1	242.1
15259	34.0	19.24	19.24		4.81			3.6	3.3	114.9	1.5	28.7	0.4	12.8	0.2	343.8	349.8	347.8	256.6	262.6	260.6	240.4	246.4	244.4
16157	36.0	20.37	20.37		5.09			4.0	3.7	128.9	1.6	32.2	0.5	14.3	0.2	358.7	364.7	362.7	260.9	266.9	264.9	242.7	248.7	246.7
17054	38.0	21.50	21.50		5.38			4.5	4.1	143.6	1.8	35.9	0.5	16.0	0.2	374.4	380.4	378.4	265.5	271.5	269.5	245.3	251.3	249.3
17952	40.0	22.63	22.63		5.66			5.0	4.5	159.1	2.0	39.8	0.6	17.7	0.3	391.0	397.0	395.0	270.3	276.3	274.3	247.9	253.9	251.9
18850	42.0	23.76	23.76		5.94			5.5	4.9	175.4	2.2	43.8	0.6	19.5	0.3	408.5	414.5	412.5	275.3	281.3	279.3	250.7	256.7	254.7
19747	44.0	24.90	24.90		6.22			6.0	5.3	192.5	2.4	48.1	0.7	21.4	0.3	426.7	432.7	430.7	280.6	286.6	284.6	253.6	259.6	257.6
20645	46.0	26.03	26.03		6.51			6.6	5.8	210.4	2.6	52.6	0.7	23.4	0.3	445.8	451.8	449.8	286.2	292.2	290.2	256.6	262.6	260.6
21542	48.0	27.16	27.16		6.79			7.2	6.3	229.1	2.8	57.3	0.8	25.5	0.4	465.8	471.8	469.8	292.0	298.0	296.0	259.8	265.8	263.8
22440	50.0	28.29	28.29		7.07			7.8	6.8	248.6	3.0	62.1	0.8	27.6	0.4	486.6	492.6	490.6	298.0	304.0	302.0	263.1	269.1	267.1
23338	52.0	29.42	29.42		7.36			8.4	7.3	268.8	3.2	67.2	0.9	29.9	0.4	508.3	514.3	512.3	304.3	310.3	308.3	266.5	272.5	270.5
24235	54.0	30.55	30.55		7.64			9.1	7.8	289.9	3.5	72.5	1.0	32.2	0.5	530.8	536.8	534.8	310.8	316.8	314.8	270.0	276.0	274.0
25133	56.0	31.69	31.69		7.92			9.7	8.4	311.8	3.7	77.9	1.0	34.6	0.5	554.1	560.1	558.1	317.6	323.6	321.6	273.7	279.7	277.7
26030	58.0	32.82	32.82		8.20			10.5	8.9	334.5	4.0	83.6	1.1	37.2	0.5	578.3	584.3	582.3	324.6	330.6	328.6	277.6	283.6	281.6
26928	60.0	33.95	33.95		8.49			11.2	9.5	357.9	4.2	89.5	1.2	39.8	0.6	603.3	609.3	607.3	331.8	337.8	335.8	281.5	287.5	285.5

PID Pump Exchange - Appraisal Study - Alternative Alignment 2 - 40 CFS Design Flow



SYSTEM CURVE CALCULATION

PROJECT: **PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY**

ALTERNATIVE: **ALTERNATIVE ALIGNMENT 3 - 10 CFS DESIGN FLOW**

BY: David Rice, P.E.

DATE: 13-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	934.0 feet	Invert at Diversion
HWL	939.0 feet	Wet Well (High River)
LWL	935.0 feet	Wet Well (Low River)

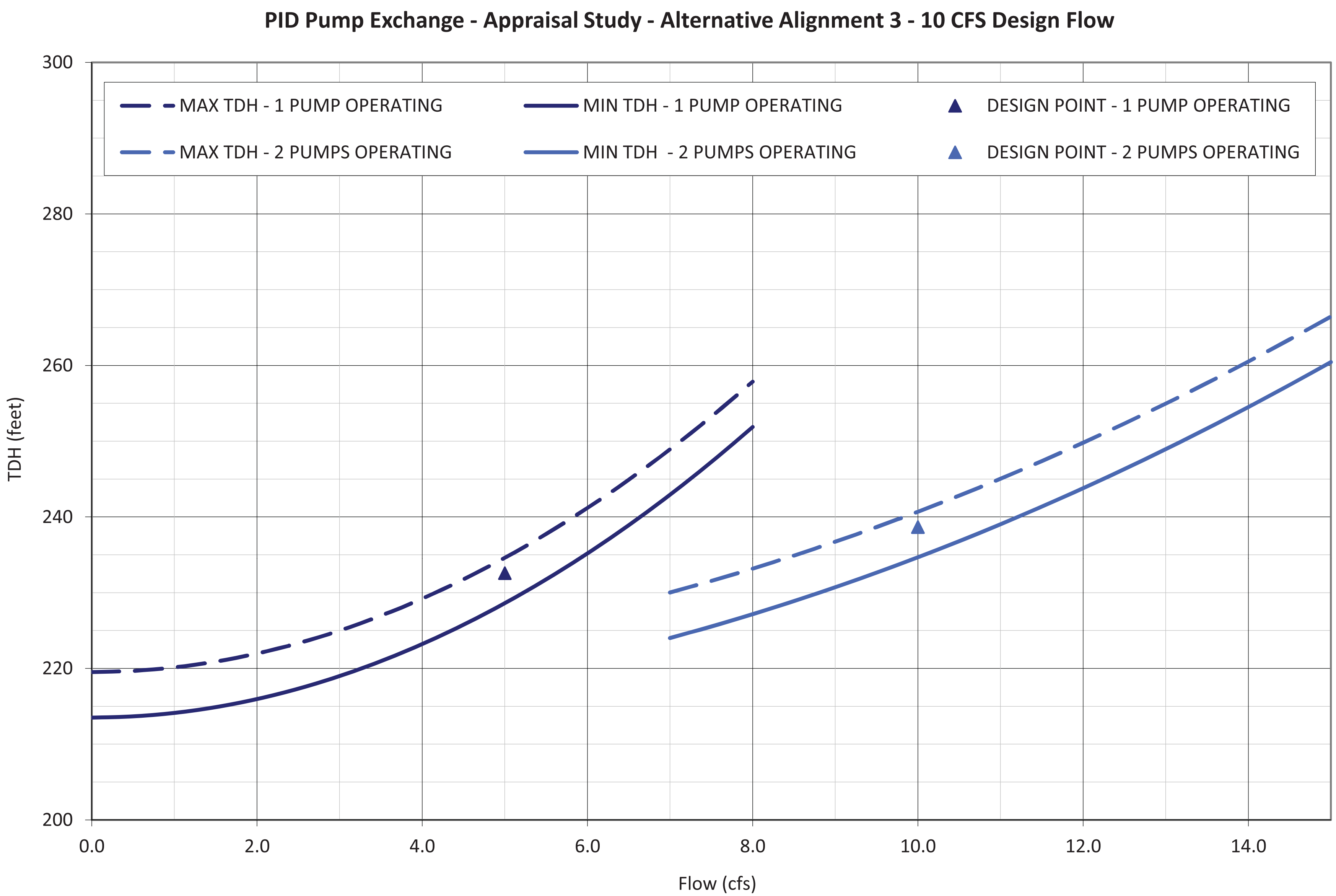
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1152.0 feet	Canal Bottom
HIGH	1154.5 feet	Canal (High Flow)
LWL	1152.5 feet	Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					12	12		20
O.D. (in)					12	12		20
I.D. (in)					12	12		20
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		1,490
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	2244	5.0	233	188.5
2	4488	10.0	239	386.8
*Assumes	70%	Efficiency		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		12-inch	12-inch	-inch	20-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0			213.5	219.5	217.5	213.5	219.5	217.5			
224	0.5	0.64	0.64		0.23			0.0	0.0	0.1	0.0	0.0	0.0			213.7	219.7	217.7	213.6	219.6	217.6			
449	1.0	1.27	1.27		0.46			0.0	0.1	0.5	0.0	0.1	0.0			214.1	220.1	218.1	213.7	219.7	217.7			
673	1.5	1.91	1.91		0.69			0.1	0.2	1.1	0.0	0.3	0.0			214.9	220.9	218.9	214.0	220.0	218.0			
898	2.0	2.55	2.55		0.92			0.1	0.3	2.0	0.1	0.5	0.0			216.0	222.0	220.0	214.4	220.4	218.4			
1122	2.5	3.18	3.18		1.15			0.2	0.4	3.1	0.1	0.8	0.0			217.3	223.3	221.3	214.9	220.9	218.9			
1346	3.0	3.82	3.82		1.37			0.3	0.5	4.5	0.1	1.1	0.0			219.0	225.0	223.0	215.5	221.5	219.5			
1571	3.5	4.46	4.46		1.60			0.4	0.7	6.2	0.2	1.5	0.0			220.9	226.9	224.9	216.2	222.2	220.2			
1795	4.0	5.09	5.09		1.83			0.5	0.9	8.1	0.2	2.0	0.1			223.2	229.2	227.2	217.0	223.0	221.0			
2020	4.5	5.73	5.73		2.06			0.7	1.1	10.2	0.3	2.5	0.1			225.8	231.8	229.8	217.9	223.9	221.9			
2244	**5.0**	**6.37**	**6.37**		**2.29**			**0.8**	**1.4**	**12.6**	**0.3**	**3.1**	**0.1**			**228.6**	**234.6**	**232.6**	**218.9**	**224.9**	**222.9**			
2468	5.5	7.00	7.00		2.52			1.0	1.7	15.2	0.4	3.8	0.1			231.7	237.7	235.7	220.1	226.1	224.1			
2693	6.0	7.64	7.64		2.75			1.2	2.0	18.1	0.4	4.5	0.1			235.2	241.2	239.2	221.3	227.3	225.3			
2917	6.5	8.27	8.27		2.98			1.4	2.3	21.3	0.5	5.3	0.1			238.9	244.9	242.9	222.6	228.6	226.6			
3142	7.0	8.91	8.91		3.21			1.6	2.6	24.7	0.6	6.2	0.2			242.9	248.9	246.9	224.0	230.0	228.0			
3366	7.5	9.55	9.55		3.44			1.8	3.0	28.3	0.6	7.1	0.2			247.2	253.2	251.2	225.5	231.5	229.5			
3590	8.0	10.18	10.18		3.67			2.1	3.3	32.2	0.7	8.1	0.2			251.9	257.9	255.9	227.2	233.2	231.2			
3815	8.5	10.82	10.82		3.90			2.4	3.7	36.4	0.8	9.1	0.2			256.8	262.8	260.8	228.9	234.9	232.9			
4039	9.0	11.46	11.46		4.12			2.6	4.1	40.8	0.9	10.2	0.3			262.0	268.0	266.0	230.7	236.7	234.7			
4264	9.5	12.09	12.09		4.35			2.9	4.6	45.4	1.0	11.4	0.3			267.4	273.4	271.4	232.7	238.7	236.7			
4488	**10.0**	**12.73**	**12.73**		**4.58**			**3.3**	**5.0**	**50.3**	**1.1**	**12.6**	**0.3**			**273.2**	**279.2**	**277.2**	**234.7**	**240.7**	**238.7**			
4712	10.5	13.37	13.37		4.81			3.6	5.5	55.5	1.2	13.9	0.3			279.3	285.3	283.3	236.8	242.8	240.8			
4937	11.0	14.00	14.00		5.04			3.9	6.0	60.9	1.3	15.2	0.4			285.7	291.7	289.7	239.0	245.0	243.0			
5161	11.5	14.64	14.64		5.27			4.3	6.5	66.6	1.4	16.6	0.4			292.3	298.3	296.3	241.4	247.4	245.4			
5386	12.0	15.28	15.28		5.50			4.7	7.0	72.5	1.5	18.1	0.4			299.3	305.3	303.3	243.8	249.8	247.8			
5610	12.5	15.91	15.91		5.73			5.1	7.6	78.6	1.7	19.7	0.5			306.5	312.5	310.5	246.3	252.3	250.3			
5834	13.0	16.55	16.55		5.96			5.5	8.2	85.1	1.8	21.3	0.5			314.0	320.0	318.0	248.9	254.9	252.9			
6059	13.5	17.19	17.19		6.19			5.9	8.8	91.7	1.9	22.9	0.5			321.9	327.9	325.9	251.7	257.7	255.7			
6283	14.0	17.82	17.82		6.42			6.4	9.4	98.7	2.1	24.7	0.6			330.0	336.0	334.0	254.5	260.5	258.5			
6508	14.5	18.46	18.46		6.65			6.9	10.0	105.8	2.2	26.5	0.6			338.4	344.4	342.4	257.4	263.4	261.4			
6732	15.0	19.10	19.10		6.87			7.3	10.6	113.2	2.3	28.3	0.6			347.1	353.1	351.1	260.4	266.4	264.4			



PID Pump Exchange - Appraisal Study - Alternative Alignment 3 - 10 CFS Design Flow
MAX TDH - 1 PUMP OPERATING
MIN TDH - 1 PUMP OPERATING
DESIGN POINT - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MIN TDH - 2 PUMPS OPERATING
DESIGN POINT - 2 PUMPS OPERATING
TDH (feet)
300
280
260
240
220
200
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
Flow (cfs)

SYSTEM CURVE CALCULATION

PROJECT: PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY

ALTERNATIVE: ALTERNATIVE ALIGNMENT 3 - 20 CFS DESIGN FLOW

BY: David Rice, P.E.

DATE: 13-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	934.0 feet	Invert at Diversion
HWL	939.0 feet	Wet Well (High River)
LWL	935.0 feet	Wet Well (Low River)

DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1152.0 feet	Canal Bottom
HIGH	1154.5 feet	Canal (High Flow)
LWL	1152.5 feet	Canal (Low Flow)

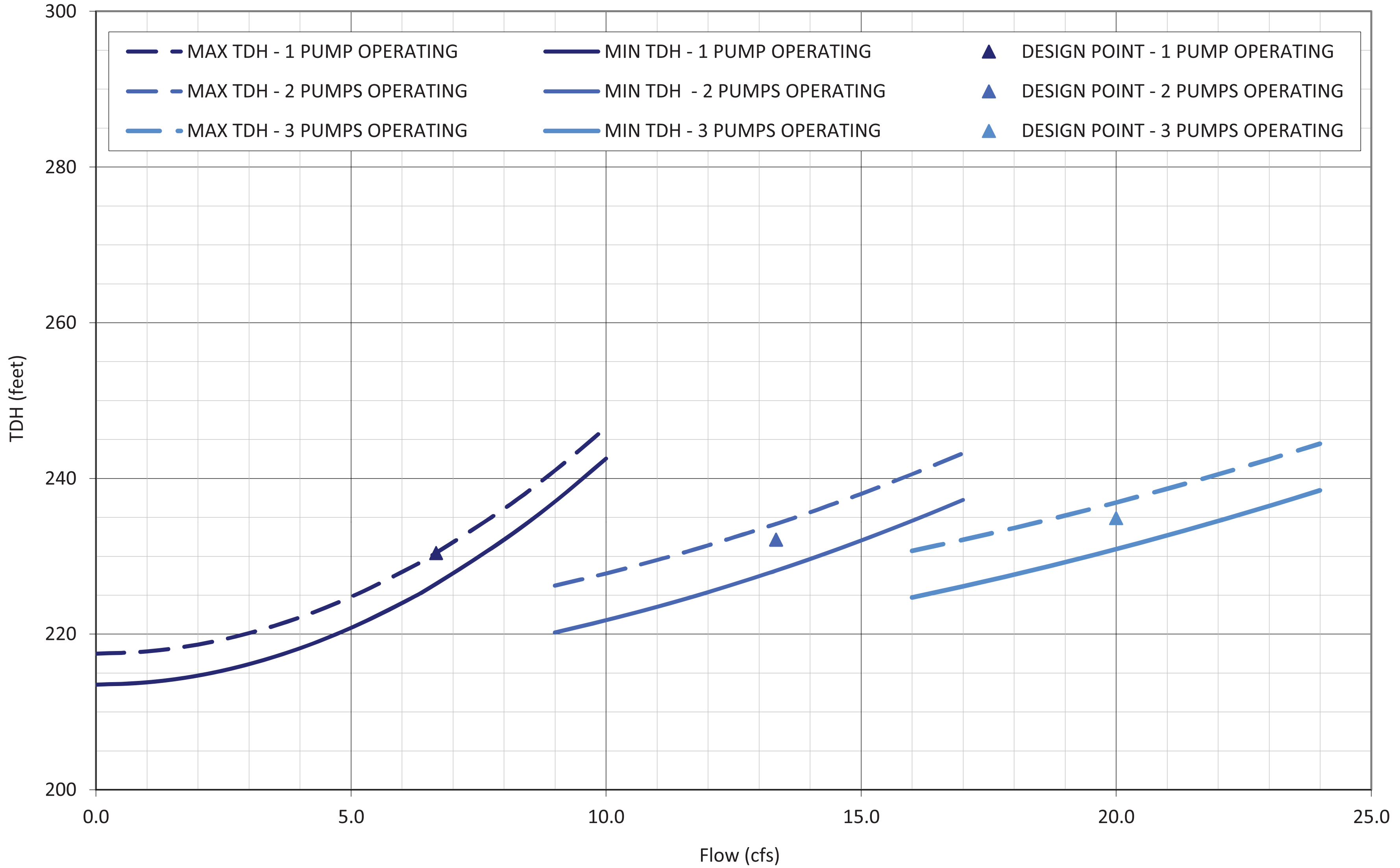
PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					14	14		30
O.D. (in)					14	14		30
I.D. (in)					14	14		30
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		1,490
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	2992	6.7	230	249.0
2	5984	13.3	232	501.6
3	8976	20.0	235	761.4
*Assumes	70%	Efficiency		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		14-inch	14-inch	-inch	30-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	213.5	219.5	217.5	213.5	219.5	217.5	213.5	219.5	217.5
449	1.0	0.94	0.94		0.20			0.0	0.0	0.3	0.0	0.1	0.0	0.0	0.0	213.8	219.8	217.8	213.6	219.6	217.6	213.5	219.5	217.5
898	2.0	1.87	1.87		0.41			0.0	0.0	1.1	0.0	0.3	0.0	0.1	0.0	214.7	220.7	218.7	213.8	219.8	217.8	213.7	219.7	217.7
1346	3.0	2.81	2.81		0.61			0.1	0.1	2.4	0.1	0.6	0.0	0.3	0.0	216.1	222.1	220.1	214.3	220.3	218.3	213.9	219.9	217.9
1795	4.0	3.74	3.74		0.81			0.1	0.1	4.3	0.1	1.1	0.0	0.5	0.0	218.2	224.2	222.2	214.8	220.8	218.8	214.2	220.2	218.2
2244	5.0	4.68	4.68		1.02			0.2	0.2	6.8	0.1	1.7	0.0	0.8	0.0	220.8	226.8	224.8	215.6	221.6	219.6	214.6	220.6	218.6
2693	6.0	5.61	5.61		1.22			0.2	0.3	9.8	0.2	2.4	0.1	1.1	0.0	224.0	230.0	228.0	216.5	222.5	220.5	215.1	221.1	219.1
2992	**6.7**	**6.24**	**6.24**		**1.36**			**0.3**	**0.3**	**12.1**	**0.2**	**3.0**	**0.1**	**1.3**	**0.0**	**226.4**	**232.4**	**230.4**	**217.2**	**223.2**	**221.2**	**215.5**	**221.5**	**219.5**
3590	8.0	7.48	7.48		1.63			0.4	0.5	17.4	0.3	4.3	0.1	1.9	0.0	232.1	238.1	236.1	218.8	224.8	222.8	216.4	222.4	220.4
4039	9.0	8.42	8.42		1.83			0.5	0.6	22.0	0.4	5.5	0.1	2.4	0.1	237.0	243.0	241.0	220.2	226.2	224.2	217.1	223.1	221.1
4488	10.0	9.35	9.35		2.04			0.6	0.7	27.2	0.5	6.8	0.1	3.0	0.1	242.5	248.5	246.5	221.8	227.8	225.8	217.9	223.9	221.9
4937	11.0	10.29	10.29		2.24			0.8	0.8	32.9	0.6	8.2	0.2	3.7	0.1	248.6	254.6	252.6	223.5	229.5	227.5	218.8	224.8	222.8
5386	12.0	11.22	11.22		2.44			0.9	1.0	39.1	0.7	9.8	0.2	4.3	0.1	255.3	261.3	259.3	225.4	231.4	229.4	219.8	225.8	223.8
5984	**13.3**	**12.47**	**12.47**		**2.72**			**1.1**	**1.2**	**48.3**	**0.9**	**12.1**	**0.2**	**5.4**	**0.1**	**265.0**	**271.0**	**269.0**	**228.2**	**234.2**	**232.2**	**221.3**	**227.3**	**225.3**
6283	14.0	13.09	13.09		2.85			1.3	1.3	53.2	1.0	13.3	0.3	5.9	0.1	270.3	276.3	274.3	229.6	235.6	233.6	222.1	228.1	226.1
6732	15.0	14.03	14.03		3.06			1.4	1.5	61.1	1.1	15.3	0.3	6.8	0.1	278.7	284.7	282.7	232.0	238.0	236.0	223.4	229.4	227.4
7181	16.0	14.97	14.97		3.26			1.6	1.7	69.6	1.2	17.4	0.3	7.7	0.2	287.6	293.6	291.6	234.5	240.5	238.5	224.7	230.7	228.7
7630	17.0	15.90	15.90		3.46			1.9	1.9	78.5	1.4	19.6	0.4	8.7	0.2	297.1	303.1	301.1	237.2	243.2	241.2	226.1	232.1	230.1
8078	18.0	16.84	16.84		3.67			2.1	2.1	88.0	1.5	22.0	0.4	9.8	0.2	307.2	313.2	311.2	240.1	246.1	244.1	227.6	233.6	231.6
8527	19.0	17.77	17.77		3.87			2.3	2.3	98.1	1.7	24.5	0.5	10.9	0.2	317.9	323.9	321.9	243.1	249.1	247.1	229.2	235.2	233.2
8976	**20.0**	**18.71**	**18.71**		**4.07**			**2.6**	**2.5**	**108.7**	**1.9**	**27.2**	**0.5**	**12.1**	**0.2**	**329.1**	**335.1**	**333.1**	**246.3**	**252.3**	**250.3**	**230.9**	**236.9**	**234.9**
9425	21.0	19.64	19.64		4.28			2.8	2.8	119.8	2.1	30.0	0.6	13.3	0.3	341.0	347.0	345.0	249.6	255.6	253.6	232.7	238.7	236.7
9874	22.0	20.58	20.58		4.48			3.1	3.0	131.5	2.2	32.9	0.6	14.6	0.3	353.4	359.4	357.4	253.1	259.1	257.1	234.5	240.5	238.5
10322	23.0	21.51	21.51		4.68			3.4	3.3	143.7	2.4	35.9	0.7	16.0	0.3	366.3	372.3	370.3	256.8	262.8	260.8	236.5	242.5	240.5
10771	24.0	22.45	22.45		4.89			3.7	3.5	156.5	2.6	39.1	0.7	17.4	0.3	379.9	385.9	383.9	260.6	266.6	264.6	238.5	244.5	242.5
11220	25.0	23.38	23.38		5.09			4.0	3.8	169.8	2.8	42.5	0.8	18.9	0.4	394.0	400.0	398.0	264.6	270.6	268.6	240.6	246.6	244.6
11669	26.0	24.32	24.32		5.30			4.4	4.1	183.7	3.1	45.9	0.8	20.4	0.4	408.7	414.7	412.7	268.7	274.7	272.7	242.8	248.8	246.8
12118	27.0	25.25	25.25		5.50			4.7	4.4	198.1	3.3	49.5	0.9	22.0	0.4	423.9	429.9	427.9	273.0	279.0	277.0	245.0	251.0	249.0
12566	28.0	26.19	26.19		5.70			5.1	4.7	213.0	3.5	53.2	1.0	23.7	0.5	439.7	445.7	443.7	277.5	283.5	281.5	247.4	253.4	251.4
13015	29.0	27.12	27.12		5.91			5.4	5.0	228.5	3.7	57.1	1.0	25.4	0.5	456.1	462.1	460.1	282.1	288.1	286.1	249.8	255.8	253.8
13464	30.0	28.06	28.06		6.11			5.8	5.3	244.5	4.0	61.1	1.1	27.2	0.5	473.1	479.1	477.1	286.9	292.9	290.9	252.3	258.3	256.3

PID Pump Exchange - Appraisal Study - Alternative Alignment 3 - 20 CFS Design Flow



SYSTEM CURVE CALCULATION

PROJECT: PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY

ALTERNATIVE: ALTERNATIVE ALIGNMENT 3 - 40 CFS DESIGN FLOW

BY: David Rice, P.E.

DATE: 13-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	934.0 feet	Invert at Diversion
HWL	939.0 feet	Wet Well (High River)
LWL	935.0 feet	Wet Well (Low River)

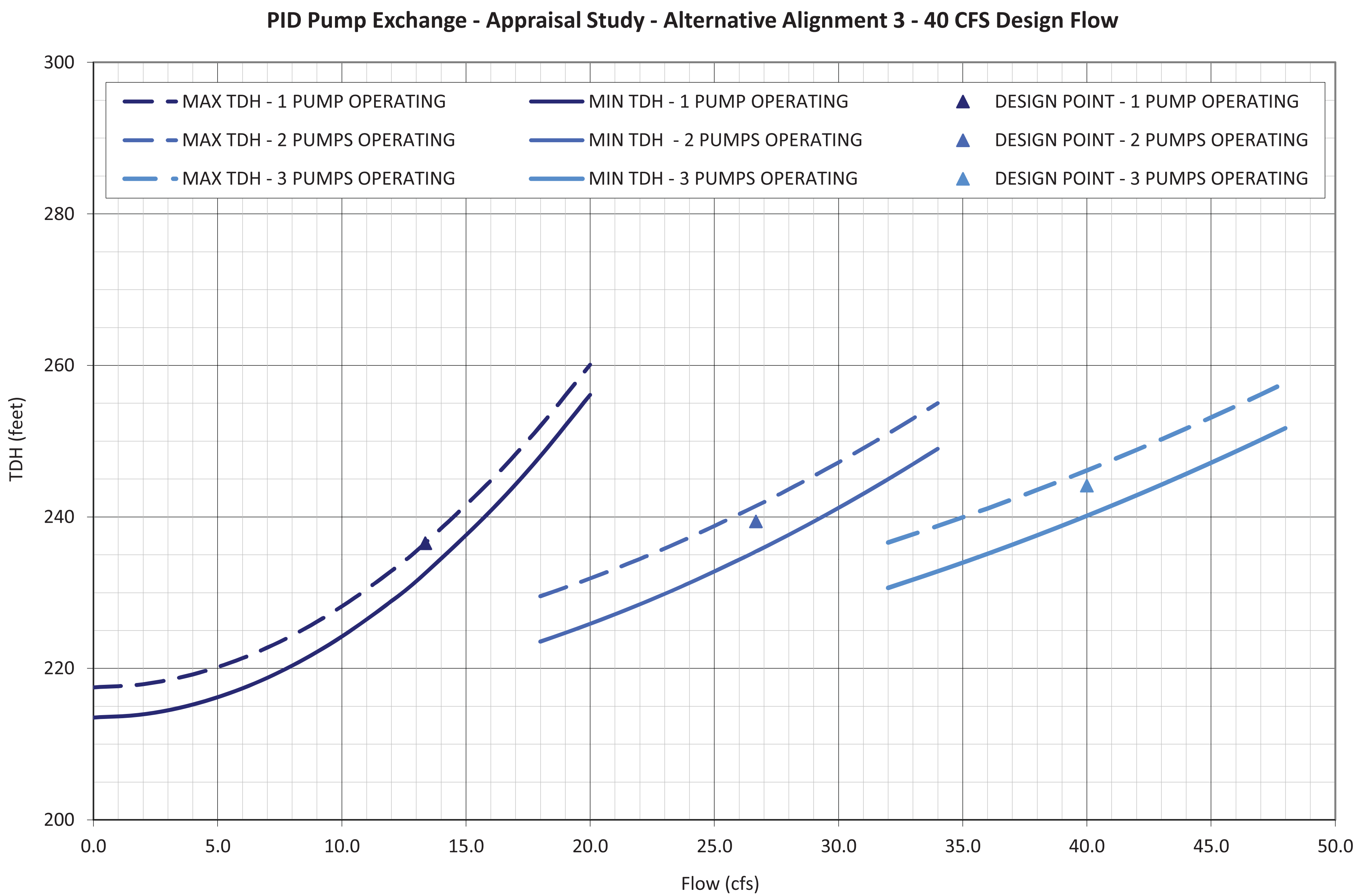
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1152.0 feet	Canal Bottom
HIGH	1154.5 feet	Canal (High Flow)
LWL	1152.5 feet	Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					18	18		36
O.D. (in)					18	18		36
I.D. (in)					18	18		36
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		1,490
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	5995	13.4	237	512.1
2	11970	26.7	239	1034.8
3	17952	40.0	244	1582.6
*Assumes	70%	Efficiency		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		18-inch	18-inch	-inch	36-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	213.5	219.5	217.5	213.5	219.5	217.5	213.5	219.5	217.5
898	2.0	1.13	1.13		0.28			0.0	0.0	0.4	0.0	0.1	0.0	0.0	0.0	213.9	219.9	217.9	213.6	219.6	217.6	213.6	219.6	217.6
1795	4.0	2.26	2.26		0.57			0.0	0.1	1.6	0.0	0.4	0.0	0.2	0.0	215.2	221.2	219.2	214.0	220.0	218.0	213.8	219.8	217.8
2693	6.0	3.39	3.39		0.85			0.1	0.1	3.6	0.1	0.9	0.0	0.4	0.0	217.4	223.4	221.4	214.6	220.6	218.6	214.1	220.1	218.1
3590	8.0	4.53	4.53		1.13			0.2	0.2	6.4	0.1	1.6	0.0	0.7	0.0	220.4	226.4	224.4	215.5	221.5	219.5	214.6	220.6	218.6
4488	10.0	5.66	5.66		1.41			0.3	0.3	9.9	0.2	2.5	0.0	1.1	0.0	224.2	230.2	228.2	216.6	222.6	220.6	215.2	221.2	219.2
5386	12.0	6.79	6.79		1.70			0.4	0.4	14.3	0.2	3.6	0.1	1.6	0.0	228.9	234.9	232.9	218.0	224.0	222.0	216.0	222.0	220.0
5995	**13.4**	**7.56**	**7.56**		**1.89**			**0.6**	**0.5**	**17.7**	**0.3**	**4.4**	**0.1**	**2.0**	**0.0**	**232.5**	**238.5**	**236.5**	**219.1**	**225.1**	**223.1**	**216.6**	**222.6**	**220.6**
7181	16.0	9.05	9.05		2.26			0.8	0.7	25.5	0.4	6.4	0.1	2.8	0.0	240.8	246.8	244.8	221.4	227.4	225.4	217.9	223.9	221.9
8078	18.0	10.18	10.18		2.55			1.0	0.9	32.2	0.5	8.1	0.1	3.6	0.1	248.0	254.0	252.0	223.5	229.5	227.5	219.0	225.0	223.0
8976	20.0	11.32	11.32		2.83			1.2	1.0	39.8	0.6	9.9	0.2	4.4	0.1	256.1	262.1	260.1	225.9	231.9	229.9	220.3	226.3	224.3
9874	22.0	12.45	12.45		3.11			1.5	1.2	48.1	0.7	12.0	0.2	5.3	0.1	265.0	271.0	269.0	228.5	234.5	232.5	221.7	227.7	225.7
10771	24.0	13.58	13.58		3.39			1.8	1.5	57.3	0.8	14.3	0.2	6.4	0.1	274.8	280.8	278.8	231.3	237.3	235.3	223.2	229.2	227.2
11970	**26.7**	**15.09**	**15.09**		**3.77**			**2.2**	**1.8**	**70.7**	**0.9**	**17.7**	**0.3**	**7.9**	**0.1**	**289.1**	**295.1**	**293.1**	**235.4**	**241.4**	**239.4**	**225.5**	**231.5**	**229.5**
12566	28.0	15.84	15.84		3.96			2.4	1.9	77.9	1.0	19.5	0.3	8.7	0.1	296.8	302.8	300.8	237.6	243.6	241.6	226.7	232.7	230.7
13464	30.0	16.97	16.97		4.24			2.8	2.2	89.5	1.2	22.4	0.3	9.9	0.2	309.1	315.1	313.1	241.2	247.2	245.2	228.6	234.6	232.6
14362	32.0	18.11	18.11		4.53			3.2	2.5	101.8	1.3	25.5	0.4	11.3	0.2	322.3	328.3	326.3	245.0	251.0	249.0	230.6	236.6	234.6
15259	34.0	19.24	19.24		4.81			3.6	2.8	114.9	1.5	28.7	0.4	12.8	0.2	336.3	342.3	340.3	249.0	255.0	253.0	232.8	238.8	236.8
16157	36.0	20.37	20.37		5.09			4.0	3.1	128.9	1.6	32.2	0.5	14.3	0.2	351.1	357.1	355.1	253.3	259.3	257.3	235.1	241.1	239.1
17054	38.0	21.50	21.50		5.38			4.5	3.4	143.6	1.8	35.9	0.5	16.0	0.2	366.8	372.8	370.8	257.8	263.8	261.8	237.6	243.6	241.6
17952	**40.0**	**22.63**	**22.63**		**5.66**			**5.0**	**3.7**	**159.1**	**2.0**	**39.8**	**0.6**	**17.7**	**0.3**	**383.3**	**389.3**	**387.3**	**262.5**	**268.5**	**266.5**	**240.1**	**246.1**	**244.1**
18850	42.0	23.76	23.76		5.94			5.5	4.1	175.4	2.2	43.8	0.6	19.5	0.3	400.6	406.6	404.6	267.5	273.5	271.5	242.8	248.8	246.8
19747	44.0	24.90	24.90		6.22			6.0	4.5	192.5	2.4	48.1	0.7	21.4	0.3	418.8	424.8	422.8	272.7	278.7	276.7	245.7	251.7	249.7
20645	46.0	26.03	26.03		6.51			6.6	4.8	210.4	2.6	52.6	0.7	23.4	0.3	437.9	443.9	441.9	278.2	284.2	282.2	248.6	254.6	252.6
21542	48.0	27.16	27.16		6.79			7.2	5.2	229.1	2.8	57.3	0.8	25.5	0.4	457.8	463.8	461.8	283.9	289.9	287.9	251.7	257.7	255.7
22440	50.0	28.29	28.29		7.07			7.8	5.6	248.6	3.0	62.1	0.8	27.6	0.4	478.5	484.5	482.5	289.9	295.9	293.9	254.9	260.9	258.9
23338	52.0	29.42	29.42		7.36			8.4	6.1	268.8	3.2	67.2	0.9	29.9	0.4	500.0	506.0	504.0	296.1	302.1	300.1	258.3	264.3	262.3
24235	54.0	30.55	30.55		7.64			9.1	6.5	289.9	3.5	72.5	1.0	32.2	0.5	522.5	528.5	526.5	302.5	308.5	306.5	261.7	267.7	265.7
25133	56.0	31.69	31.69		7.92			9.7	7.0	311.8	3.7	77.9	1.0	34.6	0.5	545.7	551.7	549.7	309.2	315.2	313.2	265.3	271.3	269.3
26030	58.0	32.82	32.82		8.20			10.5	7.4	334.5	4.0	83.6	1.1	37.2	0.5	569.8	575.8	573.8	316.1	322.1	320.1	269.1	275.1	273.1
26928	60.0	33.95	33.95		8.49			11.2	7.9	357.9	4.2	89.5	1.2	39.8	0.6	594.7	600.7	598.7	323.2	329.2	327.2	272.9	278.9	276.9


PID Pump Exchange - Appraisal Study - Alternative Alignment 3 - 40 CFS Design Flow
MAX TDH - 1 PUMP OPERATING
MIN TDH - 1 PUMP OPERATING
DESIGN POINT - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MIN TDH - 2 PUMPS OPERATING
DESIGN POINT - 2 PUMPS OPERATING
MAX TDH - 3 PUMPS OPERATING
MIN TDH - 3 PUMPS OPERATING
DESIGN POINT - 3 PUMPS OPERATING
TDH (feet)
300
280
260
240
220
200
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
Flow (cfs)

SYSTEM CURVE CALCULATION

PROJECT: **PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY**

ALTERNATIVE: **ALTERNATIVE ALIGNMENT 4 - 10 CFS DESIGN FLOW**

BY: David Rice, P.E.

DATE: 13-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	952.0 feet	Invert at Diversion
HWL	957.0 feet	Wet Well (High River)
LWL	953.0 feet	Wet Well (Low River)

DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1153.0 feet	Canal Bottom
HIGH	1155.5 feet	Canal (High Flow)
LWL	1153.5 feet	Canal (Low Flow)

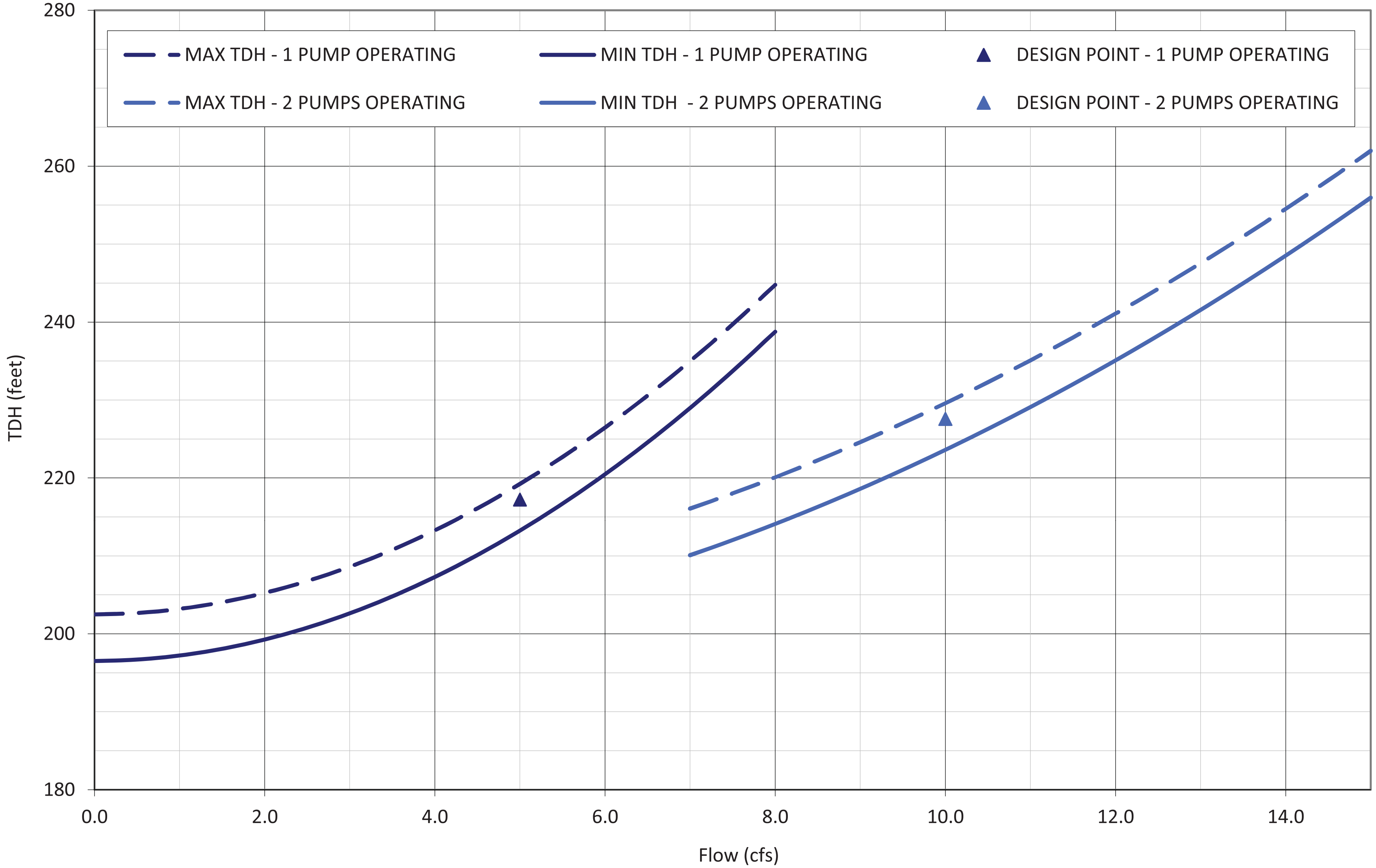
PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					12	12		20
O.D. (in)					12	12		20
I.D. (in)					12	12		20
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		3,240
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	2244	5.0	217	176.0
2	4488	10.0	228	368.8
*Assumes	70%	Efficiency		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		12-inch	12-inch	-inch	20-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0			196.5	202.5	200.5	196.5	202.5	200.5			
224	0.5	0.64	0.64		0.23			0.0	0.0	0.1	0.0	0.0	0.0			196.7	202.7	200.7	196.6	202.6	200.6			
449	1.0	1.27	1.27		0.46			0.0	0.2	0.5	0.0	0.1	0.0			197.2	203.2	201.2	196.8	202.8	200.8			
673	1.5	1.91	1.91		0.69			0.1	0.3	1.1	0.0	0.3	0.0			198.1	204.1	202.1	197.2	203.2	201.2			
898	2.0	2.55	2.55		0.92			0.1	0.6	2.0	0.1	0.5	0.0			199.3	205.3	203.3	197.7	203.7	201.7			
1122	2.5	3.18	3.18		1.15			0.2	0.8	3.1	0.1	0.8	0.0			200.8	206.8	204.8	198.4	204.4	202.4			
1346	3.0	3.82	3.82		1.37			0.3	1.2	4.5	0.1	1.1	0.0			202.6	208.6	206.6	199.1	205.1	203.1			
1571	3.5	4.46	4.46		1.60			0.4	1.6	6.2	0.2	1.5	0.0			204.8	210.8	208.8	200.1	206.1	204.1			
1795	4.0	5.09	5.09		1.83			0.5	2.0	8.1	0.2	2.0	0.1			207.3	213.3	211.3	201.1	207.1	205.1			
2020	4.5	5.73	5.73		2.06			0.7	2.5	10.2	0.3	2.5	0.1			210.1	216.1	214.1	202.3	208.3	206.3			
2244	**5.0**	**6.37**	**6.37**		**2.29**			**0.8**	**3.0**	**12.6**	**0.3**	**3.1**	**0.1**			**213.2**	**219.2**	**217.2**	**203.6**	**209.6**	**207.6**			
2468	5.5	7.00	7.00		2.52			1.0	3.6	15.2	0.4	3.8	0.1			216.7	222.7	220.7	205.0	211.0	209.0			
2693	6.0	7.64	7.64		2.75			1.2	4.2	18.1	0.4	4.5	0.1			220.5	226.5	224.5	206.6	212.6	210.6			
2917	6.5	8.27	8.27		2.98			1.4	4.9	21.3	0.5	5.3	0.1			224.6	230.6	228.6	208.3	214.3	212.3			
3142	7.0	8.91	8.91		3.21			1.6	5.7	24.7	0.6	6.2	0.2			229.0	235.0	233.0	210.1	216.1	214.1			
3366	7.5	9.55	9.55		3.44			1.8	6.4	28.3	0.6	7.1	0.2			233.7	239.7	237.7	212.0	218.0	216.0			
3590	8.0	10.18	10.18		3.67			2.1	7.2	32.2	0.7	8.1	0.2			238.8	244.8	242.8	214.1	220.1	218.1			
3815	8.5	10.82	10.82		3.90			2.4	8.1	36.4	0.8	9.1	0.2			244.1	250.1	248.1	216.3	222.3	220.3			
4039	9.0	11.46	11.46		4.12			2.6	9.0	40.8	0.9	10.2	0.3			249.8	255.8	253.8	218.6	224.6	222.6			
4264	9.5	12.09	12.09		4.35			2.9	9.9	45.4	1.0	11.4	0.3			255.8	261.8	259.8	221.0	227.0	225.0			
4488	**10.0**	**12.73**	**12.73**		**4.58**			**3.3**	**10.9**	**50.3**	**1.1**	**12.6**	**0.3**			**262.1**	**268.1**	**266.1**	**223.6**	**229.6**	**227.6**			
4712	10.5	13.37	13.37		4.81			3.6	12.0	55.5	1.2	13.9	0.3			268.8	274.8	272.8	226.3	232.3	230.3			
4937	11.0	14.00	14.00		5.04			3.9	13.0	60.9	1.3	15.2	0.4			275.7	281.7	279.7	229.1	235.1	233.1			
5161	11.5	14.64	14.64		5.27			4.3	14.2	66.6	1.4	16.6	0.4			283.0	289.0	287.0	232.0	238.0	236.0			
5386	12.0	15.28	15.28		5.50			4.7	15.3	72.5	1.5	18.1	0.4			290.5	296.5	294.5	235.1	241.1	239.1			
5610	12.5	15.91	15.91		5.73			5.1	16.5	78.6	1.7	19.7	0.5			298.4	304.4	302.4	238.2	244.2	242.2			
5834	13.0	16.55	16.55		5.96			5.5	17.8	85.1	1.8	21.3	0.5			306.6	312.6	310.6	241.5	247.5	245.5			
6059	13.5	17.19	17.19		6.19			5.9	19.0	91.7	1.9	22.9	0.5			315.2	321.2	319.2	245.0	251.0	249.0			
6283	14.0	17.82	17.82		6.42			6.4	20.4	98.7	2.1	24.7	0.6			324.0	330.0	328.0	248.5	254.5	252.5			
6508	14.5	18.46	18.46		6.65			6.9	21.7	105.8	2.2	26.5	0.6			333.1	339.1	337.1	252.2	258.2	256.2			
6732	15.0	19.10	19.10		6.87			7.3	23.1	113.2	2.3	28.3	0.6			342.6	348.6	346.6	255.9	261.9	259.9			

PID Pump Exchange - Appraisal Study - Alternative Alignment 4 - 10 CFS Design Flow



SYSTEM CURVE CALCULATION
PROJECT: **PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY**
ALTERNATIVE: **ALTERNATIVE ALIGNMENT 4 - 20 CFS DESIGN FLOW**

BY: David Rice, P.E.
DATE: 13-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	952.0 feet	Invert at Diversion
HWL	957.0 feet	Wet Well (High River)
LWL	953.0 feet	Wet Well (Low River)

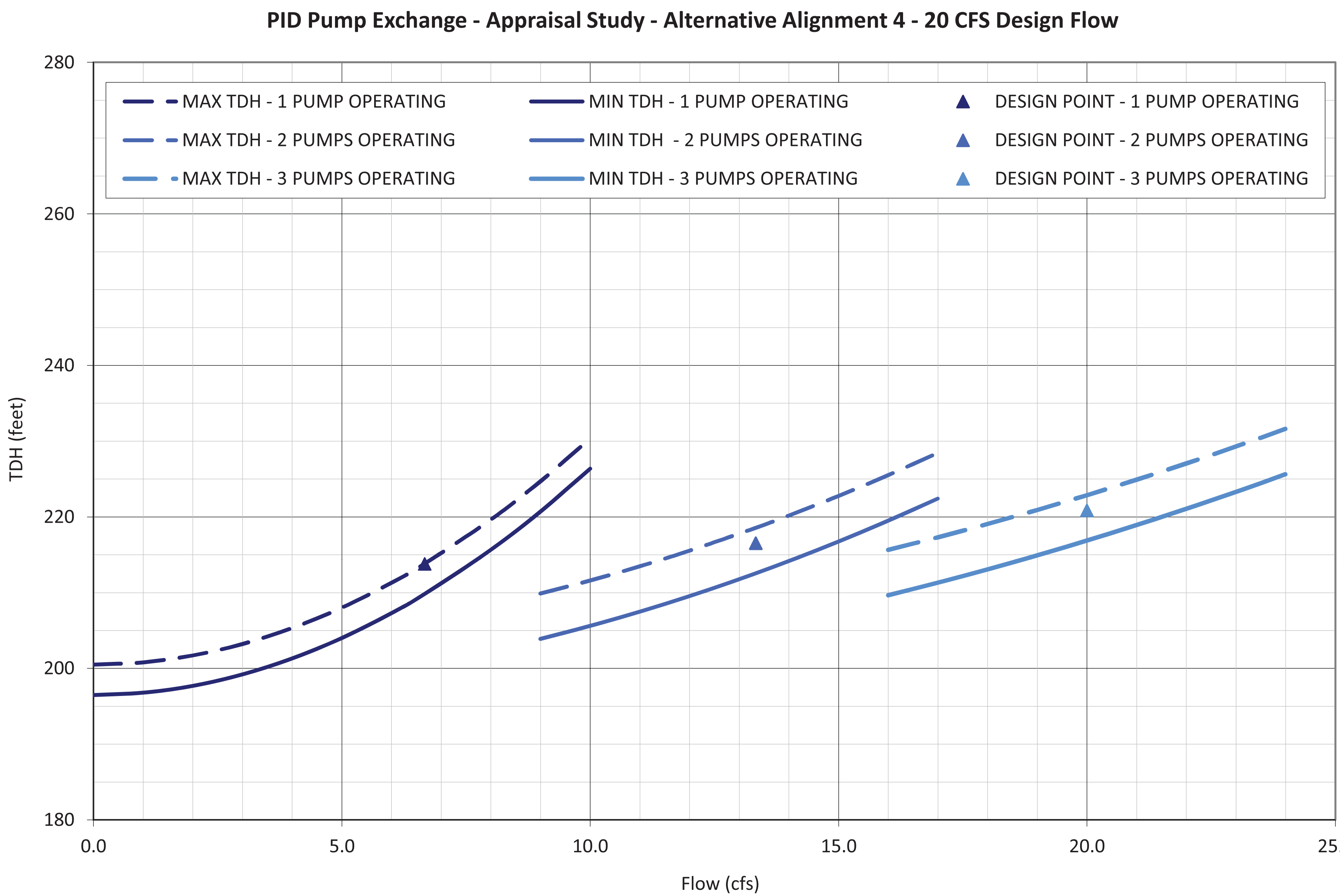
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1153.0 feet	Canal Bottom
HIGH	1155.5 feet	Canal (High Flow)
LWL	1153.5 feet	Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					14	14		30
O.D. (in)					14	14		30
I.D. (in)					14	14		30
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		3,240
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	2992	6.7	214	231.0
2	5984	13.3	217	467.9
3	8976	20.0	221	715.9
**Assumes*	*70%*	*Efficiency*		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		14-inch	14-inch	-inch	30-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	196.5	202.5	200.5	196.5	202.5	200.5	196.5	202.5	200.5
449	1.0	0.94	0.94		0.20			0.0	0.0	0.3	0.0	0.1	0.0	0.0	0.0	196.8	202.8	200.8	196.6	202.6	200.6	196.6	202.6	200.6
898	2.0	1.87	1.87		0.41			0.0	0.1	1.1	0.0	0.3	0.0	0.1	0.0	197.7	203.7	201.7	196.9	202.9	200.9	196.7	202.7	200.7
1346	3.0	2.81	2.81		0.61			0.1	0.2	2.4	0.1	0.6	0.0	0.3	0.0	199.2	205.2	203.2	197.3	203.3	201.3	197.0	203.0	201.0
1795	4.0	3.74	3.74		0.81			0.1	0.3	4.3	0.1	1.1	0.0	0.5	0.0	201.3	207.3	205.3	198.0	204.0	202.0	197.4	203.4	201.4
2244	5.0	4.68	4.68		1.02			0.2	0.4	6.8	0.1	1.7	0.0	0.8	0.0	204.0	210.0	208.0	198.8	204.8	202.8	197.9	203.9	201.9
2693	6.0	5.61	5.61		1.22			0.2	0.6	9.8	0.2	2.4	0.1	1.1	0.0	207.3	213.3	211.3	199.8	205.8	203.8	198.4	204.4	202.4
2992	**6.7**	**6.24**	**6.24**		**1.36**			**0.3**	**0.7**	**12.1**	**0.2**	**3.0**	**0.1**	**1.3**	**0.0**	**209.8**	**215.8**	**213.8**	**200.6**	**206.6**	**204.6**	**198.9**	**204.9**	**202.9**
3590	8.0	7.48	7.48		1.63			0.4	1.0	17.4	0.3	4.3	0.1	1.9	0.0	215.6	221.6	219.6	202.4	208.4	206.4	199.9	205.9	203.9
4039	9.0	8.42	8.42		1.83			0.5	1.2	22.0	0.4	5.5	0.1	2.4	0.1	220.7	226.7	224.7	203.9	209.9	207.9	200.8	206.8	204.8
4488	10.0	9.35	9.35		2.04			0.6	1.5	27.2	0.5	6.8	0.1	3.0	0.1	226.4	232.4	230.4	205.6	211.6	209.6	201.7	207.7	205.7
4937	11.0	10.29	10.29		2.24			0.8	1.8	32.9	0.6	8.2	0.2	3.7	0.1	232.6	238.6	236.6	207.5	213.5	211.5	202.8	208.8	206.8
5386	12.0	11.22	11.22		2.44			0.9	2.1	39.1	0.7	9.8	0.2	4.3	0.1	239.4	245.4	243.4	209.5	215.5	213.5	204.0	210.0	208.0
5984	**13.3**	**12.47**	**12.47**		**2.72**			**1.1**	**2.6**	**48.3**	**0.9**	**12.1**	**0.2**	**5.4**	**0.1**	**249.4**	**255.4**	**253.4**	**212.6**	**218.6**	**216.6**	**205.7**	**211.7**	**209.7**
6283	14.0	13.09	13.09		2.85			1.3	2.8	53.2	1.0	13.3	0.3	5.9	0.1	254.8	260.8	258.8	214.2	220.2	218.2	206.6	212.6	210.6
6732	15.0	14.03	14.03		3.06			1.4	3.2	61.1	1.1	15.3	0.3	6.8	0.1	263.4	269.4	267.4	216.8	222.8	220.8	208.1	214.1	212.1
7181	16.0	14.97	14.97		3.26			1.6	3.6	69.6	1.2	17.4	0.3	7.7	0.2	272.6	278.6	276.6	219.5	225.5	223.5	209.7	215.7	213.7
7630	17.0	15.90	15.90		3.46			1.9	4.1	78.5	1.4	19.6	0.4	8.7	0.2	282.3	288.3	286.3	222.4	228.4	226.4	211.3	217.3	215.3
8078	18.0	16.84	16.84		3.67			2.1	4.5	88.0	1.5	22.0	0.4	9.8	0.2	292.7	298.7	296.7	225.5	231.5	229.5	213.1	219.1	217.1
8527	19.0	17.77	17.77		3.87			2.3	5.0	98.1	1.7	24.5	0.5	10.9	0.2	303.6	309.6	307.6	228.8	234.8	232.8	214.9	220.9	218.9
8976	**20.0**	**18.71**	**18.71**		**4.07**			**2.6**	**5.5**	**108.7**	**1.9**	**27.2**	**0.5**	**12.1**	**0.2**	**315.1**	**321.1**	**319.1**	**232.2**	**238.2**	**236.2**	**216.9**	**222.9**	**220.9**
9425	21.0	19.64	19.64		4.28			2.8	6.0	119.8	2.1	30.0	0.6	13.3	0.3	327.2	333.2	331.2	235.9	241.9	239.9	218.9	224.9	222.9
9874	22.0	20.58	20.58		4.48			3.1	6.5	131.5	2.2	32.9	0.6	14.6	0.3	339.9	345.9	343.9	239.6	245.6	243.6	221.0	227.0	225.0
10322	23.0	21.51	21.51		4.68			3.4	7.1	143.7	2.4	35.9	0.7	16.0	0.3	353.2	359.2	357.2	243.6	249.6	247.6	223.3	229.3	227.3
10771	24.0	22.45	22.45		4.89			3.7	7.7	156.5	2.6	39.1	0.7	17.4	0.3	367.0	373.0	371.0	247.7	253.7	251.7	225.6	231.6	229.6
11220	25.0	23.38	23.38		5.09			4.0	8.3	169.8	2.8	42.5	0.8	18.9	0.4	381.4	387.4	385.4	252.0	258.0	256.0	228.0	234.0	232.0
11669	26.0	24.32	24.32		5.30			4.4	8.9	183.7	3.1	45.9	0.8	20.4	0.4	396.5	402.5	400.5	256.5	262.5	260.5	230.6	236.6	234.6
12118	27.0	25.25	25.25		5.50			4.7	9.5	198.1	3.3	49.5	0.9	22.0	0.4	412.1	418.1	416.1	261.2	267.2	265.2	233.2	239.2	237.2
12566	28.0	26.19	26.19		5.70			5.1	10.2	213.0	3.5	53.2	1.0	23.7	0.5	428.3	434.3	432.3	266.0	272.0	270.0	235.9	241.9	239.9
13015	29.0	27.12	27.12		5.91			5.4	10.9	228.5	3.7	57.1	1.0	25.4	0.5	445.0	451.0	449.0	271.0	277.0	275.0	238.7	244.7	242.7
13464	30.0	28.06	28.06		6.11			5.8	11.6	244.5	4.0	61.1	1.1	27.2	0.5	462.4	468.4	466.4	276.1	282.1	280.1	241.6	247.6	245.6



PID Pump Exchange - Appraisal Study - Alternative Alignment 4 - 20 CFS Design Flow
MAX TDH - 1 PUMP OPERATING
MIN TDH - 1 PUMP OPERATING
DESIGN POINT - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MIN TDH - 2 PUMPS OPERATING
DESIGN POINT - 2 PUMPS OPERATING
MAX TDH - 3 PUMPS OPERATING
MIN TDH - 3 PUMPS OPERATING
DESIGN POINT - 3 PUMPS OPERATING
TDH (feet)
280
260
240
220
200
180
0.0
5.0
10.0
15.0
20.0
25.0
Flow (cfs)

SYSTEM CURVE CALCULATION
PROJECT: PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY
ALTERNATIVE: ALTERNATIVE ALIGNMENT 4 - 40 CFS DESIGN FLOW

BY: David Rice, P.E.
DATE: 13-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	952.0 feet	Invert at Diversion
HWL	957.0 feet	Wet Well (High River)
LWL	953.0 feet	Wet Well (Low River)

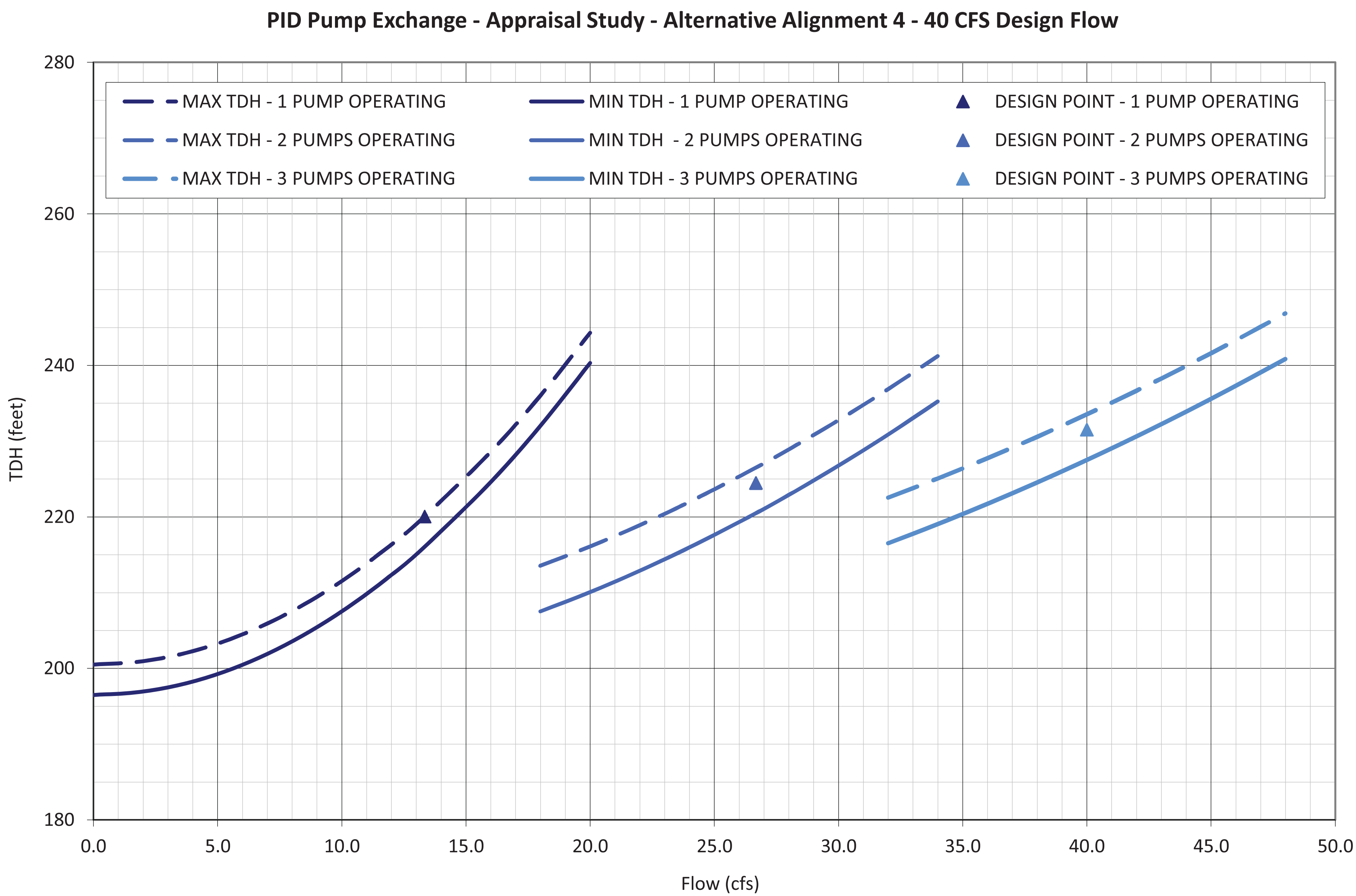
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1153.0 feet	Canal Bottom
HIGH	1155.5 feet	Canal (High Flow)
LWL	1153.5 feet	Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					18	18		36
O.D. (in)					18	18		36
I.D. (in)					18	18		36
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		3,240
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	5985	13.3	220	475.6
2	11970	26.7	224	970.3
3	17952	40.0	232	1500.8
**Assumes*	*70%*	*Efficiency*		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		18-inch	18-inch	-inch	36-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	196.5	202.5	200.5	196.5	202.5	200.5	196.5	202.5	200.5
898	2.0	1.13	1.13		0.28			0.0	0.0	0.4	0.0	0.1	0.0	0.0	0.0	196.9	202.9	200.9	196.6	202.6	200.6	196.6	202.6	200.6
1795	4.0	2.26	2.26		0.57			0.0	0.1	1.6	0.0	0.4	0.0	0.2	0.0	198.3	204.3	202.3	197.1	203.1	201.1	196.8	202.8	200.8
2693	6.0	3.39	3.39		0.85			0.1	0.2	3.6	0.1	0.9	0.0	0.4	0.0	200.5	206.5	204.5	197.8	203.8	201.8	197.3	203.3	201.3
3590	8.0	4.53	4.53		1.13			0.2	0.4	6.4	0.1	1.6	0.0	0.7	0.0	203.6	209.6	207.6	198.7	204.7	202.7	197.8	203.8	201.8
4488	10.0	5.66	5.66		1.41			0.3	0.6	9.9	0.2	2.5	0.0	1.1	0.0	207.5	213.5	211.5	200.0	206.0	204.0	198.6	204.6	202.6
5386	12.0	6.79	6.79		1.70			0.4	0.9	14.3	0.2	3.6	0.1	1.6	0.0	212.4	218.4	216.4	201.5	207.5	205.5	199.4	205.4	203.4
5985	**13.3**	**7.55**	**7.55**		**1.89**			**0.6**	**1.1**	**17.7**	**0.3**	**4.4**	**0.1**	**2.0**	**0.0**	**216.1**	**222.1**	**220.1**	**202.6**	**208.6**	**206.6**	**200.1**	**206.1**	**204.1**
7181	16.0	9.05	9.05		2.26			0.8	1.5	25.5	0.4	6.4	0.1	2.8	0.0	224.6	230.6	228.6	205.2	211.2	209.2	201.7	207.7	205.7
8078	18.0	10.18	10.18		2.55			1.0	1.9	32.2	0.5	8.1	0.1	3.6	0.1	232.0	238.0	236.0	207.5	213.5	211.5	203.0	209.0	207.0
8976	20.0	11.32	11.32		2.83			1.2	2.3	39.8	0.6	9.9	0.2	4.4	0.1	240.3	246.3	244.3	210.1	216.1	214.1	204.5	210.5	208.5
9874	22.0	12.45	12.45		3.11			1.5	2.7	48.1	0.7	12.0	0.2	5.3	0.1	249.5	255.5	253.5	212.9	218.9	216.9	206.1	212.1	210.1
10771	24.0	13.58	13.58		3.39			1.8	3.2	57.3	0.8	14.3	0.2	6.4	0.1	259.5	265.5	263.5	216.0	222.0	220.0	207.9	213.9	211.9
11970	**26.7**	**15.09**	**15.09**		**3.77**			**2.2**	**3.8**	**70.7**	**0.9**	**17.7**	**0.3**	**7.9**	**0.1**	**274.2**	**280.2**	**278.2**	**220.5**	**226.5**	**224.5**	**210.5**	**216.5**	**214.5**
12566	28.0	15.84	15.84		3.96			2.4	4.2	77.9	1.0	19.5	0.3	8.7	0.1	282.1	288.1	286.1	222.9	228.9	226.9	211.9	217.9	215.9
13464	30.0	16.97	16.97		4.24			2.8	4.8	89.5	1.2	22.4	0.3	9.9	0.2	294.7	300.7	298.7	226.8	232.8	230.8	214.2	220.2	218.2
14362	32.0	18.11	18.11		4.53			3.2	5.4	101.8	1.3	25.5	0.4	11.3	0.2	308.2	314.2	312.2	230.9	236.9	234.9	216.5	222.5	220.5
15259	34.0	19.24	19.24		4.81			3.6	6.0	114.9	1.5	28.7	0.4	12.8	0.2	322.5	328.5	326.5	235.2	241.2	239.2	219.1	225.1	223.1
16157	36.0	20.37	20.37		5.09			4.0	6.7	128.9	1.6	32.2	0.5	14.3	0.2	337.7	343.7	341.7	239.9	245.9	243.9	221.7	227.7	225.7
17054	38.0	21.50	21.50		5.38			4.5	7.4	143.6	1.8	35.9	0.5	16.0	0.2	353.7	359.7	357.7	244.8	250.8	248.8	224.6	230.6	228.6
17952	**40.0**	**22.63**	**22.63**		**5.66**			**5.0**	**8.1**	**159.1**	**2.0**	**39.8**	**0.6**	**17.7**	**0.3**	**370.7**	**376.7**	**374.7**	**249.9**	**255.9**	**253.9**	**227.5**	**233.5**	**231.5**
18850	42.0	23.76	23.76		5.94			5.5	8.9	175.4	2.2	43.8	0.6	19.5	0.3	388.4	394.4	392.4	255.3	261.3	259.3	230.6	236.6	234.6
19747	44.0	24.90	24.90		6.22			6.0	9.7	192.5	2.4	48.1	0.7	21.4	0.3	407.1	413.1	411.1	261.0	267.0	265.0	233.9	239.9	237.9
20645	46.0	26.03	26.03		6.51			6.6	10.5	210.4	2.6	52.6	0.7	23.4	0.3	426.5	432.5	430.5	266.9	272.9	270.9	237.3	243.3	241.3
21542	48.0	27.16	27.16		6.79			7.2	11.4	229.1	2.8	57.3	0.8	25.5	0.4	446.9	452.9	450.9	273.1	279.1	277.1	240.8	246.8	244.8
22440	50.0	28.29	28.29		7.07			7.8	12.3	248.6	3.0	62.1	0.8	27.6	0.4	468.1	474.1	472.1	279.5	285.5	283.5	244.5	250.5	248.5
23338	52.0	29.42	29.42		7.36			8.4	13.2	268.8	3.2	67.2	0.9	29.9	0.4	490.2	496.2	494.2	286.2	292.2	290.2	248.4	254.4	252.4
24235	54.0	30.55	30.55		7.64			9.1	14.1	289.9	3.5	72.5	1.0	32.2	0.5	513.1	519.1	517.1	293.1	299.1	297.1	252.4	258.4	256.4
25133	56.0	31.69	31.69		7.92			9.7	15.1	311.8	3.7	77.9	1.0	34.6	0.5	536.9	542.9	540.9	300.3	306.3	304.3	256.5	262.5	260.5
26030	58.0	32.82	32.82		8.20			10.5	16.1	334.5	4.0	83.6	1.1	37.2	0.5	561.5	567.5	565.5	307.8	313.8	311.8	260.8	266.8	264.8
26928	60.0	33.95	33.95		8.49			11.2	17.2	357.9	4.2	89.5	1.2	39.8	0.6	587.0	593.0	591.0	315.5	321.5	319.5	265.2	271.2	269.2


PID Pump Exchange - Appraisal Study - Alternative Alignment 4 - 40 CFS Design Flow
MAX TDH - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MAX TDH - 3 PUMPS OPERATING
MIN TDH - 1 PUMP OPERATING
MIN TDH - 2 PUMPS OPERATING
MIN TDH - 3 PUMPS OPERATING
DESIGN POINT - 1 PUMP OPERATING
DESIGN POINT - 2 PUMPS OPERATING
DESIGN POINT - 3 PUMPS OPERATING
TDH (feet)
280
260
240
220
200
180
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
Flow (cfs)

SYSTEM CURVE CALCULATION

PROJECT: **PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY**

ALTERNATIVE: **ALTERNATIVE ALIGNMENT 5 - 10 CFS DESIGN FLOW**

BY: David Rice, P.E.

DATE: 13-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	971.0 feet	Invert at Diversion
HWL	976.0 feet	Wet Well (High River)
LWL	972.0 feet	Wet Well (Low River)

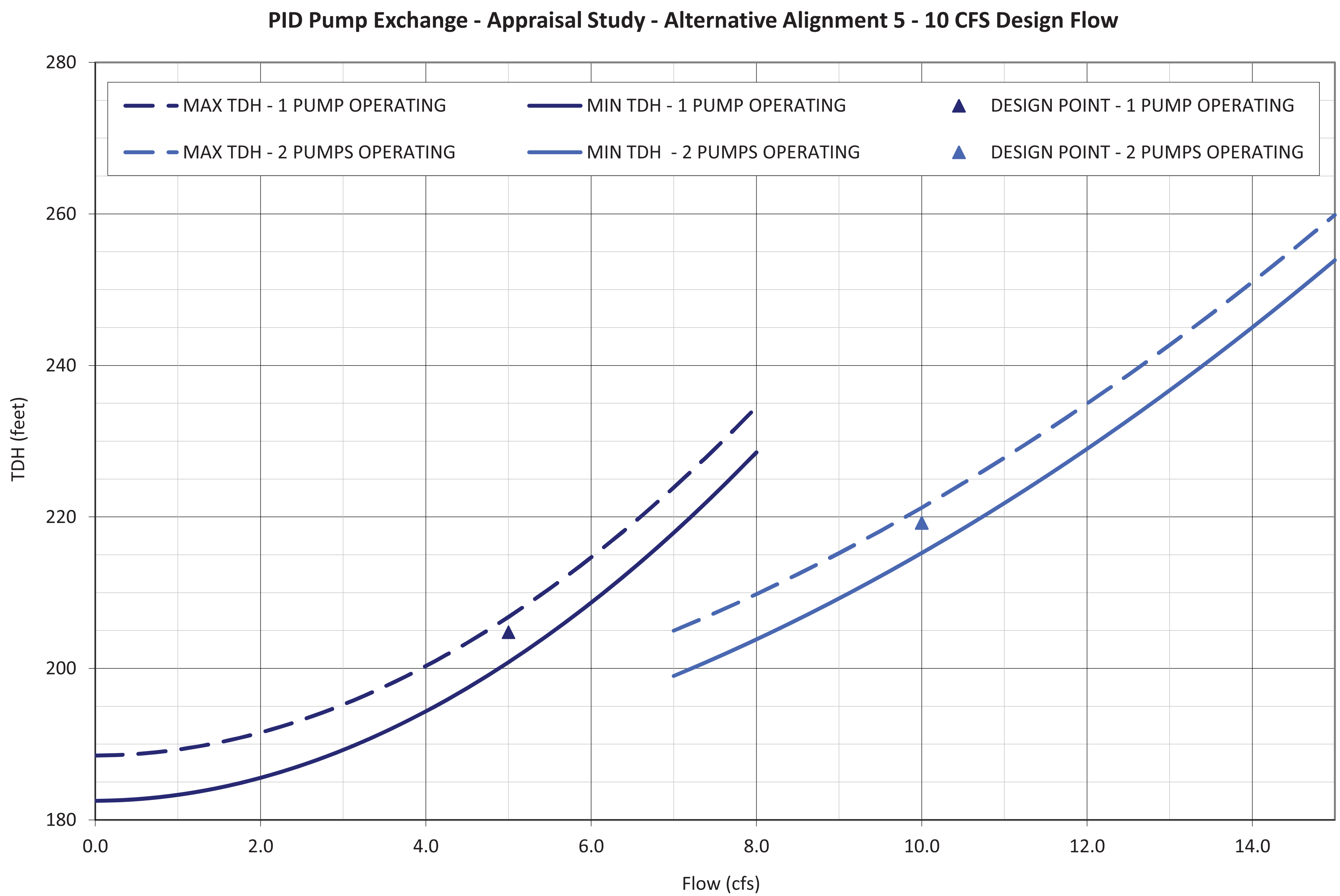
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1158.0 feet	Canal Bottom
HIGH	1160.5 feet	Canal (High Flow)
LWL	1158.5 feet	Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					12	12		20
O.D. (in)					12	12		20
I.D. (in)					12	12		20
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		4,910
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	2244	5.0	205	165.9
2	4488	10.0	219	355.3
*Assumes	70%	Efficiency		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		12-inch	12-inch	-inch	20-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0			182.5	188.5	186.5	182.5	188.5	186.5			
224	0.5	0.64	0.64		0.23			0.0	0.1	0.1	0.0	0.0	0.0			182.7	188.7	186.7	182.6	188.6	186.6			
449	1.0	1.27	1.27		0.46			0.0	0.2	0.5	0.0	0.1	0.0			183.3	189.3	187.3	182.9	188.9	186.9			
673	1.5	1.91	1.91		0.69			0.1	0.5	1.1	0.0	0.3	0.0			184.2	190.2	188.2	183.4	189.4	187.4			
898	2.0	2.55	2.55		0.92			0.1	0.8	2.0	0.1	0.5	0.0			185.5	191.5	189.5	184.0	190.0	188.0			
1122	2.5	3.18	3.18		1.15			0.2	1.3	3.1	0.1	0.8	0.0			187.2	193.2	191.2	184.8	190.8	188.8			
1346	3.0	3.82	3.82		1.37			0.3	1.8	4.5	0.1	1.1	0.0			189.2	195.2	193.2	185.7	191.7	189.7			
1571	3.5	4.46	4.46		1.60			0.4	2.4	6.2	0.2	1.5	0.0			191.6	197.6	195.6	186.9	192.9	190.9			
1795	4.0	5.09	5.09		1.83			0.5	3.0	8.1	0.2	2.0	0.1			194.3	200.3	198.3	188.1	194.1	192.1			
2020	4.5	5.73	5.73		2.06			0.7	3.8	10.2	0.3	2.5	0.1			197.4	203.4	201.4	189.6	195.6	193.6			
2244	**5.0**	**6.37**	**6.37**		**2.29**			**0.8**	**4.6**	**12.6**	**0.3**	**3.1**	**0.1**			**200.8**	**206.8**	**204.8**	**191.1**	**197.1**	**195.1**			
2468	5.5	7.00	7.00		2.52			1.0	5.5	15.2	0.4	3.8	0.1			204.6	210.6	208.6	192.9	198.9	196.9			
2693	6.0	7.64	7.64		2.75			1.2	6.4	18.1	0.4	4.5	0.1			208.7	214.7	212.7	194.8	200.8	198.8			
2917	6.5	8.27	8.27		2.98			1.4	7.5	21.3	0.5	5.3	0.1			213.1	219.1	217.1	196.8	202.8	200.8			
3142	7.0	8.91	8.91		3.21			1.6	8.6	24.7	0.6	6.2	0.2			217.9	223.9	221.9	199.0	205.0	203.0			
3366	7.5	9.55	9.55		3.44			1.8	9.7	28.3	0.6	7.1	0.2			223.0	229.0	227.0	201.3	207.3	205.3			
3590	8.0	10.18	10.18		3.67			2.1	11.0	32.2	0.7	8.1	0.2			228.5	234.5	232.5	203.8	209.8	207.8			
3815	8.5	10.82	10.82		3.90			2.4	12.3	36.4	0.8	9.1	0.2			234.3	240.3	238.3	206.4	212.4	210.4			
4039	9.0	11.46	11.46		4.12			2.6	13.6	40.8	0.9	10.2	0.3			240.5	246.5	244.5	209.2	215.2	213.2			
4264	9.5	12.09	12.09		4.35			2.9	15.1	45.4	1.0	11.4	0.3			246.9	252.9	250.9	212.1	218.1	216.1			
4488	**10.0**	**12.73**	**12.73**		**4.58**			**3.3**	**16.6**	**50.3**	**1.1**	**12.6**	**0.3**			**253.8**	**259.8**	**257.8**	**215.2**	**221.2**	**219.2**			
4712	10.5	13.37	13.37		4.81			3.6	18.1	55.5	1.2	13.9	0.3			260.9	266.9	264.9	218.4	224.4	222.4			
4937	11.0	14.00	14.00		5.04			3.9	19.8	60.9	1.3	15.2	0.4			268.4	274.4	272.4	221.8	227.8	225.8			
5161	11.5	14.64	14.64		5.27			4.3	21.5	66.6	1.4	16.6	0.4			276.3	282.3	280.3	225.3	231.3	229.3			
5386	12.0	15.28	15.28		5.50			4.7	23.2	72.5	1.5	18.1	0.4			284.4	290.4	288.4	229.0	235.0	233.0			
5610	12.5	15.91	15.91		5.73			5.1	25.0	78.6	1.7	19.7	0.5			292.9	298.9	296.9	232.8	238.8	236.8			
5834	13.0	16.55	16.55		5.96			5.5	26.9	85.1	1.8	21.3	0.5			301.8	307.8	305.8	236.7	242.7	240.7			
6059	13.5	17.19	17.19		6.19			5.9	28.9	91.7	1.9	22.9	0.5			311.0	317.0	315.0	240.8	246.8	244.8			
6283	14.0	17.82	17.82		6.42			6.4	30.9	98.7	2.1	24.7	0.6			320.5	326.5	324.5	245.0	251.0	249.0			
6508	14.5	18.46	18.46		6.65			6.9	32.9	105.8	2.2	26.5	0.6			330.3	336.3	334.3	249.4	255.4	253.4			
6732	15.0	19.10	19.10		6.87			7.3	35.1	113.2	2.3	28.3	0.6			340.5	346.5	344.5	253.9	259.9	257.9			


PID Pump Exchange - Appraisal Study - Alternative Alignment 5 - 10 CFS Design Flow
MAX TDH - 1 PUMP OPERATING
MIN TDH - 1 PUMP OPERATING
DESIGN POINT - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MIN TDH - 2 PUMPS OPERATING
DESIGN POINT - 2 PUMPS OPERATING
TDH (feet)
280
260
240
220
200
180
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
Flow (cfs)

SYSTEM CURVE CALCULATION

PROJECT: **PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY**

ALTERNATIVE: **ALTERNATIVE ALIGNMENT 5 - 20 CFS DESIGN FLOW**

BY: David Rice, P.E.

DATE: 13-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	971.0 feet	Invert at Diversion
HWL	976.0 feet	Wet Well (High River)
LWL	972.0 feet	Wet Well (Low River)

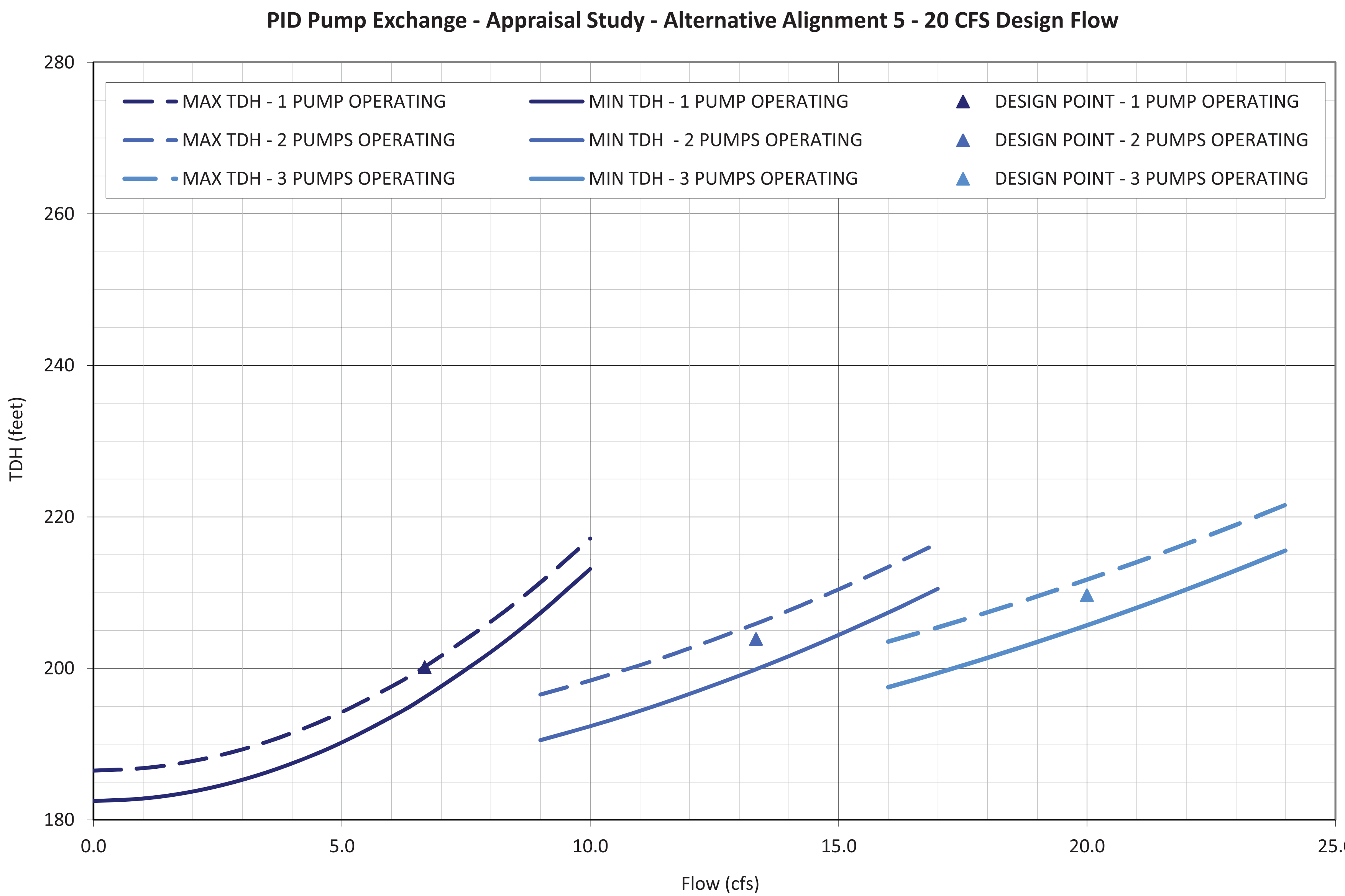
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1158.0 feet	Canal Bottom
HIGH	1160.5 feet	Canal (High Flow)
LWL	1158.5 feet	Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					14	14		30
O.D. (in)					14	14		30
I.D. (in)					14	14		30
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		4,910
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	2992	6.7	200	216.3
2	5985	13.3	204	440.6
3	8976	20.0	210	679.6
Assumes	*70%*	*Efficiency*		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		14-inch	14-inch	-inch	30-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	182.5	188.5	186.5	182.5	188.5	186.5	182.5	188.5	186.5
449	1.0	0.94	0.94		0.20			0.0	0.0	0.3	0.0	0.1	0.0	0.0	0.0	182.8	188.8	186.8	182.6	188.6	186.6	182.6	188.6	186.6
898	2.0	1.87	1.87		0.41			0.0	0.1	1.1	0.0	0.3	0.0	0.1	0.0	183.8	189.8	187.8	182.9	188.9	186.9	182.8	188.8	186.8
1346	3.0	2.81	2.81		0.61			0.1	0.2	2.4	0.1	0.6	0.0	0.3	0.0	185.3	191.3	189.3	183.4	189.4	187.4	183.1	189.1	187.1
1795	4.0	3.74	3.74		0.81			0.1	0.4	4.3	0.1	1.1	0.0	0.5	0.0	187.5	193.5	191.5	184.1	190.1	188.1	183.5	189.5	187.5
2244	5.0	4.68	4.68		1.02			0.2	0.6	6.8	0.1	1.7	0.0	0.8	0.0	190.2	196.2	194.2	185.0	191.0	189.0	184.1	190.1	188.1
2693	6.0	5.61	5.61		1.22			0.2	0.9	9.8	0.2	2.4	0.1	1.1	0.0	193.6	199.6	197.6	186.1	192.1	190.1	184.7	190.7	188.7
2992	**6.7**	**6.24**	**6.24**		**1.36**			**0.3**	**1.1**	**12.1**	**0.2**	**3.0**	**0.1**	**1.3**	**0.0**	**196.2**	**202.2**	**200.2**	**187.0**	**193.0**	**191.0**	**185.2**	**191.2**	**189.2**
3590	8.0	7.48	7.48		1.63			0.4	1.5	17.4	0.3	4.3	0.1	1.9	0.0	202.2	208.2	206.2	188.9	194.9	192.9	186.4	192.4	190.4
4039	9.0	8.42	8.42		1.83			0.5	1.9	22.0	0.4	5.5	0.1	2.4	0.1	207.4	213.4	211.4	190.5	196.5	194.5	187.4	193.4	191.4
4488	10.0	9.35	9.35		2.04			0.6	2.3	27.2	0.5	6.8	0.1	3.0	0.1	213.1	219.1	217.1	192.4	198.4	196.4	188.5	194.5	192.5
4937	11.0	10.29	10.29		2.24			0.8	2.7	32.9	0.6	8.2	0.2	3.7	0.1	219.5	225.5	223.5	194.4	200.4	198.4	189.8	195.8	193.8
5386	12.0	11.22	11.22		2.44			0.9	3.2	39.1	0.7	9.8	0.2	4.3	0.1	226.5	232.5	230.5	196.6	202.6	200.6	191.1	197.1	195.1
5985	**13.3**	**12.47**	**12.47**		**2.72**			**1.1**	**3.9**	**48.3**	**0.9**	**12.1**	**0.2**	**5.4**	**0.1**	**236.8**	**242.8**	**240.8**	**199.9**	**205.9**	**203.9**	**193.0**	**199.0**	**197.0**
6283	14.0	13.09	13.09		2.85			1.3	4.3	53.2	1.0	13.3	0.3	5.9	0.1	242.3	248.3	246.3	201.6	207.6	205.6	194.1	200.1	198.1
6732	15.0	14.03	14.03		3.06			1.4	4.9	61.1	1.1	15.3	0.3	6.8	0.1	251.1	257.1	255.1	204.4	210.4	208.4	195.8	201.8	199.8
7181	16.0	14.97	14.97		3.26			1.6	5.5	69.6	1.2	17.4	0.3	7.7	0.2	260.4	266.4	264.4	207.4	213.4	211.4	197.5	203.5	201.5
7630	17.0	15.90	15.90		3.46			1.9	6.1	78.5	1.4	19.6	0.4	8.7	0.2	270.4	276.4	274.4	210.5	216.5	214.5	199.4	205.4	203.4
8078	18.0	16.84	16.84		3.67			2.1	6.8	88.0	1.5	22.0	0.4	9.8	0.2	281.0	287.0	285.0	213.8	219.8	217.8	201.4	207.4	205.4
8527	19.0	17.77	17.77		3.87			2.3	7.5	98.1	1.7	24.5	0.5	10.9	0.2	292.2	298.2	296.2	217.4	223.4	221.4	203.5	209.5	207.5
8976	**20.0**	**18.71**	**18.71**		**4.07**			**2.6**	**8.3**	**108.7**	**1.9**	**27.2**	**0.5**	**12.1**	**0.2**	**303.9**	**309.9**	**307.9**	**221.1**	**227.1**	**225.1**	**205.7**	**211.7**	**209.7**
9425	21.0	19.64	19.64		4.28			2.8	9.1	119.8	2.1	30.0	0.6	13.3	0.3	316.3	322.3	320.3	224.9	230.9	228.9	208.0	214.0	212.0
9874	22.0	20.58	20.58		4.48			3.1	9.9	131.5	2.2	32.9	0.6	14.6	0.3	329.2	335.2	333.2	229.0	235.0	233.0	210.4	216.4	214.4
10322	23.0	21.51	21.51		4.68			3.4	10.7	143.7	2.4	35.9	0.7	16.0	0.3	342.8	348.8	346.8	233.3	239.3	237.3	212.9	218.9	216.9
10771	24.0	22.45	22.45		4.89			3.7	11.6	156.5	2.6	39.1	0.7	17.4	0.3	357.0	363.0	361.0	237.7	243.7	241.7	215.6	221.6	219.6
11220	25.0	23.38	23.38		5.09			4.0	12.5	169.8	2.8	42.5	0.8	18.9	0.4	371.7	377.7	375.7	242.3	248.3	246.3	218.3	224.3	222.3
11669	26.0	24.32	24.32		5.30			4.4	13.5	183.7	3.1	45.9	0.8	20.4	0.4	387.0	393.0	391.0	247.1	253.1	251.1	221.1	227.1	225.1
12118	27.0	25.25	25.25		5.50			4.7	14.4	198.1	3.3	49.5	0.9	22.0	0.4	403.0	409.0	407.0	252.1	258.1	256.1	224.1	230.1	228.1
12566	28.0	26.19	26.19		5.70			5.1	15.5	213.0	3.5	53.2	1.0	23.7	0.5	419.5	425.5	423.5	257.2	263.2	261.2	227.1	233.1	231.1
13015	29.0	27.12	27.12		5.91			5.4	16.5	228.5	3.7	57.1	1.0	25.4	0.5	436.6	442.6	440.6	262.6	268.6	266.6	230.3	236.3	234.3
13464	30.0	28.06	28.06		6.11			5.8	17.6	244.5	4.0	61.1	1.1	27.2	0.5	454.4	460.4	458.4	268.1	274.1	272.1	233.5	239.5	237.5


PID Pump Exchange - Appraisal Study - Alternative Alignment 5 - 20 CFS Design Flow
MAX TDH - 1 PUMP OPERATING
MIN TDH - 1 PUMP OPERATING
DESIGN POINT - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MIN TDH - 2 PUMPS OPERATING
DESIGN POINT - 2 PUMPS OPERATING
MAX TDH - 3 PUMPS OPERATING
MIN TDH - 3 PUMPS OPERATING
DESIGN POINT - 3 PUMPS OPERATING
TDH (feet)
280
260
240
220
200
180
0.0
5.0
10.0
15.0
20.0
25.0
Flow (cfs)

SYSTEM CURVE CALCULATION
PROJECT: PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY
ALTERNATIVE: ALTERNATIVE ALIGNMENT 5 - 40 CFS DESIGN FLOW

BY: David Rice, P.E.
DATE: 13-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	971.0 feet	Invert at Diversion
HWL	976.0 feet	Wet Well (High River)
LWL	972.0 feet	Wet Well (Low River)

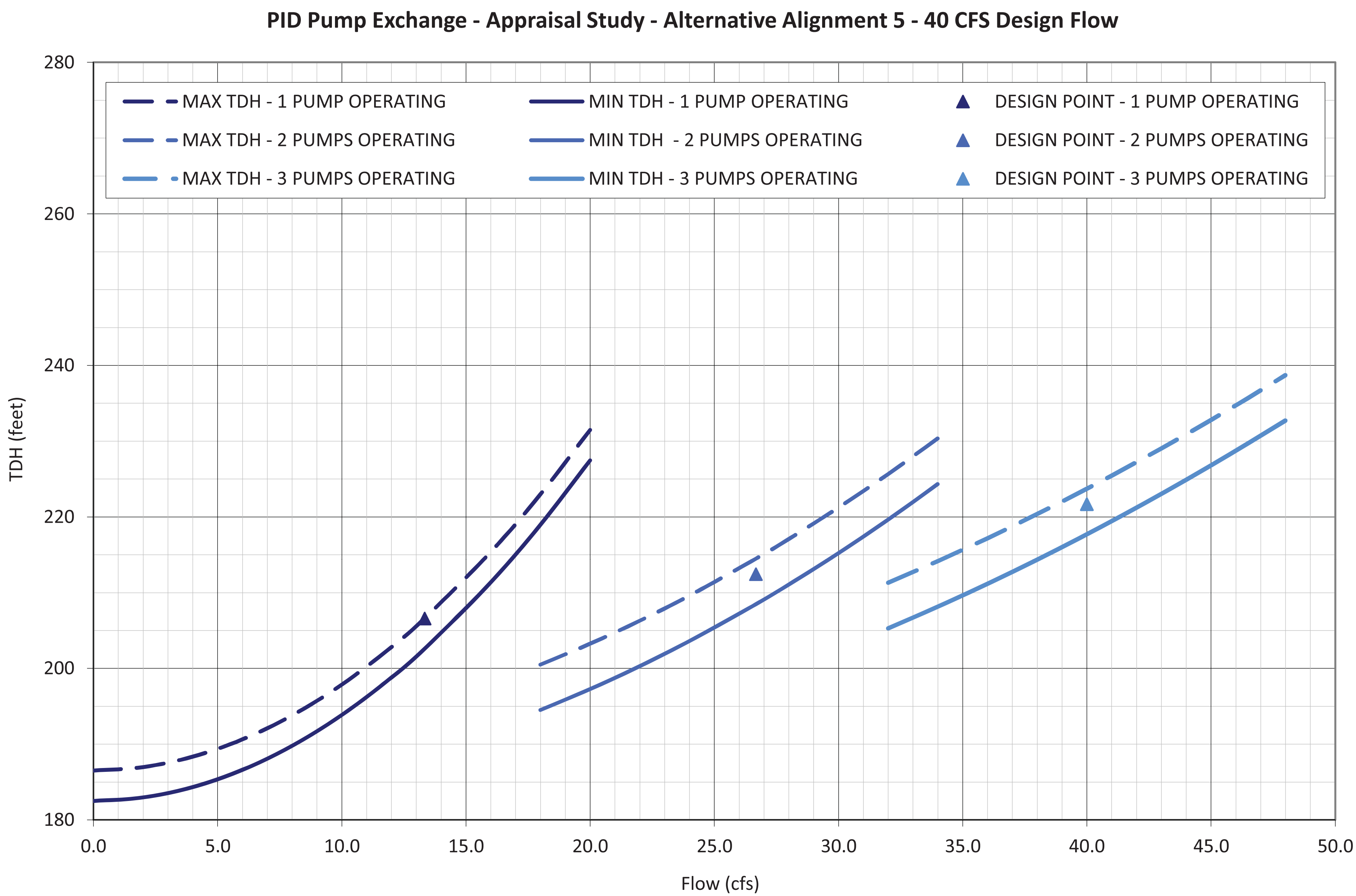
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1158.0 feet	Canal Bottom
HIGH	1160.5 feet	Canal (High Flow)
LWL	1158.5 feet	Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					18	18		36
O.D. (in)					18	18		36
I.D. (in)					18	18		36
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	12		4,910
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	5985	13.3	207	446.5
2	11970	26.7	212	918.3
3	17952	40.0	222	1437.2
Assumes	*70%*	*Efficiency*		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		18-inch	18-inch	-inch	36-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	182.5	188.5	186.5	182.5	188.5	186.5	182.5	188.5	186.5
898	2.0	1.13	1.13		0.28			0.0	0.0	0.4	0.0	0.1	0.0	0.0	0.0	183.0	189.0	187.0	182.7	188.7	186.7	182.6	188.6	186.6
1795	4.0	2.26	2.26		0.57			0.0	0.2	1.6	0.0	0.4	0.0	0.2	0.0	184.3	190.3	188.3	183.1	189.1	187.1	182.9	188.9	186.9
2693	6.0	3.39	3.39		0.85			0.1	0.4	3.6	0.1	0.9	0.0	0.4	0.0	186.6	192.6	190.6	183.9	189.9	187.9	183.4	189.4	187.4
3590	8.0	4.53	4.53		1.13			0.2	0.6	6.4	0.1	1.6	0.0	0.7	0.0	189.8	195.8	193.8	184.9	190.9	188.9	184.0	190.0	188.0
4488	10.0	5.66	5.66		1.41			0.3	0.9	9.9	0.2	2.5	0.0	1.1	0.0	193.9	199.9	197.9	186.3	192.3	190.3	184.9	190.9	188.9
5386	12.0	6.79	6.79		1.70			0.4	1.3	14.3	0.2	3.6	0.1	1.6	0.0	198.8	204.8	202.8	187.9	193.9	191.9	185.9	191.9	189.9
5985	**13.3**	**7.55**	**7.55**		**1.89**			**0.6**	**1.6**	**17.7**	**0.3**	**4.4**	**0.1**	**2.0**	**0.0**	**202.6**	**208.6**	**206.6**	**189.2**	**195.2**	**193.2**	**186.7**	**192.7**	**190.7**
7181	16.0	9.05	9.05		2.26			0.8	2.3	25.5	0.4	6.4	0.1	2.8	0.0	211.4	217.4	215.4	192.0	198.0	196.0	188.4	194.4	192.4
8078	18.0	10.18	10.18		2.55			1.0	2.8	32.2	0.5	8.1	0.1	3.6	0.1	219.0	225.0	223.0	194.5	200.5	198.5	190.0	196.0	194.0
8976	20.0	11.32	11.32		2.83			1.2	3.4	39.8	0.6	9.9	0.2	4.4	0.1	227.5	233.5	231.5	197.3	203.3	201.3	191.6	197.6	195.6
9874	22.0	12.45	12.45		3.11			1.5	4.1	48.1	0.7	12.0	0.2	5.3	0.1	236.9	242.9	240.9	200.3	206.3	204.3	193.5	199.5	197.5
10771	24.0	13.58	13.58		3.39			1.8	4.8	57.3	0.8	14.3	0.2	6.4	0.1	247.1	253.1	251.1	203.6	209.6	207.6	195.5	201.5	199.5
11970	**26.7**	**15.09**	**15.09**		**3.77**			**2.2**	**5.8**	**70.7**	**0.9**	**17.7**	**0.3**	**7.9**	**0.1**	**262.2**	**268.2**	**266.2**	**208.5**	**214.5**	**212.5**	**198.5**	**204.5**	**202.5**
12566	28.0	15.84	15.84		3.96			2.4	6.4	77.9	1.0	19.5	0.3	8.7	0.1	270.3	276.3	274.3	211.1	217.1	215.1	200.1	206.1	204.1
13464	30.0	16.97	16.97		4.24			2.8	7.2	89.5	1.2	22.4	0.3	9.9	0.2	283.2	289.2	287.2	215.2	221.2	219.2	202.6	208.6	206.6
14362	32.0	18.11	18.11		4.53			3.2	8.1	101.8	1.3	25.5	0.4	11.3	0.2	297.0	303.0	301.0	219.6	225.6	223.6	205.3	211.3	209.3
15259	34.0	19.24	19.24		4.81			3.6	9.1	114.9	1.5	28.7	0.4	12.8	0.2	311.6	317.6	315.6	224.3	230.3	228.3	208.2	214.2	212.2
16157	36.0	20.37	20.37		5.09			4.0	10.1	128.9	1.6	32.2	0.5	14.3	0.2	327.1	333.1	331.1	229.3	235.3	233.3	211.2	217.2	215.2
17054	38.0	21.50	21.50		5.38			4.5	11.2	143.6	1.8	35.9	0.5	16.0	0.2	343.6	349.6	347.6	234.6	240.6	238.6	214.4	220.4	218.4
17952	**40.0**	**22.63**	**22.63**		**5.66**			**5.0**	**12.3**	**159.1**	**2.0**	**39.8**	**0.6**	**17.7**	**0.3**	**360.8**	**366.8**	**364.8**	**240.1**	**246.1**	**244.1**	**217.7**	**223.7**	**221.7**
18850	42.0	23.76	23.76		5.94			5.5	13.5	175.4	2.2	43.8	0.6	19.5	0.3	379.0	385.0	383.0	245.9	251.9	249.9	221.2	227.2	225.2
19747	44.0	24.90	24.90		6.22			6.0	14.7	192.5	2.4	48.1	0.7	21.4	0.3	398.0	404.0	402.0	252.0	258.0	256.0	224.9	230.9	228.9
20645	46.0	26.03	26.03		6.51			6.6	15.9	210.4	2.6	52.6	0.7	23.4	0.3	418.0	424.0	422.0	258.3	264.3	262.3	228.7	234.7	232.7
21542	48.0	27.16	27.16		6.79			7.2	17.2	229.1	2.8	57.3	0.8	25.5	0.4	438.8	444.8	442.8	264.9	270.9	268.9	232.7	238.7	236.7
22440	50.0	28.29	28.29		7.07			7.8	18.6	248.6	3.0	62.1	0.8	27.6	0.4	460.4	466.4	464.4	271.8	277.8	275.8	236.9	242.9	240.9
23338	52.0	29.42	29.42		7.36			8.4	20.0	268.8	3.2	67.2	0.9	29.9	0.4	483.0	489.0	487.0	279.0	285.0	283.0	241.2	247.2	245.2
24235	54.0	30.55	30.55		7.64			9.1	21.4	289.9	3.5	72.5	1.0	32.2	0.5	506.4	512.4	510.4	286.4	292.4	290.4	245.7	251.7	249.7
25133	56.0	31.69	31.69		7.92			9.7	22.9	311.8	3.7	77.9	1.0	34.6	0.5	530.7	536.7	534.7	294.1	300.1	298.1	250.3	256.3	254.3
26030	58.0	32.82	32.82		8.20			10.5	24.5	334.5	4.0	83.6	1.1	37.2	0.5	555.8	561.8	559.8	302.1	308.1	306.1	255.1	261.1	259.1
26928	60.0	33.95	33.95		8.49			11.2	26.0	357.9	4.2	89.5	1.2	39.8	0.6	581.9	587.9	585.9	310.4	316.4	314.4	260.0	266.0	264.0



PID Pump Exchange - Appraisal Study - Alternative Alignment 5 - 40 CFS Design Flow
MAX TDH - 1 PUMP OPERATING
MIN TDH - 1 PUMP OPERATING
DESIGN POINT - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MIN TDH - 2 PUMPS OPERATING
DESIGN POINT - 2 PUMPS OPERATING
MAX TDH - 3 PUMPS OPERATING
MIN TDH - 3 PUMPS OPERATING
DESIGN POINT - 3 PUMPS OPERATING
TDH (feet)
280
260
240
220
200
180
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
Flow (cfs)

APPENDIX D
FISH SCREENING CRITERIA AND CALCULATIONS

PRELIMINARY FISH SCREEN EVALUATION
PROJECT: PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY

APPLICABLE CRITERIA:
National Marine Fisheries Science Anadromous Salmonid Passage Facility Design
Chapeter 11 - Fish Screen Bypass Facilities

Washington State Department of Fish and Wildlife Fish Protection Screen Guidelines

Location and Orientation:
-Where possible, screen should be constructed at point of diversion with screen face parallel to river flow.
-For screens constructed at the bankline, the screen face must be aligned with the adjacent bankline.
-Screen facilities must be designed to function properly within the full range of stream hydraulic conditions.

Approach Velocity:

$V_{approach}$ =	0.4	fps max. (active screens)
	0.2	fps max. (passive screens)

Effective Screen Area:

$A_{screen\ min.} = Q_{max}/V_{approach}$

Sweeping Velocity:

V_{sweep} =	0.8	ft/s min. (or > $V_{approach}$ if screen is 6' or longer)
	3	ft/s max.

Screen Material:

$A_{open\ min.}$ =	0.087	inches (wire mesh, 14 gauge max.)
$A_{open\ min.}$ =	1.75	mm (profile bar, slotted)
$A_{open\ min.}$ =	0.097	inches (circular openings, perforated plate)
$A_{open\ min.}$ =	0.097	inches on diagonal (square openings)
A_{open} =	27%	X A_{screen}

Submergence:

D_{screen} = 1 radius (for end of pipe screen, below water surface)

Clearance:

L_{clear} = 1 radius (for end of pipe screen, around screen)

SCREEN SIZING:

Assumptions:

Screen Type = Fixed Plate, Active (Self-Cleaning), at Angle of 45°

F.O.S. = 27%

Q_{max} (CFS)	$V_{approach}$ (FPS)	$A_{screen\ min.}$ (SF)	$A_{screen\ with\ F.O.S.}$ (SF)	$H_{screen\ proposed}$ (FT)	$L_{screen\ min.}$ (FT)
5	0.4	12.50	15.88	4.0	4.0
10	0.4	25.00	31.75	4.0	7.9
15	0.4	37.50	47.63	4.0	11.9
20	0.4	50.00	63.50	4.0	15.9
25	0.4	62.50	79.38	4.0	19.8
30	0.4	75.00	95.25	4.0	23.8
35	0.4	87.50	111.13	4.0	27.8
40	0.4	100.00	127.00	4.0	31.8

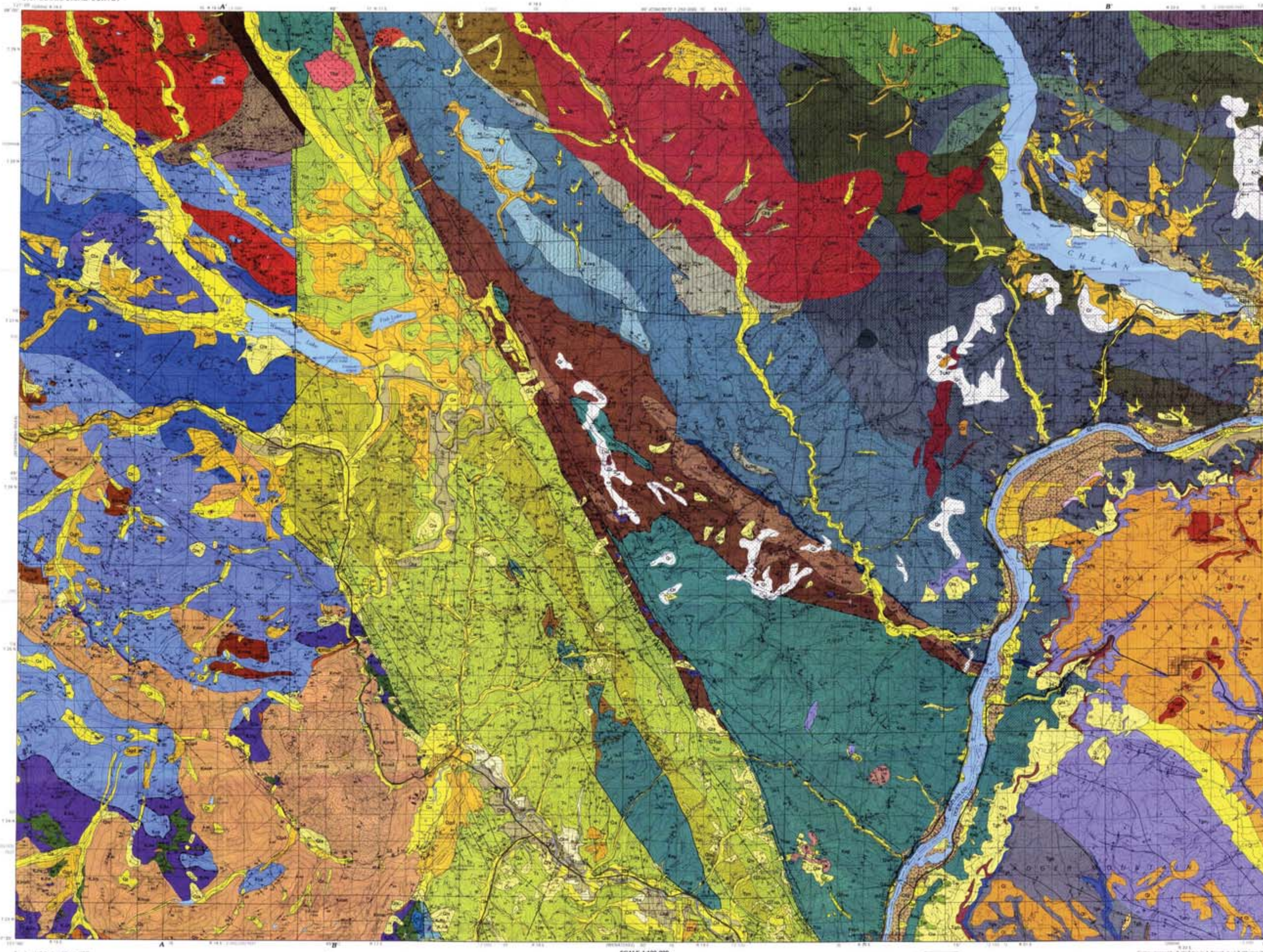
Assumptions:

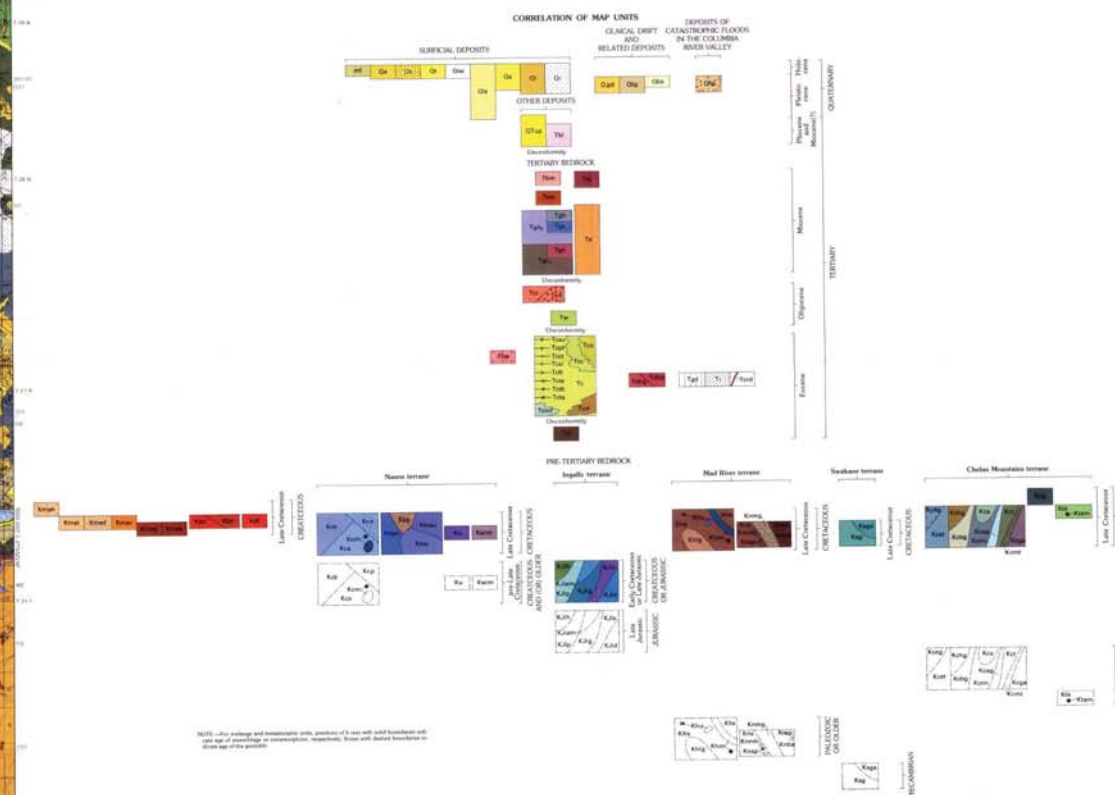
Screen Type = Cylinder Screen, End of Pipe, Passive

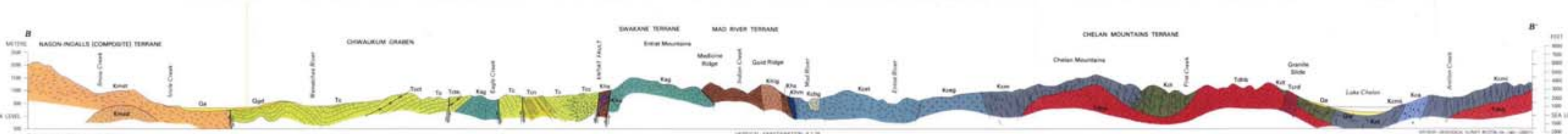
F.O.S. = 27%

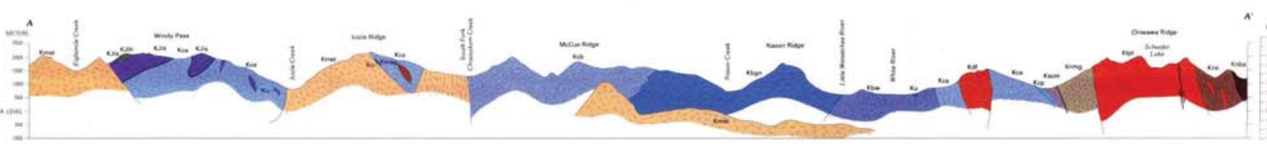
Q_{max} (CFS)	$V_{approach}$ (FPS)	$A_{screen\ min.}$ (SF)	$A_{screen\ with\ F.O.S.}$ (SF)	$D_{screen\ proposed}$ (IN)	$L_{screen\ min.}$ (FT)
5	0.2	25.00	31.75	12.0	10.1
10	0.2	50.00	63.50	12.0	20.2
15	0.2	75.00	95.25	12.0	30.3
20	0.2	100.00	127.00	18.0	27.0
25	0.2	125.00	158.75	18.0	33.7
30	0.2	150.00	190.50	24.0	30.3
35	0.2	175.00	222.25	24.0	35.4
40	0.2	200.00	254.00	24.0	40.4

APPENDIX E
GEOLOGIC REVIEW DATA









GEOLOGIC MAP OF THE CHELAN 30-MINUTE BY 60-MINUTE QUADRANGLE, WASHINGTON

By

R. W. Tabor, V. A. Frizzell, Jr., J. T. Whetten, R. B. Waitt, D. A. Swanson,
G. R. Byerly, D. B. Booth, M. J. Hetherington, and R. E. Zartman

1987

DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

mf MANMADE FILL AND MODIFIED LAND (HOLOCENE)—Gravel or diamicton as fill, or extensively graded natural deposits

Qe EOLIAN DEPOSITS (HOLOCENE)—Well-sorted loose sand deflated from Columbia River floodplain that is now drowned behind dams

Qb BOG DEPOSITS (HOLOCENE)—Peat and alluvium. Poorly drained and at least intermittently wet. Grades into unit Qa

Qt TALUS DEPOSITS (HOLOCENE)—Nonsorted angular boulder gravel to boulder diamicton. At lower altitudes only arbitrarily distinguished from unit Qa. At higher altitudes in western part of quadrangle includes Holocene moraines, rock glaciers, and protalus ramparts

LANDSLIDE DEPOSITS—Consist of:

Qlsi Incipient blockslides (Holocene)—Large nonrotated mass of bedrock extensively crevassed as a result of slight movement toward nearby free faces. Crevasse arrow symbol shows direction of movement

Qls Landslides (Holocene and Pleistocene)—Diamicton of angular clasts of bedrock and surficial deposits derived from upslope. Locally includes rotated blockslides. Arrows denote downslope direction

Qa ALLUVIUM (HOLOCENE AND PLEISTOCENE)—Moderately sorted cobble gravel along rivers grading to poorly sorted gravelly sand on small-tributary fans; as mapped, includes some material in fans similar to unit Qt

Ql LOESS (HOLOCENE AND PLEISTOCENE)—Slightly compacted well-sorted silt. In places below edge of Columbia Plateau grades into unit Qe

Qr REGOLITH (HOLOCENE AND PLEISTOCENE)—Slightly compacted to loose silt, diamictite, and soils. Extensive and thick on upland surfaces north and northwest of Columbia River. Includes considerable loess and weathering debris. Mostly mapped on basis of gentle ridgetop topography; contacts approximate

GLACIAL DRIFT AND RELATED DEPOSITS

Qgd GLACIAL DRIFT (PLEISTOCENE)—Ranges from till in uplands and upvalley areas to gravelly outwash on broad valley floors. In lower Chelan Valley and in large valleys of Wenatchee drainage east of Lake Wenatchee, outwash gravel is interbedded with till and minor lacustrine sediment; in these areas gravel fraction is cognate with unit Qtg. Mostly last-glacial deposit, but in some places passes upslope into older, weathered drift. Conspicuous, large, sharp-crested moraines distinguished by dot-dash pattern

Qtg TERRACE GRAVEL (PLEISTOCENE)—Moderately sorted cobble to pebble gravel. Largely but not entirely inwash and outwash fill, the latter grading upvalley to moraines within unit Qgd. No subsequent incision of drainage network since accumulation

Qbs BEDDED SILT (PLEISTOCENE)—Ranges from very fine sand to clay; distinctly interbedded; commonly contains ice-rafted dropstones. Polygenetic lacustrine deposits

DEPOSITS OF CATASTROPHIC FLOODS IN THE COLUMBIA RIVER VALLEY

Qfg FLOOD GRAVEL (PLEISTOCENE)—Similar to unit Qtg but contains large boulders and rarely has associated fields of large boulders, giant current dunes, fosses behind bedrock protuberances, and scabland on adjacent bedrock

OTHER DEPOSITS

QTup GRAVEL AND DIAMICTITE OF UPLAND AREAS (PLEISTOCENE, PLIOCENE, AND MIOCENE?)—Moderately sorted river gravel to poorly sorted diamicton or diamictite sparsely capping ridges or upland erosion surface. Considerable incision of drainage network since deposition. May possibly include some deposits of Holocene age

Tbl CONGLOMERATE OF BRAYS LANDING (PLIOCENE AND MIOCENE?)—Moderately sorted pebble conglomerate of diverse rock types, all from Columbia River drainage. Columbia River has incised 240 m below the surface of the deposit

TERTIARY BEDROCK

Tbm ANDESITE AND DACITE OF BURCH MOUNTAIN (MIOCENE)—Gray to dark-gray and black pyroxene and hornblende pyroxene andesite and dacite. Some rocks with minor hypersthene, zoned labradorite, and conspicuous apatite needles. Porphyritic and glomeroporphyritic, holocrystalline, cryptocrystalline to aphanitic. Occurs as plugs and dikes

Tsp ANDESITE OF SUGARLOAF PEAK [18][1] (MIOCENE)—Hypersthene clinopyroxene andesite, porphyritic holocrystalline aphanitic with zoned labradorite. Well-developed vertical columnar joints

[1] Numbers in brackets refer to locations on figure 6, in pamphlet

Te ELLENSBURG FORMATION (MIOCENE)—Micaceous feldspathic sandstone, and very minor pebble conglomerate and dark mudstone. Weakly indurated. Interbedded with the Grande Ronde Basalt and underlies the Priest Rapids Member of the Wanapum Basalt

COLUMBIA RIVER BASALT GROUP (MIOCENE)

YAKIMA BASALT SUBGROUP—In this area, consists of

VOLCANIC ROCKS OF CHIKAMIN CREEK (OLIGOCENE)—Divided into:

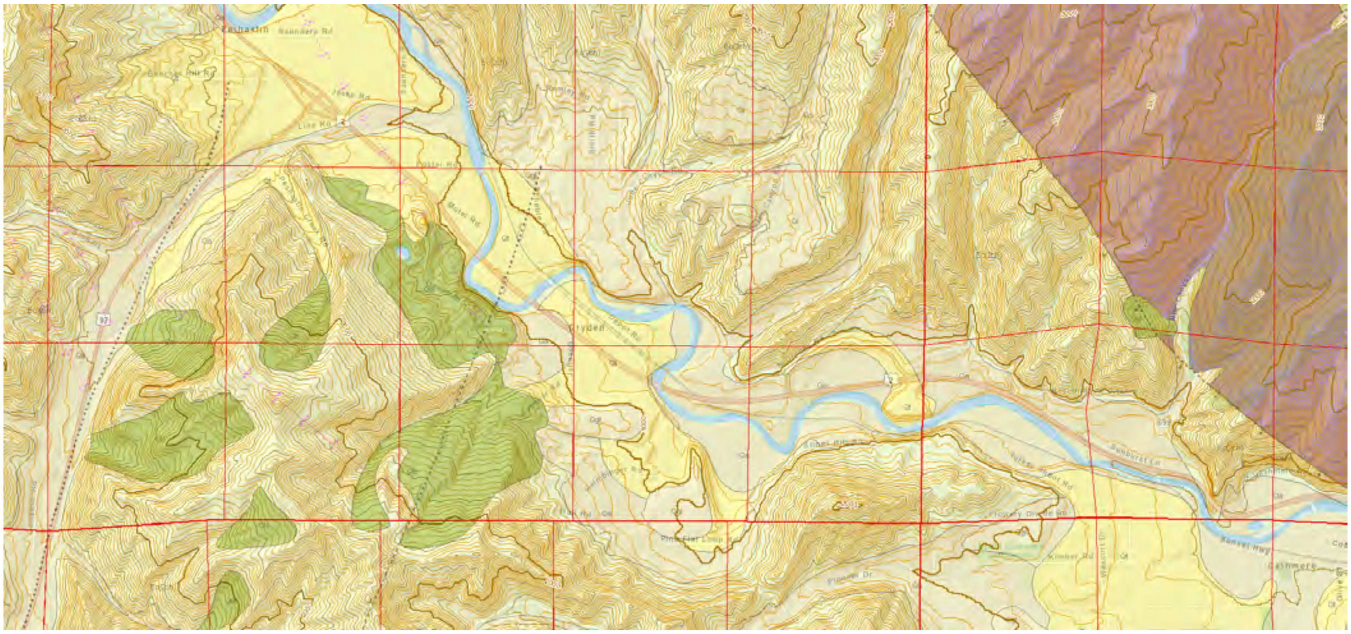
Rhyolite—White, orange brown to gray ...

Rhyolite tuff and breccia—Gray to brown ...

Peshastin Irrigation District Geologic Map

-120.6309° 47.5668°

-120.4661° 47.5668°



47.5150° -120.6309°

47.5150° -120.4661°

Map Scale 1:74045

WASHINGTON STATE DEPARTMENT OF Natural Resources

Thursday, August 4, 2011 15:49:05 PM
https://fortress.wa.gov/dnr/geology

Division of Geology and Earth Resources
http://www.dnr.wa.gov/ResearchScience/GeologyEarthSciences/

Map Legend

Base Layers

Contours, 40 foot

Contours 40 foot

Public Land Survey (Sections)

Public Land Survey (Sections)

Public Land Survey (Township/Range)

Public Land Survey (Township/Range)

30x60-minute Quadrangle Boundaries

30x60-minute Quadrangle Boundaries

Landslides

Landslides, 1:100,000 Scale

Landslides, 1:100,000 Scale

Landslides, 1:24,000 Scale

Unknown

Block fall or topple

Debris flow

Debris slide and avalanches

Deep-seated; Deep-seated composite; Deep-seated earthflow; Deep-seated rotational; Deep-seated translational

Hyperconcentrated flows

Shallow undifferentiated

Surface Geology

Geologic Unit Points 100K

Geologic Unit Points 100K

Dikes 100K

Dike - Identity and existence certain, location accurate

Dike - Identity or existence certain, location concealed

Contacts 100K

Contact - Identity and existence certain, location accurate

Shoreline

Faults 100K

Fault, unknown offset - Identity and existence certain, location concealed

Right-lateral strike-slip fault - Identity and existence certain, location concealed. Arrows show relative motion

Normal fault - Identity and existence certain, location accurate. Bar and ball on downthrown block

Normal fault - Identity and existence certain, location concealed. Bar and ball on downthrown block

Right-lateral strike-slip fault - Identity and existence certain, location inferred. Arrows show relative motion

Folds 100K

Anticline - Identity and existence certain, location accurate

Anticline - Identity and existence certain, location concealed

Syncline - Identity and existence certain, location accurate

Syncline - Identity and existence certain, location concealed

Linear Geologic Features 100K

Linear geologic feature, other than dike - Identity and existence certain, location accurate

Linear geologic feature, other than dike - Identity and existence certain, location concealed

Continental ice limit, late Wisconsinan

Continental ice limit, pre-late Wisconsinan

Geologic Units 100K

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

Sedimentary Rocks and Deposits

Quaternary–Miocene continental sedimentary rocks

Eocene continental sedimentary rocks

Metamorphic Rocks (Amphibolite Facies and Higher)

Precambrian metamorphic rocks

Other Geologic Units or Features

Water


120° 34' 56"
120° 33' 19"
47° 33' 39"
47° 33' 37"
681900
682200
682500
682800
683100
683400
683700
5270100
5269800
5269500
5269200
5268900
5268600
5268300
5268000
5267700
5267400
5267100
Jeske Rd
Peshastin Creek
Saunders Rd
Otis Rd
Foster Rd
Frontage Rd
Remley Rd
Smith Rd
Smith-Remley Rd
Scheble Rd
Motel Rd
Dryden Dump Rd
Icicle Canal
School St
Alice Ave
Josephine Ave
Dryden Rd
Smith St
Depot Rd
Dryden Ave
1st St
Dorn St
Main St
Stines Hill Rd
Willis Springs Rd
Deadman Hill Rd
Goehner Rd
2
CcA
BvA
VaD
VaC
Pe
BuA
Te
Be
BuE
BvC
BuD
BvB
BuA
CwD
BuB
CdC
BuC
BvD
PrB
PrD
PrB
W
Bf
CnE
VaE
CoF2
BvC
WeB
BvD
BuC
VaD
CnF
47° 31' 51"
47° 31' 49"
120° 35' 1"
120° 33' 24"
Map Scale: 1:9,260 if printed on B size (11" x 17") sheet.
N
Meters
0 50 100 200 300
Feet
0 250 500 1,000 1,500

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features

- Gully
- Short Steep Slope
- Other

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:9,260 if printed on B size (11" × 17") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Chelan County Area, Washington (Parts of Chelan and Kittitas Counties)
Survey Area Data: Version 7, Jun 10, 2009

Date(s) aerial images were photographed: 7/15/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Chelan County Area, Washington (Parts of Chelan and Kittitas Counties) (WA607)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Be	Beverly fine sandy loam	55.5	7.2%
Bf	Beverly gravelly fine sandy loam	46.4	6.0%
BuA	Burch fine sandy loam, 0 to 3 percent slopes	7.9	1.0%
BuB	Burch fine sandy loam, 3 to 8 percent slopes	13.8	1.8%
BuC	Burch fine sandy loam, 8 to 15 percent slopes	18.6	2.4%
BuD	Burch fine sandy loam, 15 to 25 percent slopes	0.6	0.1%
BuE	Burch fine sandy loam, 25 to 45 percent slopes	9.3	1.2%
BvA	Burch loam, 0 to 3 percent slopes	52.9	6.9%
BvB	Burch loam, 3 to 8 percent slopes	25.4	3.3%
BvC	Burch loam, 8 to 15 percent slopes	83.5	10.9%
BvD	Burch loam, 15 to 25 percent slopes	28.4	3.7%
CcA	Cashmont sandy loam, 0 to 3 percent slopes	22.4	2.9%
CdC	Cashmont gravelly sandy loam, 8 to 15 percent slopes	1.6	0.2%
CnE	Cle Elum silt loam, 25 to 45 percent slopes	120.8	15.7%
CnF	Cle Elum silt loam, 45 to 65 percent slopes	6.1	0.8%
CoF2	Cle Elum-Rock outcrop complex, 25 to 65 percent slopes	18.5	2.4%
CwD	Cowiche silt loam, 15 to 25 percent slopes	1.8	0.2%
Pe	Peoh silt loam	3.8	0.5%
PhB	Peshastin loam, 3 to 8 percent slopes	22.3	2.9%
PlD	Peshastin stony loam, 0 to 25 percent slopes	30.8	4.0%
PoB	Pogue fine sandy loam, 3 to 8 percent slopes	30.3	3.9%
PrB	Pogue gravelly fine sandy loam, 3 to 8 percent slopes	3.8	0.5%
PrD	Pogue gravelly fine sandy loam, 15 to 25 percent slopes	5.3	0.7%
Te	Terrace escarpments	23.2	3.0%
VaC	Varelum silt loam, 3 to 15 percent slopes	36.3	4.7%
VaD	Varelum silt loam, 15 to 25 percent slopes	11.1	1.4%
VaE	Varelum silt loam, 25 to 45 percent slopes	3.2	0.4%
W	Water	48.0	6.2%
WeB	Wenatchee silt loam, 3 to 8 percent slopes	37.5	4.9%
Totals for Area of Interest		**768.9**	**100.0%**

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

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. /
Permit No.

(1) OWNER: Name CLAUDIA MINKS Address P.O. Box 436 Dryden Wa. 98821

(2) LOCATION OF WELL: County CHELAN — NE ¼ NW ¼ Sec. 27 T. 24 N., R. 18 W.M.

Bearing and distance from section or subdivision corner

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

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

New well [X] Method: Dug ☐ Bored ☐
Deepened ☐ Cable [X] Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 36 ft. Depth of completed well 35 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from 0 ft. to 35 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded [X] " Diam. from ft. to ft.

Perforations: Yes ☐ No [X]
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 [X]
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No [X] Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes [X] No ☐ To what depth? 20 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes ☐ No [X]
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.... ft.
Static level 25 ft. below top of well Date 4-10-84
Artesian pressure 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 [X] If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.

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 2 gal./min. with ft. drawdown after hrs.
Artesian flow
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.*

MATERIAL	FROM	TO
BLACK TOPSOIL	0	1
BROWN GUMBO CLAY	1	7
ROCKS, GRAVEL, + CLAY	7	29
HARD CEMENTED SAND + GRAVEL	29	36

Work started 4-5, 1984 Completed 4-10, 1984

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 TUMWATER DRILLING INC. (Person, firm, or corporation) (Type or print)

Address RT. 1 BOX 133C LEAVENWORTH

[Signed] [signature] (Well Driller)

License No. 1249 Date 4-17-1984

XA7-10-84

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

File Original and First Copy with the Division of Water Management
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. 003466

Permit No. ....

(1) OWNER: Name R. A. Grohne, dba RIVERVIEW ORCH Address Rt 1, Cashmere, Wa. 98815

(2) LOCATION OF WELL: County CHELAN — NE ¼ NW ¼ Sec 27 T. 24N., R. 18E W.M.

Bearing and distance from section or subdivision corner 2281.5' E and 352'S of the NW Cor of Sec 27

(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 ☒
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 4 inches.
Drilled 20 ft. Depth of completed well 34 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 4" Diam. from 14 ft. to 34 ft.
Threaded ☐ ....." Diam. from ..... ft. to ..... ft.
Welded ☐ ....." Diam. from ..... 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 No record available
Type ..... Model No. .....
Diam. ..... Slot size ..... from ..... ft. to ..... ft.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.

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

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

(7) PUMP: Manufacturer's Name Pacific - Jet
Type: JN3 1½x3/4 H.P. ½

(8) WATER LEVELS: Land-surface elevation above mean sea level.... 970 ft.
Static level 17 ft. below top of well Date 1958
Artesian pressure ..... 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: ..... gal./min. with ..... ft. drawdown after ..... hrs.
" " " "
" " " "

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. drawdown after ..... hrs.
Artesian flow ..... g.p.m. Date .....
Temperature of water ..... Was a chemical analysis made? .....

(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.*

MATERIAL	FROM	TO
Deepened by drilling and installing 4" casing below dug section during 1955-56 period. Further information not available		
[signature] R. A. Grohne, present owner.		

RECEIVED
MAR 30 1971
DEPARTMENT OF ECOLOGY

Work started ....., 19..... Completed ....., 19.....

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 ..... (Person, firm, or corporation) (Type or print)

Address .....

[Signed] ..... (Well Driller)

License No. ..... Date ....., 19.....

1/23/74

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 5-69)—5-69.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. F

Permit No.

(1) OWNER: Name Chelan Co. Dept. of Public Works Address Chelan Co. Courthouse Wenatchee Wa. 98801

(2) LOCATION OF WELL: County CHELAN — SE ¼ NW ¼ Sec. 27 T. 24 N., R. 18 W.M.

Bearing and distance from section or subdivision corner

(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 ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 54 ft. Depth of completed well 54 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 8" Diam. from +1½ ft. to 53 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from 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
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

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

Surface seal: Yes ☒ No ☐ To what depth? 18 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name BERKLEY
Type: SUBMERSIBLE H.P. 3

(8) WATER LEVELS: Land-surface elevation above mean sea level.......
Static level 34 ft. below top of well Date 8-26-87
Artesian pressure 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: gal./min. with ft. drawdown after hrs.

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 55 gal./min. with ft. drawdown after 1½ 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.*

MATERIAL	FROM	TO
BROWN CLAY	0	33
SANDY CLAY WB	33	36
BROWN CLAY	36	49
BROWN COARSE SAND, CLAY + GRAVEL	49	52
SANDSTONE	52	54

RECEIVED [date stamp] 3 1987 DEPARTMENT OF ECOLOGY CENTRAL REGION OFFICE

Work started 8-25, 1987 Completed 8-26, 1987

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 TUMWATER DRILLING INC. (Person, firm, or corporation) (Type or print)

Address LEAVENWORTH, WASH.

[Signed] [signature] (Well Driller)

License No. 1249 Date 8-28, 1987

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

350

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. F

Water Right Permit No.

(1) OWNER: Name Della Noel Address 9003 Motel Rd Dryden Wa.

(2) LOCATION OF WELL: County CHELAN SE ¼ NW ¼ Sec 27 T. 24 N., R 18 W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address)

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

(4) TYPE OF WORK: Owner's number of well (if more than one)
Abandoned [ ] New well [X] Deepened [ ] Reconditioned [ ]
Method: Dug [ ] Cable [ ] Rotary [X] Bored [ ] Driven [ ] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 34½ feet. Depth of completed well 33 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Diam. from +1½ ft. to 33 ft.
Welded [X] " Diam. from ft. to ft.
Liner installed [ ] " Diam. from ft. to ft.
Threaded [ ]

Perforations: Yes [ ] No [X]
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 [X]
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes [ ] No [X] Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes [X] No [ ] To what depth? 18 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes [ ] No [X]
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name WEDTROL
Type: SUBMERSIBLE H.P. ½

(8) WATER LEVELS: Land-surface elevation above mean sea level
Static level 8½ ft. below top of well Date 4-11-88
Artesian pressure 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 [X] If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.

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. drawdown after hrs.
Airtest 50 gal./min. with stem set at 31 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes [ ] No [X]

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

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 information.

MATERIAL	FROM	TO
BLACK LOAMY CLAY	0	3
GRAVEL, ROCKS + SAND	3	34½

APR 29 1988

Work started 4-11-88. Completed 4-11-88.

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 TUMWATER DRILLING INC. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address LEAVENWORTH, WASH.
(Signed) [signature] (WELL DRILLER) License No. 1249
Contractor's Registration No. TUMWADI 130L Date 4-12-, 1988

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-

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

5

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT F

Start Card No. 016192

STATE OF WASHINGTON

Water Right Permit No. ______

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

(1) OWNER: Name DENIS S. KNISHRA Address BOX 56, DRYDEN, WA. 98821

(2) LOCATION OF WELL: County CHELAN SE ¼ NW ¼ Sec 27 T 24 N., R 18 W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) 8990 MOTEL RD. LOT 3 OF SHORT PLAT # 1145

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

(4) TYPE OF WORK: Owner's number of well (if more than one) ______
Abandoned [ ] New well [X] Deepened [ ] Reconditioned [ ]
Method: Dug [ ] Cable [ ] Rotary [X] Bored [ ] Driven [ ] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 39 feet. Depth of completed well 38½ ft.

(6) CONSTRUCTION DETAILS:
Casing Installed: 6 " Diam. from +2 ft. to 38½ ft.
Welded [X] ______ " Diam. from ______ ft. to ______ ft.
Liner installed [ ] ______ " Diam. from ______ ft. to ______ ft.
Threaded [ ]

Perforations: Yes [ ] No [X]
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 [X]
Manufacturer's Name ______
Type ______ Model No. ______
Diam. ______ Slot size ______ from ______ ft. to ______ ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.

Gravel packed: Yes [ ] No [X] Size of gravel ______
Gravel placed from ______ ft. to ______ ft.

Surface seal: Yes [X] No [ ] To what depth? 18 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes [ ] No [X]
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 11 ft. below top of well Date 8-12-88
Artesian pressure ______ 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 [X] If yes, by whom? ______
Yield: ______ gal./min. with ______ ft. drawdown after ______ hrs.
" " " "
" " " "

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. drawdown after ______ hrs.
Airtest 45 gal./min. with stem set at 37 ft. for 1 hrs.
Artesian flow ______ g.p.m. Date 8-12-88
Temperature of water ______ Was a chemical analysis made? Yes [ ] No [X]

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

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 information.

MATERIAL	FROM	TO
BLACK TOPSOIL	0	3
GRAVEL, SAND + ROCKS	3	39

RECEIVED
AUG 24 1988
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

Work started 8-12, 19__ Completed 8-12, 1988

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 TUMWATER DRILLING INC. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address LEAVENWORTH, WASH.

(Signed) Brett [signature] (WELL DRILLER) License No. 1249

Contractor's Registration No. TUMWADI-133OC Date 8-12, 1988

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

F

Start Card No. W 49112

UNIQUE WELL I.D. # ABL 910

Water Right Permit No. ____

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

(1) OWNER: Name DENNIS KNISHKA Address PO BOX 56 DRYDEN, WA 98821

(2) LOCATION OF WELL: County CHELAN SE 1/4 NW 1/4 Sec 27 T 24 N., R 18E W.M. F

(2a) STREET ADDRESS OF WELL (or nearest address) 8900 MOTEL RD. DRYDEN, WA.

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

(4) TYPE OF WORK: Owner's number of well (If more than one) ____
Abandoned [ ] New well [X] Deepened [ ] Reconditioned [ ]
Method: Dug [ ] Cable [ ] Rotary [X] Bored [ ] Driven [ ] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 39 1/2 feet. Depth of completed well 38 1/2 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from +1 1/2 ft. to 38 1/2 ft.
Welded [X] ____" Diam. from ____ ft. to ____ ft.
Liner installed [ ] ____" Diam. from ____ ft. to ____ ft.
Threaded [ ]

Perforations: Yes [ ] No [X]
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 [X]
Manufacturer's Name ____
Type ____ Model No. ____
Diam. ____ Slot size ____ from ____ ft. to ____ ft.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel packed: Yes [ ] No [X] Size of gravel ____
Gravel placed from ____ ft. to ____ ft.

Surface seal: Yes [X] No [ ] To what depth? 19 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes [ ] No [X]
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 14 ft. below top of well Date 8-2-94
Artesian pressure ____ 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 [X] If yes, by whom? ____
Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.
" " " "
" " " "

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. drawdown after ____ hrs.
Airtest 70 gal./min. with stem set at 38 ft. for 1 hrs.
Artesian flow ____ g.p.m. Date 8-2-94
Temperature of water ____ Was a chemical analysis made? Yes [X] No [ ]

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

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 information.

MATERIAL	FROM	TO
BLACK SANDY TOPSOIL	0	2
BLACK GRAVEL, COBBLES	2	13
BLACK GRAVEL + SAND WATER BEARING	13	16
HARD PACKED BLACK BROKEN GRAVEL, CLAY, ROCKS	16	28
GRAVELS + SAND WATER BEARING	28	39 1/2

AUG 15 1994
DEPARTMENT OF ECOLOGY CENTRAL REGION OFFICE

Work Started 8-2, 19. Completed 8-2, 1994

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 TUMWATER DRILLING INC. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address LEAVENWORTH, WASH.
(Signed) [signature] (WELL DRILLER) License No. 1249
Contractor's Registration No. TUMWADI 1330C Date 8-3, 1994

(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.

ECY 050-1-20 (9/93)

134

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 25533

Water Right Permit No. ______

(1) OWNER: Name Stanley D. Price Address PO Box 395 Dryden Wa. 98821

(2) LOCATION OF WELL: County CHELAN SE ¼ NW ¼ Sec. 27 T. 24 N., R. 18 W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) 8991 Motel Rd. Dryden Wa. 98821

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

(4) TYPE OF WORK: Owner's number of well (if more than one) ______
Abandoned [ ] New well [X] Deepened [ ] Reconditioned [ ]
Method: Dug [ ] Cable [ ] Rotary [X] Bored [ ] Driven [ ] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 39 feet. Depth of completed well 38 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Diam. from +1½ ft. to 38 ft.
Welded [X] ______ " Diam. from ______ ft. to ______ ft.
Liner installed [ ]
Threaded [ ] ______ " Diam. from ______ ft. to ______ ft.

Perforations: Yes [ ] No [X]
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 [X]
Manufacturer's Name ______
Type ______ Model No. ______
Diam. ______ Slot size ______ from ______ ft. to ______ ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.

Gravel packed: Yes [ ] No [X] Size of gravel ______
Gravel placed from ______ ft. to ______ ft.

Surface seal: Yes [X] No [ ] To what depth? 18 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes [ ] No [X]
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 ______ ft.
Static level 13 ft. below top of well Date 12-8-88
Artesian pressure ______ 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 [X] If yes, by whom? ______
Yield: ______ gal./min. with ______ ft. drawdown after ______ hrs.
" " " "
" " " "

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. drawdown after ______ hrs.
Airtest 30 gal./min. with stem set at 35 ft. for 1 hrs.
Artesian flow ______ g.p.m. Date ______
Temperature of water ______ Was a chemical analysis made? Yes [ ] No [X]

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

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 information.

MATERIAL	FROM	TO
BLACK TOPSOIL	0	1
ROCKS, GRAVEL, SAND + CLAY	1	39

N 30[redacted]

Work started 12-7, 19__. Completed 12-8, 1988

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 TUMWATER DRILLING INC. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address LEAVENWORTH WASH.
(Signed) [signature] (WELL DRILLER) License No. 1249
Contractor's Registration No. TUMWAD I-1330C Date 12-9, 1988

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W 047936
Unique Well I.D. # NONE
Water Right Permit No.

(1) OWNER: Name PROSCH, DAVID Address 8896 DEAD MAN HILL RD. CASHMERE, WA 98815-

(2) LOCATION OF WELL: County CHELAN - SW 1/4 SE 1/4 Sec 27 T 24 N., R 18E WM
(2a) STREET ADDRESS OF WELL (or nearest address) SAME,

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one)
NEW WELL Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 311 ft. Depth of completed well 302 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Dia. from +1.5 ft. to 133 ft.
WELDED W/LINER 4 " Dia. from -129 ft. to 302 ft.
" Dia. from ft. to ft.

Perforations: YES
Type of perforator used SKILL SAW
SIZE of perforations 7 in. by .125 in.
136 perforations from 227 ft. to 302 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 19 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
Method of sealing strata off SEAL METHOD 1

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 239 ft. below top of well Date 07/13/95
Artesian Pressure lbs. per square inch Date
Artesian water controlled by CAP

(9) 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 hrs.

Recovery data
Time Water Level Time Water Level Time Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 20 gal/min. w/ stem set at 302 ft. for 1.5 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? 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 in formation.

MATERIAL	FROM	TO
BROWN CLAY	0	32
GRAY SHALE	32	34
BROWN SANDY CLAY	34	38
BROWN GUMBO CLAY	38	68
VARIOUS COLORS CLAY	68	82
WHITE CLAY	82	84
GRAY CLAY SHALE SANDSTONE	84	113
WHITE CLAY	113	129
BROKEN SHALE BROWN CLAY	129	133
BRN. SANDSTONE	133	137
DECAYED BRN. SANDSTONE CLAY	137	157
BROKEN SHALE CLAY	157	165
BRN. SANDSTONE	165	176
SHALE BROWN CLAY	176	192
BRN. SANDSTONE	192	208.5
VOID CAVING	208.5	211
BROWN CLAY BRN. SANDSTONE SHALE	211	282
WATER BEARING	270	275
DECAYED BRN. SANDSTONE	282	302
WATER BEARING	287	291
CAVING BROKEN BRN. SANDSTONE	302	311

AUG 2 1995

Work started 07/11/95 Completed 07/13/95

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 TUMWATER DRILLING, INC.
(Person, firm, or corporation) (Type or print)

ADDRESS P.O.BOX 777
[SIGNED] License No. 1249

Contractor's Registration No. TUMWADI 1330C Date 07/15/95

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W057204
UNIQUE WELL I.D. # ABQ 443
Water Right Permit No. ______

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

(1) OWNER: Name Don Hansen Address 6969 Stinehill Rd. Cashmere, WA. 98815

(2) LOCATION OF WELL: County Chelan - SW 1/4 SE 1/4 Sec 27 T. 24 N., R 18E W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) 8807 Josephine Ave. Dryden, WA. 98821

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

(4) TYPE OF WORK: Owner's number of well (If more than one) ______
[ ] Abandoned [X] New well [ ] Deepened [ ] Reconditioned
Method: [ ] Dug [ ] Cable [X] Rotary [ ] Bored [ ] Driven [ ] Jetted

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 80 feet. Depth of completed well 80 ft.

(6) CONSTRUCTION DETAILS:
Casing Installed: [X] Welded [X] Liner installed [ ] Threaded
6 " Diam. from +2 ft. to 27 ft.
4PVC " Diam. from -20 ft. to 80 ft.
" Diam. from ______ ft. to ______ ft.

Perforations: Yes [X] No [ ]
Type of perforator used skill saw
SIZE of perforations 1/4 in. by 6 in.
35 perforations from 60 ft. to 80 ft.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.

Screens: Yes [ ] No [X]
Manufacturer's Name ______
Type ______ Model No. ______
Diam. ______ Slot size ______ from ______ ft. to ______ ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.

Gravel packed: Yes [ ] No [X] Size of gravel ______
Gravel placed from ______ ft. to ______ ft.

Surface seal: Yes [X] No [ ] To what depth? 18 ft.
Material used in seal bentonite
Did any strata contain unusable water? Yes [ ] No [X]
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 ______ ft.
Static level 14 ft. below top of well Date 10/7/94
Artesian pressure ______ 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 [X] If yes, by whom? ______
Yield: 20 gal./min. with ______ ft. drawdown after ______ hrs.
" " " "
" " " "

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. drawdown after ______ hrs.
Airtest ______ gal./min. with stem set at ______ ft. for ______ hrs.
Artesian flow ______ g.p.m. Date ______
Temperature of water ______ Was a chemical analysis made? Yes [ ] No [X]

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

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 information.

MATERIAL	FROM	TO
silty gravels	0	3
gravel, cobbles & boulders	3	15
sand & gravel, coarse w/water	15	28
sandstone, brown w/lenses of shale	28	70
w/water	70	75
sandstone, brown/grey	75	80

RECEIVED
DEC 1 2 1994

Work Started 10/6/94, 19. Completed 10/7/94, 19

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 FOGLE PUMP & SUPPLY, INC. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address 316 W. 5th Colville, Wa. 99114
(Signed) Mike Robinson Jr (WELL DRILLER) License No. 1544
Contractor's Registration No. FOGLEPS095L4 Date 10/7/94, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

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

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

6845
Start Card No. 87137
Water Right Permit No. Q

OWNER: Name LARRY APIGIAN Address 8892 DEAD MAN HILL RD. CASHMERE

(2) LOCATION OF WELL: County CHELAN SW ¼ SE ¼ Sec 27 T. 24 N., R 18 W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) (SAME)

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

(4) TYPE OF WORK: Owner's number of well (if more than one)
Abandoned [ ] New well [X] Deepened [ ] Reconditioned [ ]
Method: Dug [ ] Cable [ ] Rotary [X] Bored [ ] Driven [ ] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 40 feet. Depth of completed well 40 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Diam. from +1½ ft. to 40 ft.
Welded [X] " Diam. from ft. to ft.
Liner installed [ ]
Threaded [ ] " Diam. from ft. to ft.

Perforations: Yes [X] No [ ]
Type of perforator used ROTARY MILLS
SIZE of perforations 48 in. by 1 in.
55 perforations from 19 ft. to 23 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes [ ] No [X]
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes [ ] No [X] Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes [X] No [ ] To what depth? 18 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes [ ] No [X]
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 ft.
Static level 14 ft. below top of well Date 4-27-92
Artesian pressure 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 [X] If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "

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. drawdown after hrs.
Airtest 15 gal./min. with stem set at 39 ft. for 1 hrs.
Artesian flow g.p.m. Date 4-27-92
Temperature of water Was a chemical analysis made? Yes [ ] No [ ]

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

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 information.

MATERIAL	FROM	TO
EXISTING 12" HAND DUG	0	12
BROWN SILTY CLAY + GRAVEL	12	24
GREY CLAY + SHALE	24	40

PR 0[redacted]

Work started 4-27, 19. Completed 4-27, 1992

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 TUMWATER DRILLING INC. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address LEAVENWORTH, WASH.
(Signed) [signature] (WELL DRILLER) License No. 1249
Contractor's Registration No. TUMWAD 1350L Date 4-28, 1992

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. ________ Permit No. ________

(1) OWNER: Name Rich McCandless Address P.O. Box 332, Deyden Wa.

(2) LOCATION OF WELL: County Chelan SW ¼ SE ¼ Sec. 27 T. 24 N., R. 18 W.M.

Bearing and distance from section or subdivision corner Lot 10 UmBarg Flats

(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 ☐ Deepened ☒ Reconditioned ☐

Method: Dug ☐ Bored ☐ Cable ☒ Driven ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well ________ inches.
Drilled ________ ft. Depth of completed well ________ ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from -8 ft. to 27 ft.
Threaded ☐ ________" Diam. from ________ ft. to ________ ft.
Welded ☐ ________" Diam. from ________ 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 ________
Type ________ Model No. ________
Diam. ________ Slot size ________ from ________ ft. to ________ ft.
Diam. ________ Slot size ________ from ________ ft. to ________ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ________
Gravel placed from ________ ft. to ________ ft.

Surface seal: Yes ☐ No ☒ To what depth? ________ ft.
Material used in seal ________
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 ________ ft.
Static level 17 ft. below top of well Date 11/3/86
Artesian pressure ________ 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: ________ gal./min. with ________ ft. drawdown after ________ hrs.
" " " "
" " " "

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 15 gal./min. with 4 ft. drawdown after 1 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.*

MATERIAL	FROM	TO
Gravel + Sand	18	27
Sandstone	27	30

Work started ________, 19____ Completed 11/3, 1986

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 Glessner Drilling Inc (Person, firm, or corporation) (Type or print)

Address Box 7174 E. Wenatchee

[Signed] Wesley Glessner (Well Driller)

License No. 0154 Date 11/3, 1986

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

45

Prosecution Landfill

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 25534

Water Right Permit No. ______

(1) OWNER: Name Craig Carson / Lakeside Orchards Address 9230 Deadman's Hill Rd. Peshastin Wa 98847

(2) LOCATION OF WELL: County CHELAN [redacted] T24 N

(2a) STREET ADDRESS OF WELL (or nearest address) ~~NW Sec 27 204 18 M~~

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

(4) TYPE OF WORK: Owner's number of well (if more than one) 2
Abandoned [ ] New well [X] Deepened [ ] Reconditioned [ ]
Method: Dug [ ] Cable [ ] Rotary [X] Bored [ ] Driven [ ] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 299 feet. Depth of completed well 299 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from +1 1/2 ft. to 218 ft.
Welded [X] 4 1/2" Diam. from 236 ft. to ______ ft.
Liner installed [X]
Threaded [ ] ______" Diam. from ______ ft. to ______ ft.

Perforations: Yes [X] No [ ]
Type of perforator used SKIL SAW
SIZE of perforations 1/8 in. by 7 in.
66 perforations from 259 ft. to 299 ft.
______ perforations from ______ ft. to ______ ft.
______ perforations from ______ ft. to ______ ft.

Screens: Yes [ ] No [X]
Manufacturer's Name ______
Type ______ Model No. ______
Diam. ______ Slot size ______ from ______ ft. to ______ ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.

Gravel packed: Yes [ ] No [X] Size of gravel ______
Gravel placed from ______ ft. to ______ ft.

Surface seal: Yes [X] No [ ] To what depth? 20 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes [X] No [ ]
Type of water? LAND FILL DRAINAGE Depth of strata 30'
Method of sealing strata off CASED

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ______ ft.
Static level 114 ft. below top of well Date 12-20-88
Artesian pressure ______ 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 [X] If yes, by whom? ______
Yield: ______ gal./min. with ______ ft. drawdown after ______ hrs.

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

JAN 30 1989

Date of test ______
Bailer test ______ gal./min. with ______ ft. drawdown after ______ hrs.
Airtest 42 gal./min. with stem set at 298 ft. for 1 1/2 hrs.
Artesian flow ______ g.p.m. Date ______
Temperature of water ______ Was a chemical analysis made? Yes [ ] No [X]

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

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 information.

MATERIAL	FROM	TO
BROWN CLAY	0	68
WHITISH/GREY CLAY	68	87
DK GREY CLAY	87	150
BROWN CLAY	150	160
GREENISH/GREY SANDY HARD CLAY	160	163
GREY & BROWN FRACTURED SANDSTONE w/ CLAY WB* 8-10 GPM	163	193
BROWN PACKED SANDY CLAY	193	212
BROWN GUMBO CLAY	212	214
GREY/BLUE GUMBO CLAY	214	217
GREY SHALE 1 1/2 GPM @ 216-271	217	278
BROKEN BROWN SANDSTONE 40 GPM	278	281
BROWN SANDSTONE	281	299

* WATER FOAMED UP ALOT - SEEMED TO STING CUTS & SORES ON HAND. GARBAGE LAND FILL NEAR BY. DRAINAGE ???

Work started 12-15, 19__ Completed 12-20, 1988

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 TUMWATER DRILLING INC. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address LEAVENWORTH, WASH.
(Signed) [signature] (WELL DRILLER) License No. 1249
Contractor's Registration No. TUMWADI-133OC Date 12-30, 1988

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-

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

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W 114960
Unique Well I.D. # AFE473
Water Right Permit No.

(1) OWNER: Name REIMAN, WALTER L. Address P.O.BOX 26 DRYDEN, WA 98821-0026

(2) LOCATION OF WELL: County CHELAN NW1/4 SW1/4 Sec 37 T.24 N., R.18E WM
(2a) STREET ADDRESS OF WELL (or nearest address) 8722 SCHOOL ST., DRYDEN

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one)
NEW WELL Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 60 ft. Depth of completed well 59 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Dia. from +1 ft. to 59 ft.
WELDED W/TUBEX " Dia. from ft. to ft.
" Dia. from ft. to ft.

Perforations: 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: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 19 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
Method of sealing strata off SEAL METHOD 1

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 31.5 ft. below top of well Date 10/28/99
Artesian Pressure lbs. per square inch Date
Artesian water controlled by CAP

(10) WELL LOG M

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 in formation.

MATERIAL	FROM	TO
LOAMY BROWN CLAY	0	4
SANDY GRAVEL	4	7
BROWN CLAY ROCKY GRAVEL BOULDER (S)	7	31
BROWN GRAVEL WATER BEARING	31	39
BLACK BROKEN ROCK [illegible]	39	44
BROWN CLAY GRAVEL	44	48
BLACK BROKEN ROCK [illegible]	48	53
BROWN SANDY GRAVEL WATER BEARING	53	60

RECEIVED

DEPT OF ECOLOGY

Work started 10/28/99 Completed 10/28/99

(9) 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 hrs.

Recovery data
Time Water Level Time Water Level Time Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 54 gal/min. w/ stem set at 58 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

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 TUMWATER DRILLING, INC.
(Person, firm, or corporation) (Type or print)

ADDRESS P.O.BOX 777

[SIGNED] License No. 1249

Contractor's Registration No. TUMWADP 011 LZ Date 10/29/99

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. ——
Permit No. ——

(1) OWNER: Name Lakeside Orchard Address P.O. Box 357 Peshastin Wa. 98847

LOCATION OF WELL: County Chelan — SW ¼ NW ¼ Sec. 27 T. 24 N., R. 18 E W.M.

Bearing and distance from section or subdivision corner

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

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

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 187 ft. Depth of completed well 187 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 185 ft.
Threaded [ ] " Diam. from ft. to ft.
Welded [X] " Diam. from ft. to ft.

Perforations: Yes [ ] No [X]
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 [X]
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes [ ] No [X] Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes [X] No [ ] To what depth? 18 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes [ ] No [X]
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 ft.
Static level 84½ ft. below top of well Date 11-7-83
Artesian pressure 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 [X] If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.

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 30+ gal./min. with 66 ft. drawdown after 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes [ ] No [X]

(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.*

MATERIAL	FROM	TO
BROWN GUMBO CLAY	0	28
GRAY CLAY	28	41
BROWN GRITTY CLAY	41	110
RUST-ORANGE CLAY + GRAVEL	110	116
SANDY GRAY CLAY	116	149
BLUE-GRAY QUICKSAND	149	163
GRAY GUMBO CLAY	163	168
BLUE SANDY CLAY	168	185
GRAY SANDSTONE	185	187

Work started 11-1, 1983 Completed 11-7, 1983

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 TUMWATER DRILLING INC (Person, firm, or corporation) (Type or print)

Address Rt. 1 Box 83C LEAVENWORTH

[Signed] [signature] (Well Driller)

License No. 1249 Date 11-8, 1983

CR 2-16-84

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

99119

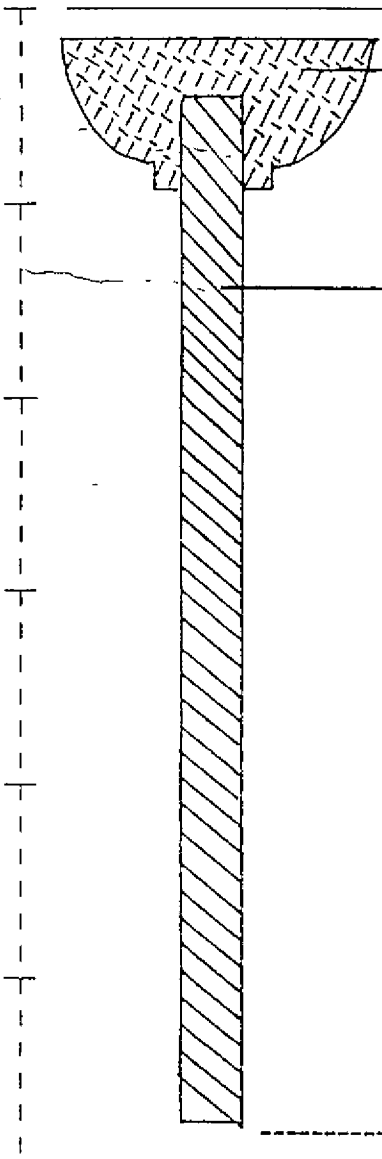
SOIL BORING REPORT

Notification # S 07296

Project Name: WEN-007B Cell Tower
Drilling Method: HSA
Driller: Brian G Gose
Firm: Cascade Drilling, Inc.
Signature: [signature]
Consulting Firm: STI-NW
Representative: Paul Nelson

County: Chelan
Location: SW1/4 NW1/4 Sec 27 T 24N R 18E
Street Address of Boring:
9149 - Deadman Hill Rd, Dryden
Water Level Elevation: N/A
Ground Surface Elevation: N/A
Date of Drilling: 6/6/07

Invoice # 1364

AS-BUILT	WELL DATA	FORMATION DESCRIPTION
	Concrete Surface Seal	0 - 10 ft. Brown sand + silt
	Backfill bent chips	10 - 34 ft Brown sandstone
		- ft
	Depth of Boring 34 ' "	

SCALE 1" = ______ PAGE ____ OF ____

ECY 050-12 (Rev 11/89)

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

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. E
Permit No.

(1) OWNER: Name TOM GOODWIN Address 808 6th Ave Coulee Dam Wa. 99116

(2) LOCATION OF WELL: County CHELAN — SW ¼ NW ¼ Sec. 27 T. 24 N., R. 18 W.M.

Bearing and distance from section or subdivision corner

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

(4) TYPE OF WORK: Owner's number of well (if more than one) 3
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 156 ft. Depth of completed well 155 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from +1½ ft. to 121 ft.
Threaded ☐ 4½" Diam. from 95 ft. to 155 ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☒ No ☐
Type of perforator used SPAR + SKIL SAW
SIZE of perforations 1 + 7 in. by ¼ + 1/8 in.
150 perforations from 93 ft. to 110 ft.
39 perforations from 135 ft. to 155 ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

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

Surface seal: Yes ☒ No ☐ To what depth? 18 ft.
Material used in seal BENTONITE
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 ft.
Static level 90 ft. below top of well Date 6-30-87
Artesian pressure 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: gal./min. with ft. drawdown after hrs.
" " " "
" " " "

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 25 gal./min. with ft. drawdown after 1 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.*

MATERIAL	FROM	TO
BROWN SANDSTONE	0	6
BROWN HARD CLAY W/ SANDSTONE ROCKS	6	18
BROWN SOFT MOIST CLAY	18	121
HARD BROWN SAND + CLAY W/ SANDSTONE LAYERS	121	143
GRAVEL	143	145
BROWN SANDSTONE	145	148
SHALE	148	150
WATER BROWN SANDSTONE	150	156

RECEIVED JUL 23 1987 DEPARTMENT OF ECOLOGY CENTRAL REGIONAL OFFICE

Work started 6-25, 1987 Completed 6-30, 1987

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 TUMWATER DRILLING INC. (Person, firm, or corporation) (Type or print)

Address LEAVENWORTH, WASH.

[Signed] Brett [signature] (Well Driller)

License No. 1249 Date 06-30, 1987

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. E

Permit No.

(1) OWNER: Name TOM GOODWIN Address 808 6th Ave Coulee Dam Wa 9916

(2) LOCATION OF WELL: County CHELAN — SW ¼ NW ¼ Sec 27 T 24 N., R 18 W.M.

Bearing and distance from section or subdivision corner

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

(4) TYPE OF WORK: Owner's number of well (if more than one) 2
New well [X] Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary [X] Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 157 ft. Depth of completed well 156 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from +1½ ft. to 133 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded [X] " Diam. from ft. to ft.

Perforations: Yes [X] No ☐
Type of perforator used ROTARY STAR
SIZE of perforations 1 in. by ¼ in.
100 perforations from 115 ft. to 126 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No [X]
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No [X] Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes [X] No ☐ To what depth? 30 ft.
Material used in seal BENTONITE
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 78 ft. below top of well Date 6-25-87
Artesian pressure 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 [X] If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "

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 7 gal./min. with ft. drawdown after 1 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.

MATERIAL	FROM	TO
BROWN CLAY	0	3
BROWN SANDSTONE	3	6
BROWN CLAY	6	47
BROWN CLAY W/ SHALE + SANDSTONE PEBBLES	47	114
BROKEN SANDSTONE + CLAY	114	127
BROKEN BROWN SANDSTONE	127	132
GREY SANDSTONE	132	157

RECEIVED JUL 23 1987 DEPARTMENT OF ECOLOGY CENTRAL REGION OFFICE

Work started 6-24, 1987 Completed 6-25, 1987

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 TUMWATER DRILLING INC. (Person, firm, or corporation) (Type or print)

Address LEAVENWORTH, WASH.

[Signed] [signature] (Well Driller)

License No. 1249 Date 6- 1987

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

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

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. E

Permit No.

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

(1) OWNER: Name TOM GOODWIN Address 808 6th Ave Coulee Dam Wa 99116

(2) LOCATION OF WELL: County CHELAN SW ¼ NW ¼ Sec. 27 T. 24 N., R. 18 W.M.

Bearing and distance from section or subdivision corner

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

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

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 337 ft. Depth of completed well 325 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6" Diam. from +1½ ft. to 133 ft.
Threaded ☐ 4" PVC Diam. from 10 ft. to 325 ft.
Welded X " Diam. from ft. to ft.

Perforations: Yes X No ☐
Type of perforator used SKIL SAW
SIZE of perforations 1/8 in. by 7 in.
157 perforations from 225 ft. to 325 ft.
61 perforations from 165 ft. to 205 ft.
perforations from ft. to ft.

Screens: Yes ☐ No X
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

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

Surface seal: Yes X No ☐ To what depth? 18 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes ☐ No X
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 ft.
Static level 201 ft. below top of well Date 6-24-87
Artesian pressure 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 X No ☐ If yes, by whom? Tumwater Drlg.
Yield: 7 gal./min. with ft. drawdown after hrs.

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

RECEIVED
JUL 23 1987
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

Date of test 6-24-87
Bailer test 3 gal./min. with ft. drawdown after 1½ hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No X

(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.

MATERIAL	FROM	TO
BROWN CLAY	0	47
HARD BROWN CLAY + PEBBLES	47	63
BROWN SANDY CLAY	63	81
DECOMPOSED SANDSTONE	81	100
HARD BR. CLAY + SHALE PIECES	100	120
BROWN SANDY CLAY	120	122
SANDSTONE	122	124
BROWN SANDY CLAY	124	129
SANDSTONE	129	134
HARD SHALE	134	136
BROWN CLAY	136	161
BROWN HARD CLAY	161	184
HARD CLAY + PEA GRAVEL	184	216
GREY SANDSTONE	216	222
BROWN CLAY	222	232
BLACK GRAVEL WB	232	241
BROWN CLAY + GRAVEL	241	327
BROWN SANDY CLAY (CAVED IN)	327	337

Work started 6-11, 1987 Completed 6-16, 1987

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 TUMWATER DRILLING INC.
(Person, firm, or corporation) (Type or print)

Address LEAVENWORTH, WASH

[Signed] Brett [signature]
(Well Driller)

License No. 1249 Date 6-[illegible]-87

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

836d

Start Card No. 212618

Water Right Permit No. N

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

(1) OWNER: Name Marvin Landon Address Deadman Hill, Dryden, WA. 98821

(2) LOCATION OF WELL: County Chelan SW corner xx SW ¼ Sec 27 T. 24 N., R. 18 W.M.

(2a) STREET ADDORESS OF WELL (or nearest address)

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

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

Abandoned [ ] New well [X] Deepened [ ] Reconditioned [ ] Method: Dug [ ] Cable [ ] Rotary [X] Bored [ ] Driven [ ] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 200 feet. Depth of completed well 200 ft.

(6) CONSTRUCTION DETAILS:

Casing Installed: 6 " Diam. from +1 ft. to 74 ft.
Welded [X] 5 " Diam. from +2 ft. to 115 ft.
Liner installed [ ]
Threaded [ ] " Diam. from ft. to ft.

Perforations: Yes [ ] No [X]
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 [X]
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes [ ] No [X] Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes [X] No [ ] To what depth? 20 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes [ ] No [X]
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 ft.
Static level ft. below top of well Date
Artesian pressure 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 [X] If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.

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. drawdown after hrs.
Airtest 0 gal./min. with stem set at ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes [ ] No [X]

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

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 information.

MATERIAL	FROM	TO
Overburden	0	3
Sand & gravel	3	15
Sandstone, med., brown	15	75
Broken rock, grey	75	80
Sandstone, med., brown	80	95
Broken rock, grey	95	115
sandstone, brown, med.	115	200

Work started 2/11, 19. Completed 2/18, 1993

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 FOGLE PUMP & SUPPLY, INC. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 316 W. 5th Colville, WA. 99114

(Signed) Mike [signature] (WELL DRILLER) License No. 1451

Contractor's Registration No. FOGLEPS095L4 Date 2/19, 1993

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W081913
Unique Well I.D. # ACR848
Water Right Permit No.

(1) OWNER: Name LANDON, MARVIN   Address PO BOX 602 IRRIGON, OR 97844-

(2) LOCATION OF WELL: County CHELAN   - 1/4 SW 1/4 Sec 27 T 24 N., R 18 WM
(2a) STREET ADDRESS OF WELL (or nearest address) 9060 DEADMAN HILL RD,   L,M,N,P

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one) 2
NEW WELL   Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 84 ft. Depth of completed well 78 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Dia. from +2 ft. to 77 ft.
WELDED " Dia. from ft. to ft.
" Dia. from ft. to ft.

Perforations: 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: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 20 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
Method of sealing strata off CASING

(7) PUMP: Manufacturer's Name
Type NONE H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 58 ft. below top of well Date 04/15/98
Artesian Pressure lbs. per square inch Date
Artesian water controlled by CAP

(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 in formation.

MATERIAL	FROM	TO
CLAY BROWN SOFT	0	21
CLAY BROWN GRAVEL	21	32
CLAY BROWN MEDIUM	32	48
CLAY BROWN GRAVEL	48	55
BROKEN BASALT CLAY	55	74
SOFT	74	
BROKEN BASALT W/WATER	74	84
	84	

- 4 1998

Work started 04/15/98   Completed 04/15/98

(9) 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 hrs.

Recovery data
Time Water Level Time Water Level Time Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 5 gal/min. w/ stem set at 78 ft. for 1.5 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

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 FOGLE PUMP & SUPPLY, INC.
(Person, firm, or corporation) (Type or print)

ADDRESS 316 W. 5TH COLVILLE, WA

(SIGNED) [signature] License No. 2341

Contractor's Registration No. FOGLEPS095L4   Date 04/23/98

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W 087015
Unique Well I.D. # ACE377
Water Right Permit No.

(1) OWNER: Name MYRICK, LARRY & KAY Address P.O.BOX 206 DRYDEN, WA 98821-

(2) LOCATION OF WELL: County CHELAN - NE 1/4 SW 1/4 Sec 27 T 24 N., R 18E WM
(2a) STREET ADDRESS OF WELL (or nearest address) 8901 JOESEPHINE, DRYDEN

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one)
NEW WELL Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 40 ft. Depth of completed well 39 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Dia. from +1.5 ft. to 39 ft.
WELDED " Dia. from ft. to ft.
" Dia. from ft. to ft.

Perforations: 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: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 19 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? YES
Type of water? FIRST WATER Depth of strata 12 ft.
Method of sealing strata off SEAL METHOD 1

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

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 5 ft. below top of well Date 02/19/96
Artesian Pressure lbs. per square inch Date
Artesian water controlled by CAP

(9) 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 hrs.

Recovery data
Time Water Level Time Water Level Time Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 95+ gal/min. w/ stem set at 38 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? 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 in formation.

MATERIAL	FROM	TO
BROWN SAND	0	4
BROWN SANDY GRAVEL COBBLES	4	16
WATER BEARING	4	16
GRAY HARDPAN COBBLES	16	31
SANDY GRAVEL WATER BEARING	31	40

RECEIVED APR 8 1996

Work started 02/19/96 Completed 02/19/96

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 TUMWATER DRILLING, INC.
(Person, firm, or corporation) (Type or print)

ADDRESS P.O.BOX 777, LEAVENWORTH

[SIGNED] License No. 1249

Contractor's Registration No. TUMWADI 1330C Date 02/21/96

336

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy (Bill Tydings)

WATER WELL REPORT P

STATE OF WASHINGTON

Start Card No. 16180 25525

Water Right Permit No.

(1) OWNER: Name CASHMERE VALLEY BANK Address PO Box G. Cashmere Wa. 98815

(2) LOCATION OF WELL: County CHELAN SE ¼ SW ¼ Sec 22 T 24 N., R 18 W.M.

(2a) STREET ADDRESS OF WELL (or nearest address) 9020 FOSTER RD. CASHMERE

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

(4) TYPE OF WORK: Owner's number of well (if more than one)
Abandoned [ ] New well [X] Deepened [ ] Reconditioned [ ] Method: Dug [ ] Cable [ ] Rotary [X] Bored [ ] Driven [ ] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 78 feet. Depth of completed well 78 ft.

(6) CONSTRUCTION DETAILS:
* Casing installed: 6 " Diam. from +1½ ft. to 78 ft.
Welded [X] " Diam. from ft. to ft.
Liner installed [ ] " Diam. from ft. to ft.
Threaded [ ]

Perforations: Yes [ ] No [X]
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 [X]
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes [ ] No [X] Size of gravel
Gravel placed from ft. to ft.

Surface seal: Yes [X] No [ ] To what depth? 18 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes [ ] No [X]
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name Webtrol
Type: Submersible H.P. 3/4

(8) WATER LEVELS: Land-surface elevation above mean sea level
Static level 60 ft. below top of well Date 11-10-88
Artesian pressure 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 [X] If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.

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. drawdown after hrs.
Airtest 17 gal./min. with stem set at 76 ft. for 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes [ ] No [X]

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

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 information.

MATERIAL	FROM	TO
GRAVEL + ROCKS	0	39
SAND	39	44
GRAVEL + ROCKS	44	62
SAND	62	71
ROCKS	71	76
SANDY CLAY + GRAVEL	76	78

* ODEX
5½" DRIVE SHOE

RECEIVED
DEC - 7 1988
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

Work started 11-4, 19 Completed 11-4, 1988

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 TUMWATER DRILLING Inc. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address LEAVENWORTH, WASH
(Signed) [signature] (WELL DRILLER) License No. 1249
Contractor's Registration No. TUMWADI-B30C Date 11-12, 1988

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329-

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

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. P
Permit No.

(1) OWNER: Name AL K SMITH Address 9010 Foster Rd. Cashmere Wa 98826

(2) LOCATION OF WELL: County [redacted] [redacted] CHELAN — SE ¼ SW ¼ Sec. 22 T. 24 N., R. 18 W.M.

Bearing and distance from section or subdivision corner

(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 ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 42 ft. Depth of completed well 39 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from +1½ ft. to 39 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from 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
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

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

Surface seal: Yes ☒ No ☐ To what depth? 18 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name GRUNFOS
Type: SUBMERSIBLE H.P. ½

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 22 ft. below top of well Date 11-20-86
Artesian pressure 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: gal./min. with ft. drawdown after hrs.
" " " "
" " " "

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 15 gal./min. with ft. drawdown after 1 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.*

MATERIAL	FROM	TO
BROWN LOAM	0	14
GRAVEL, SAND + ROCKS	14	42

RECEIVED
DEC 10 1986
DEPARTMENT OF ECOLOGY
CENTRAL REGIONAL OFFICE

Work started 11-19, 19 86 Completed 11-20, 19 86

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 TUMWATER DRILLING INC. (Person, firm, or corporation) (Type or print)

Address LEAVENWORTH, WASH.

[Signed] (signature) (Well Driller)

License No. 1249 Date 11-27, 19 86

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. P

Permit No.

(1) OWNER: Name PAUL HERRON Address 9014 Foster Rd. Cashmere Wa. 98815

LOCATION OF WELL: County CHELAN SE ¼ SW ¼ Sec 22 T 24 N., R 18 W.M.

Bearing and distance from section or subdivision corner

(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 ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 64 ft. Depth of completed well 63 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from +1½ ft. to 63 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☒ " Diam. from 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
Type Model No.
Diam. Slot size from ft. to ft.
Diam Slot size from ft. to ft.

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

Surface seal: Yes ☒ No ☐ To what depth? 18 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name WEBTROL
Type: SUBMERSIBLE H.P. 1/2

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 46 ft. below top of well Date 8-27-86
Artesian pressure 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: gal./min. with ft. drawdown after hrs.

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 12 gal/min. with ft. drawdown after 1 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.*

MATERIAL	FROM	TO
SAND, GRAVEL + COBBLE STNS	0	33
GRAVEL + ROCKS	33	64

RECEIVED OCT 2 1986 DEPARTMENT OF ECOLOGY CENTRAL REGION OFFICE

Work started 8-26, 1986. Completed 8-27, 1986

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 TUMWATER DRILLING INC. (Person, firm, or corporation) (Type or print)

Address LEAVENWORTH, WASH.

[Signed] Brett [signature] (Well Driller)

License No. 1249 Date 9-12, 1986

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

64-27392

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. 64-27392

Permit No. 1

(1) OWNER: Name Willow Springs Orchard Jack Griffith Address Pine Flats Lp Rd. Dryden Wash

(2) LOCATION OF WELL: County Chelan — SE ¼ SW ¼ Sec. 22 T. 24 N., R. 18 W.M.

Bearing and distance from section or subdivision corner

(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 ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 41 ft. Depth of completed well 41 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 8" Diam. from 0 ft. to 41 ft.
Threaded ☐ ...." Diam. from ... ft. to ... ft.
Welded ☑ ...." Diam. from ... 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....
Type .... Model No....
Diam. .... Slot size .... from .... ft. to .... ft.
Diam. .... Slot size .... from .... ft. to .... ft.

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

Surface seal: Yes ☑ No ☐ To what depth? 18 ft.
Material used in seal Bentonite
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.... ft.
Static level 22 ft. below top of well Date 4-25-80
Artesian pressure .... 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: .... gal./min. with .... ft. drawdown after .... hrs.

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 75 gal./min. with 5 ft. drawdown after 1½ hrs.
Artesian flow .... g.p.m. Date ....
Temperature of water 55 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.*

MATERIAL	FROM	TO
Loam over lay	0	6
clay and river rock	6	12
cemented gravel	12	35
clean large gravel	35	40
clay and gravel	40	41

Work started 4-24 1980 Completed 4-25 1980

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 Tumwater Drilling Corp. (Person, firm, or corporation) (Type or print)

Address Rt 1 Box 133C Leavenworth, WA

[Signed] Clayton Rhythias (Well Driller)

License No. 0950 Date 4/30 1980

(USE ADDITIONAL SHEETS IF NECESSARY)

DK 11-20-80

ECY 050-1-20

DEPARTMENT OF ECOLOGY State of Washington

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

Construction/Decommission *("x" in circle)*

☒ Construction 417429

☐ Decommission *ORIGINAL INSTALLATION*

Notice of Intent Number ______

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other ______

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

☒ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven ☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 259 ft. Depth of completed well 259 ft.

CONSTRUCTION DETAILS

Casing Installed: ☒ Welded 6" Diam. from +1 1/2 ft. to 46 1/2 ft.
☒ Liner installed 4" Diam. from -25 ft. to 259 ft.
☐ Threaded ______" Diam. From ______ ft. to ______ ft.

Perforations: ☒ Yes ☐ No

Type of perforator used Saw cut & rotary mills knife***

SIZE of perfs 1/8 in. by 9 in. and no. of perfs 38 from 225 ft. to 259 ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location ______

Manufacturer's Name ______

Type ______ Model No. ______

Diam. ______ Slot size ______ from ______ ft. to ______ ft.
Diam. ______ Slot size ______ from ______ ft. to ______ ft.

Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand ______

Materials placed from ______ ft. to ______ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 19 ft.

Material used in seal Bentonite

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 above mean sea level 1018 ft.

Static level 64 ft. below top of well Date 06-06-11

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: ______ gal./min. with ______ ft. drawdown after ______ hrs.
Yield: ______ gal./min. with ______ ft. drawdown after ______ hrs.
Yield: ______ gal./min. with ______ ft. drawdown after ______ hrs.

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. drawdown after ______ hrs.

Airtest 37 gal./min. with stem set at 258 ft. for 1 hrs.

Artesian flow ______ g.p.m. Date 06-06-11

Temperature of water ______ Was a chemical analysis made? ☐ Yes ☒ No

CURRENT

Notice of Intent No. W 301427

Unique Ecology Well ID Tag No. BCF 501

Water Right Permit No. ______

Property Owner Name Pearmont Inc.

Well Street Address 8343 Pine Flats Loop Rd.

City Cashmere County Chelan

Location SW1/4-1/4 NW1/4 Sec 35 Twn 24 R 18 EWM ☒ Or WWM ☐

(s, t, r Still REQUIRED)

Lat/Long Lat Deg N 47 Lat Min/Sec 32.059
Long Deg W 120 Long Min/Sec 33.419

Tax Parcel No. (Required) 241835 230 050

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Brown clay	0	8
Brown clay, gravel, rocks	8	13
Brown sand	13	16
Brown sandy clay, cobbles	16	29
Brown sand, gravel	29	35
Brown sandy clay, gravel,		
rocks WB	35	46
Brown sandstone	46	53
Gray soft sandstone	53	93
Black shale	93	97
Gray sandstone w/ shale	97	123
Lt. gray sandstone	123	151
Gray sandstone / shale	151	160
Shale	160	172
Lt. gray sandstone	172	202
Black shale	202	205
Lt. gray sandstone	205	214
Shale	214	216
Gray sandstone	216	248
15+ gpm @ 235-238'		
Crumbly black shale WB	248	252
Gray sandstone	252	259
*** Casing perferated @		
38-45' w/ static of 36 =3 gpm		
Cascading after finding water		
down at 235-252'. Placed		
shale packer on PVC liner at		
65' with bentonite to		
separate the two waters.		

RECEIVED JUN 24 2011 DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

Start Date 06-03-11 Completed Date 06-06-11

WELL CONSTRUCTION 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.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Brett Phythian

Driller/Engineer/Trainee Signature [signature]

Driller or trainee License No. 1249

IF TRAINEE: Driller's License No:

Driller's Signature:

Drilling Company Tumwater Drilling & Pump Inc.

Address P.O.Box 777 / 9290 Hwy 2

City, State, Zip Leavenworth, WA, 98826

Contractor's Registration No. TUMWADIP011LZ Date 06-07-2011

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W 087215
Unique Well I.D. # ACI553
Water Right Permit No.

(1) OWNER: Name TALLEY, ROBERT D. Address P.O.BOX 302 DRYDEN, WA 98821-

(2) LOCATION OF WELL: County CHELAN - SE 1/4 SW 1/4 Sec 27 T 24 N., R 18E WM
(2a) STREET ADDRESS OF WELL (or nearest address) 9081 DEADMAN HILL RD., DRYDEN

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one)
NEW WELL Method: ROTARY

(5) DIMENSIONS: Diameter of well 6 inches
Drilled 649 ft. Depth of completed well 649 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Dia. from +1.5 ft. to 107 ft.
WELDED W/LINER 4 " Dia. from -99 ft. to 649 ft.
" Dia. from ft. to ft.

Perforations: YES
Type of perforator used SKILL SAW
SIZE of perforations .125 in. by 7 in.
27 perforations from 469 ft. to 489 ft.
27 perforations from 569 ft. to 589 ft.
72 perforations from 609 ft. to 649 ft.
~~27~~ ~~389~~ ~~409~~

Screens: NO
Manufacturer's Name
Type Model No.
Diam. slot size from ft. to ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 20 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
Method of sealing strata off SEAL METHOD 1

(7) PUMP: Manufacturer's Name GRUNFOS
Type SUBMERSIBLE H.P. 1.5

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 129 ft. below top of well Date 11/17/97
Artesian Pressure lbs. per square inch Date
Artesian water controlled by CAP

(9) 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 hrs.

Recovery data

Time	Water Level	Time	Water Level	Time	Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 5 gal/min. w/ stem set at 648 ft. for 4.5 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? 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 in formation.

MATERIAL	FROM	TO
BROWN CLAY	0	3
BROWN SANDY CLAY	3	25
BROWN CLAY	25	63
GRAY CLAY SHALE	63	67
BROWN CLAY SHALE	67	74
SHALE	74	77
BROWN CLAY	77	88
BRN. SANDSTONE	88	92
BROWN CLAY	92	104
BRN. SANDSTONE CLAY LAYER (S)	104	172
BROKEN BASALT	172	180
GRAY CLAY SHALE	180	186
FRACTURED GRAY SANDSTONE SHALE	186	211
GRAY SANDSTONE	211	237
SHALE	237	242
GRAY SANDSTONE	242	261
SHALE	261	297
GRAY SANDSTONE	297	303
SHALE	303	313
GRAY SANDSTONE	313	318
SHALE	318	334
GRAY SANDSTONE	334	350
SHALE	350	390
GRAY SANDSTONE	390	417
SHALE	417	454
GRAY SANDSTONE	454	489
WATER BEARING 3/4 gpm	460	480
SHALE	489	496
GRAY SANDSTONE	496	519
SHALE GRAY CLAY	519	536
GRAY SANDSTONE	536	562
SHALE WATER BEARING 1-1¼ gpm	562	573
GRAY SANDSTONE SHALE MIX	573	592

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CENTRAL REGION OFFICE

PLEASE SEE ATTACHED SHEET FOR ADDITIONAL FORMATIONS

Work started 11/11/97 Completed 11/14/97

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 TUMWATER DRILLING, INC.
(Person, firm, or corporation) (Type or print)

ADDRESS P.O.BOX 777,LEAVENWORTH

[SIGNED] License No. 1249

Contractor's Registration No. TUMWADI 1330 C Date 11/17/97

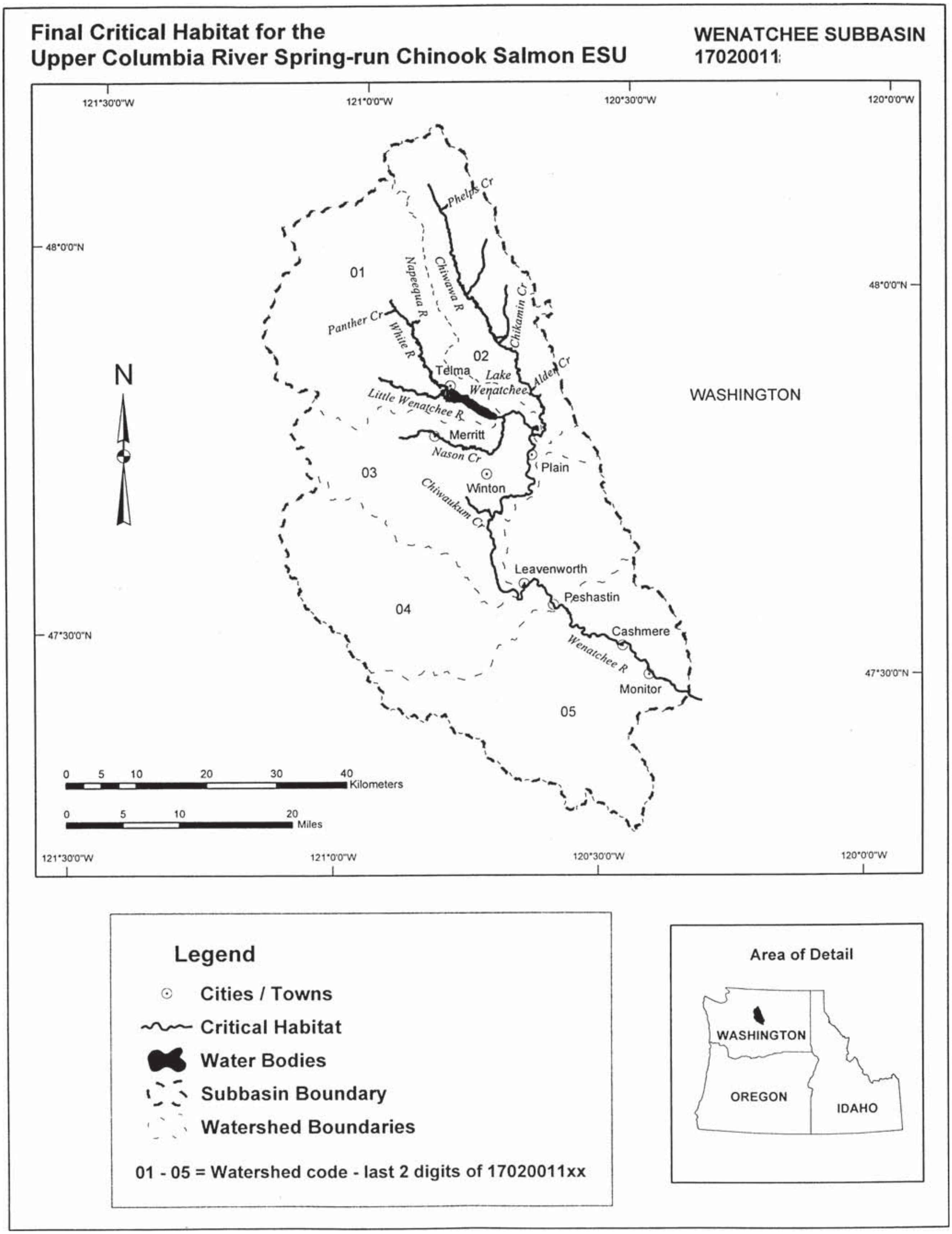
WATER WELL REPORT
STATE OF WASHINGTON
CONTINUATION SHEET

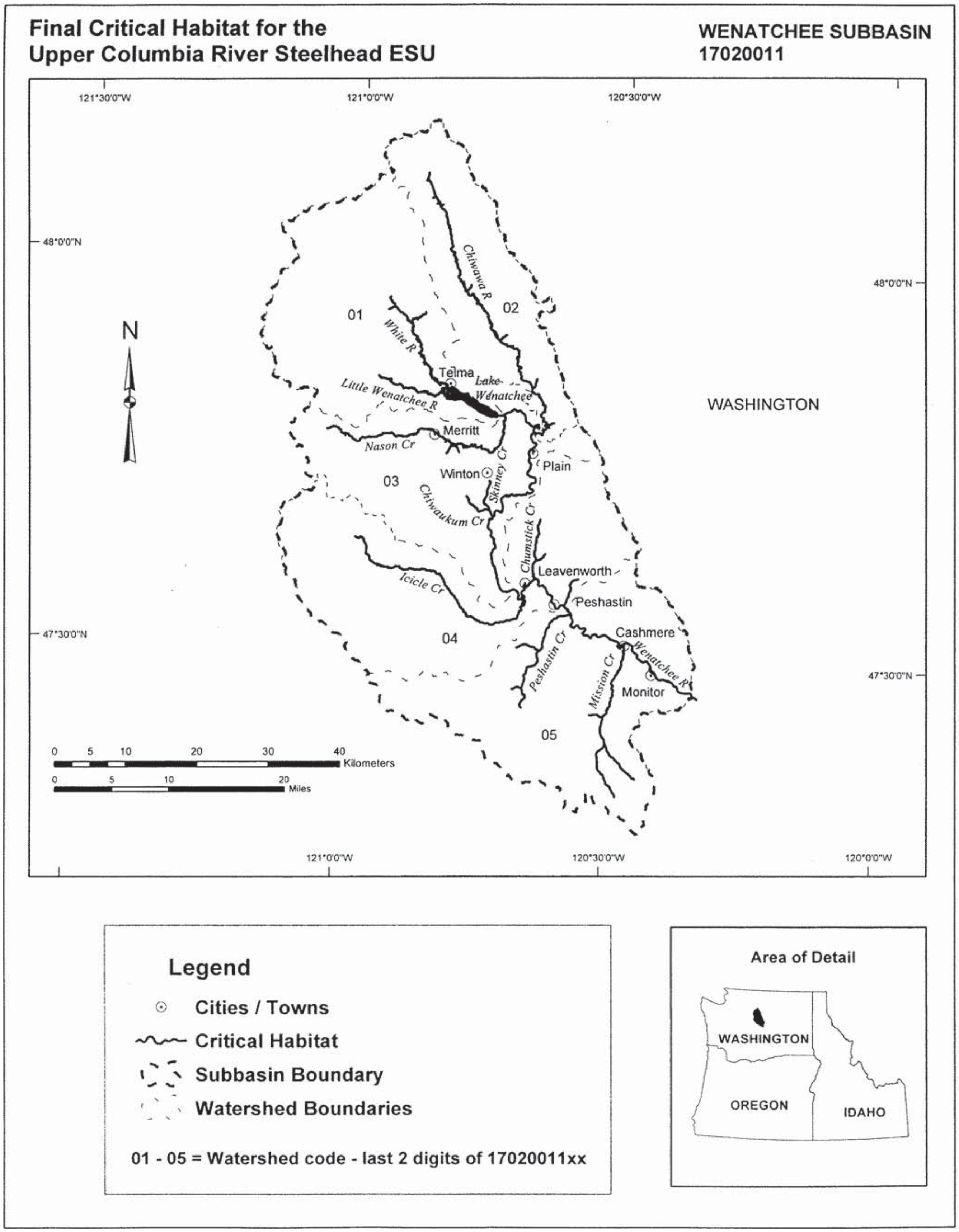
(10) WELL LOG

MATERIAL	FROM	TO
SHALE GRAY CLAY		592
GRAY SANDSTONE		603
SHALE		609
BLACK SHALE		618
GRAY SANDSTONE		620
BROKEN SHALE WATER BEARING 3-4gpm		623
GRAY SANDSTONE		630
SHALE		636
GRAY SANDSTONE		644

RECEIVED
NOV 20 1997
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

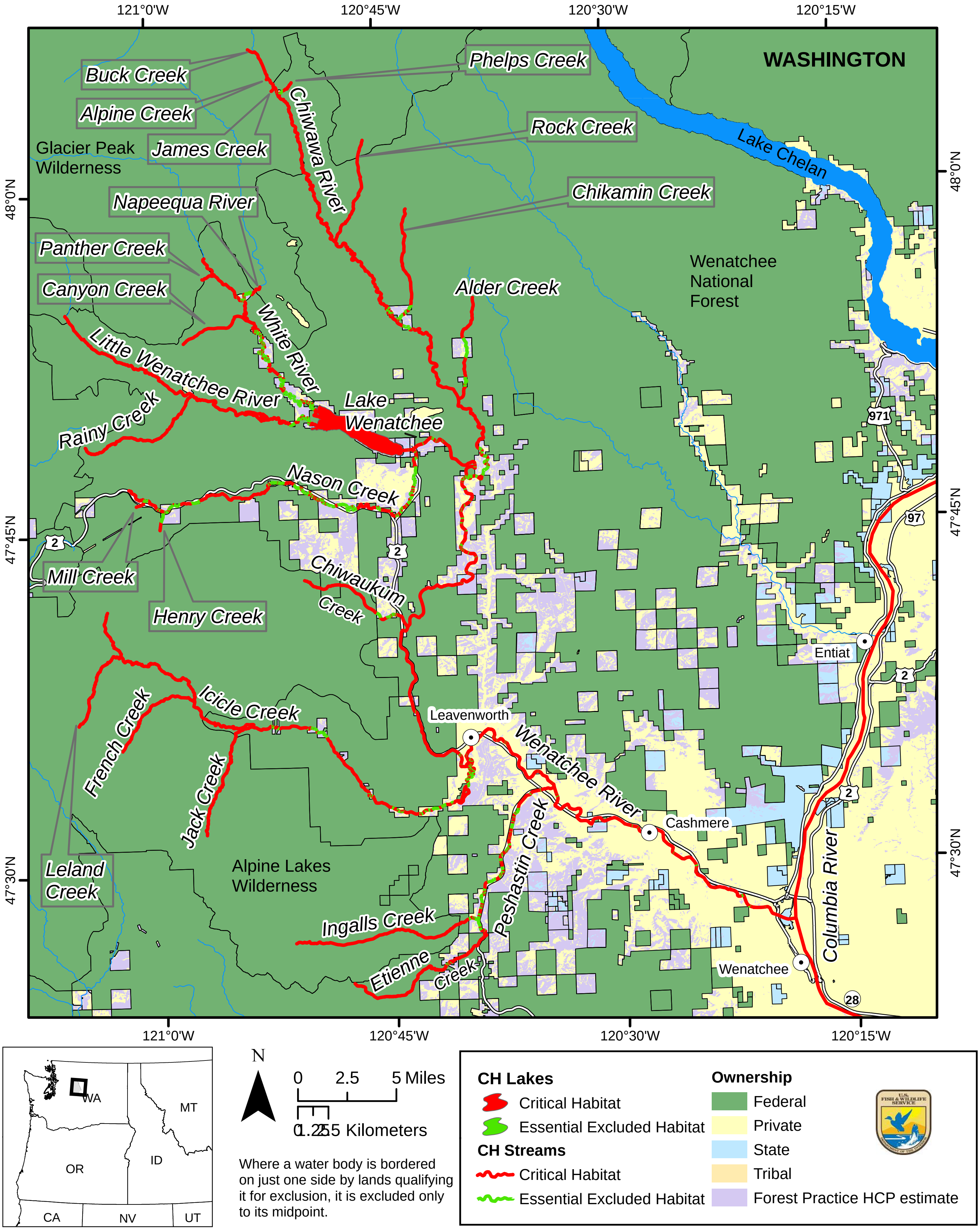
APPENDIX F
ENVIRONMENTAL REVIEW DATA

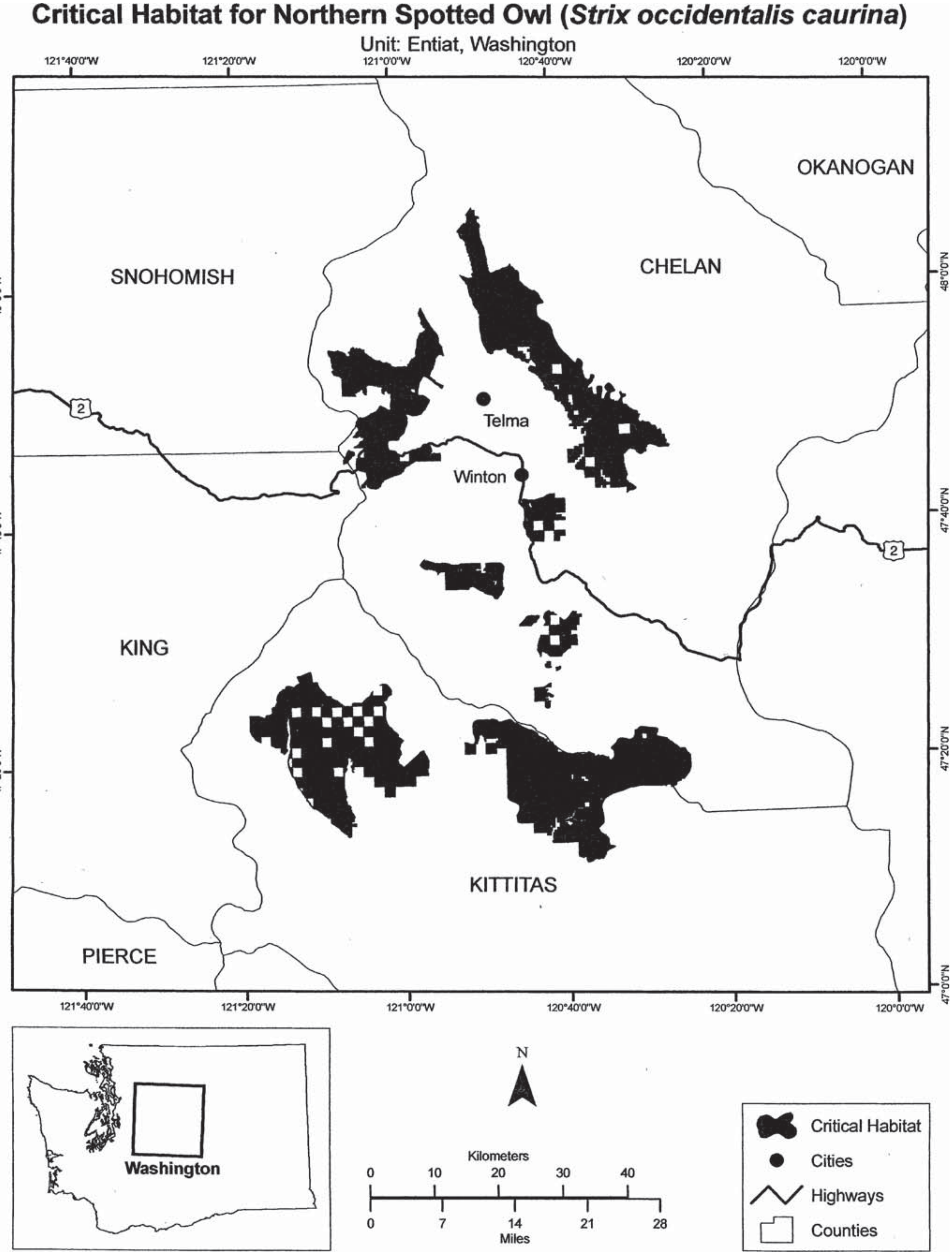

Final Critical Habitat for the
Upper Columbia River Spring-run Chinook Salmon ESU
WENATCHEE SUBBASIN
17020011
121°30'0"W
121°0'0"W
120°30'0"W
120°0'0"W
48°0'0"N
47°30'0"N
N
01
02
03
04
05
Phelps Cr
Chiwawa R
Napeequa R
Chikamin Cr
Panther Cr
White R
Telma
Lake Wenatchee
Alder Cr
Little Wenatchee R
Merritt
Nason Cr
Plain
Winton
Chiwaukum Cr
Leavenworth
Peshastin
Cashmere
Wenatchee R
Monitor
WASHINGTON
0 5 10 20 30 40 Kilometers
0 5 10 20 Miles
Legend
Cities / Towns
Critical Habitat
Water Bodies
Subbasin Boundary
Watershed Boundaries
01 - 05 = Watershed code - last 2 digits of 17020011xx
Area of Detail
WASHINGTON
OREGON
IDAHO


Final Critical Habitat for the
Upper Columbia River Steelhead ESU
WENATCHEE SUBBASIN
17020011
121°30'0"W
121°0'0"W
120°30'0"W
48°0'0"N
47°30'0"N
120°0'0"W
N
01
02
03
04
05
Chiwawa R
White R
Telma
Lake Wenatchee
Little Wenatchee R
Merritt
Nason Cr
Winton
Skinney Cr
Plain
Chiwaukum Cr
Chumstick Cr
Leavenworth
Icicle Cr
Peshastin
Cashmere
Peshastin Cr
Mission Cr
Wenatchee R
Monitor
WASHINGTON
0 5 10 20 30 40 Kilometers
0 5 10 20 Miles
Legend
Cities / Towns
Critical Habitat
Subbasin Boundary
Watershed Boundaries
01 - 05 = Watershed code - last 2 digits of 17020011xx
Area of Detail
WASHINGTON
OREGON
IDAHO

Critical Habitat for Bull Trout *(Salvelinus confluentus)*

Unit: 10, Upper Columbia River Basins, Sub-unit: Wenatchee River





BILLING CODE 4310–55–C

APPENDIX G
OPINIONS OF PROBABLE COST

Peshastin Irrigation District Pump Exchange Appraisal Study
Opinion of Probable Costs
Design Flow Rate = 10 CFS

D. Rice
20-Sep-12

ITEM	UNIT	UNIT COST	ALTERNATIVE 1		ALTERNATIVE 2		ALTERNATIVE 3		ALTERNATIVE 4		ALTERNATIVE 5	
			QTY	COST	QTY	COST	QTY	COST	QTY	COST	QTY	COST
Micellaneous Site Work												
Diversion and care of water	LS	VARIES	1	$30,000	1	$30,000	1	$30,000	1	$30,000	1	$30,000
Temporary & permanent access	LS	VARIES	1	$40,000	1	$18,000	1	$30,000	1	$20,000	1	$15,000
Erosion and sediment control	LS	VARIES	1	$8,000	1	$12,000	1	$8,000	1	$14,000	1	$12,000
Clearing and grubbing	AC	$3,500	0.9	$2,989	1.0	$3,668	0.9	$3,053	1.8	$6,248	0.2	$592
Subtotal - Miscellaneous Site Work				**$80,989**		**$63,668**		**$71,053**		**$70,248**		**$57,592**
Earthwork												
Excavation and stockpile, soil	CY	$6.00	902	$5,412	1,148	$6,889	1,014	$6,084	1,797	$10,783	2,545	$15,268
Excavation and stockpile, rock	CY	$15.00	601	$9,021	765	$11,482	676	$10,140	1,198	$17,972	1,696	$25,446
Backfill (imported material)	CY	$30.00	383	$11,504	548	$16,451	458	$13,752	983	$29,493	1,484	$44,514
Backfill (native material)	CY	$8.00	581	$4,647	774	$6,196	669	$5,351	1,285	$10,277	1,872	$14,978
Waste/Disposal of excess material	CY	$5.00	923	$4,613	1,139	$5,696	1,021	$5,105	1,711	$8,553	2,369	$11,844
Subtotal - Earthwork				**$35,197**		**$46,714**		**$40,432**		**$77,079**		**$112,050**
Pump Station and Intake Facility												
Reinforced Concrete Structure	LS	$60,000	1	$60,000	1	$60,000	1	$60,000	1	$60,000	1	$60,000
Steel Supports for Screen	LS	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000
Wedge Wire or Profile Bar Screen	SF	$300	32	$9,600	32	$9,600	32	$9,600	32	$9,600	32	$9,600
Air Blast or Other Screen Self-Cleaning System	LS	$90,000	1	$90,000	1	$90,000	1	$90,000	1	$90,000	1	$90,000
Vertical Turbine Pumps - 175-200 HP, VFD	EA	$140,000	2	$280,000	2	$280,000	2	$280,000	2	$280,000	2	$280,000
3-Phase Power Extension	LS	VARIES	1	$110,000	1	$50,000	1	$70,000	1	$50,000	1	$25,000
Electrical and Controls	LS	$110,000	1	$110,000	1	$110,000	1	$110,000	1	$110,000	1	$110,000
Piping, Valves, Meter and Appurtenances	LS	$40,000	1	$40,000	1	$40,000	1	$40,000	1	$40,000	1	$40,000
Subtotal - Pump Station and Intake Facility				**$724,600**		**$664,600**		**$684,600**		**$664,600**		**$639,600**
Delivery Pipeline												
20" CL 52 D.I. Pipe	LF	$115.00	1,391	$159,965	2,607	$299,805	1,654	$190,210	3,086	$354,890	4,876	$560,740
Fittings and Appurtenances	LF	$15.00	1,391	$20,865	2,607	$39,105	1,654	$24,810	3,086	$46,290	4,876	$73,140
U.S. Highway 2 Crossing	LS	VARIES	0	$0	1	$50,000	0	$0	1	$300,000	1	$300,000
Subtotal - Delivery Pipeline				**$180,830**		**$388,910**		**$215,020**		**$701,180**		**$933,880**
Outlet Structure												
Reinforced Concrete Outlet Structure	LS	$5,000.00	1	$5,000	1	$5,000	1	$5,000	1	$5,000	1	$5,000
Subtotal - Outlet Structure				**$5,000**		**$5,000**		**$5,000**		**$5,000**		**$5,000**
Construction Subtotal				**$1,027,000**		**$1,169,000**		**$1,016,000**		**$1,518,000**		**$1,748,000**
Mobilization / Demobilization	10.0%			$102,700		$116,900		$101,600		$151,800		$174,800
Contingency	30.0%			$338,910		$385,770		$335,280		$500,940		$576,840
Engineering, Permitting and Administration	20.0%			$225,940		$257,180		$223,520		$333,960		$384,560
Sales Tax	8.0%			$135,564		$154,308		$134,112		$200,376		$230,736
Allowance for Land Acquisition	LS	$50,000.00	1	$50,000	1	$50,000	1	$50,000	1	$50,000	1	$50,000
Total Project Cost				**$1,880,000**		**$2,133,000**		**$1,861,000**		**$2,755,000**		**$3,165,000**

Peshastin Irrigation District Pump Exchange Appraisal Study
Opinion of Probable Operating Costs
Design Flow Rate = 10 CFS

D. Rice
20-Sep-12

ITEM	UNIT	UNIT COST	ALIGNMENT 1 QTY	ALIGNMENT 1 COST	ALIGNMENT 2 QTY	ALIGNMENT 2 COST	ALIGNMENT 3 QTY	ALIGNMENT 3 COST	ALIGNMENT 4 QTY	ALIGNMENT 4 COST	ALIGNMENT 5 QTY	ALIGNMENT 5 COST
Annual Operations and Maintenance Cost[1]				**$11,920**		**$12,820**		**$11,920**		**$14,720**		**$16,120**
Pumping Power Costs[2]												
Monthly Basic Charge (3-Phase Power)	/EA/MO	$14.50	1	$14.50	1	$14.50	1	$14.50	1	$14.50	1	$14.50
Monthly Demand Charge	/HP/MO	$3.52	395	$1,390.40	400	$1,408.00	387	$1,362.24	369	$1,298.88	355	$1,249.60
Energy Charge												
2-Week Annual Pumping Duration	kWH	$0.0165	99,009	$1,633.65	100,262	$1,654.33	97,004	$1,600.56	92,492	$1,526.12	88,983	$1,468.22
4-Week Annual Pumping Duration	kWH	$0.0165	198,018	$3,267.30	200,525	$3,308.66	194,008	$3,201.13	184,984	$3,052.24	177,966	$2,936.44
6-Week Annual Pumping Duration	kWH	$0.0165	297,027	$4,900.95	300,787	$4,962.99	291,012	$4,801.69	277,476	$4,578.36	266,949	$4,404.65
8-Week Annual Pumping Duration	kWH	$0.0165	396,036	$6,534.60	401,050	$6,617.32	388,015	$6,402.26	369,968	$6,104.48	355,932	$5,872.87
Total Annual Pumping Costs												
2-Week Annual Pumping Duration				$8,658		$8,767		$8,484		$8,093		$7,789
4-Week Annual Pumping Duration				$10,292		$10,421		$10,085		$9,619		$9,257
6-Week Annual Pumping Duration				$11,925		$12,075		$11,685		$11,145		$10,725
8-Week Annual Pumping Duration				$13,559		$13,730		$13,286		$12,671		$12,193
Total Annual Operating Costs[3]												
2-Week Annual Pumping Duration				**$20,600**		**$21,600**		**$20,400**		**$22,800**		**$23,900**
4-Week Annual Pumping Duration				**$22,200**		**$23,200**		**$22,000**		**$24,300**		**$25,400**
6-Week Annual Pumping Duration				**$23,800**		**$24,900**		**$23,600**		**$25,900**		**$26,800**
8-Week Annual Pumping Duration				**$25,500**		**$26,500**		**$25,200**		**$27,400**		**$28,300**

Notes:
1) Annual Operations and Maintenance Costs include estimated salaries, benefits, transportation, maintenance, repairs, administration, insurance, and accounting, in 2012 dollars.
2) Pumping power costs are based on Chelan PUD Electrical Rate Schedule 5 (Irrigation Service), and are applied May through June, in 2012 dollars.
3) Rounded to nearest $100.

Peshastin Irrigation District Pump Exchange Appraisal Study
Opinion of Probable Costs
Design Flow Rate = 20 CFS

D. Rice
20-Sep-12

ITEM	UNIT	UNIT COST	ALIGNMENT 1 QTY	ALIGNMENT 1 COST	ALIGNMENT 2 QTY	ALIGNMENT 2 COST	ALIGNMENT 3 QTY	ALIGNMENT 3 COST	ALIGNMENT 4 QTY	ALIGNMENT 4 COST	ALIGNMENT 5 QTY	ALIGNMENT 5 COST
Micellaneous Site Work												
Diversion and care of water	LS	VARIES	1	$30,000	1	$30,000	1	$30,000	1	$30,000	1	$30,000
Temporary & permanent access	LS	VARIES	1	$42,000	1	$20,000	1	$32,000	1	$22,000	1	$17,000
Erosion and sediment control	LS	VARIES	1	$9,000	1	$13,000	1	$9,000	1	$15,000	1	$13,000
Clearing and grubbing	AC	$3,500	0.9	$2,989	1.0	$3,668	0.9	$3,053	1.8	$6,248	0.2	$592
Subtotal - Miscellaneous Site Work				**$83,989**		**$66,668**		**$74,053**		**$73,248**		**$60,592**
Earthwork												
Excavation and stockpile, soil	CY	$6.00	1,279	$7,674	1,631	$9,784	1,439	$8,633	2,558	$15,348	3,626	$21,756
Excavation and stockpile, rock	CY	$15.00	853	$12,789	1,087	$16,307	959	$14,388	1,705	$25,580	2,417	$36,259
Backfill (imported material)	CY	$30.00	549	$16,464	784	$23,507	656	$19,665	1,403	$42,077	2,115	$63,464
Backfill (native material)	CY	$8.00	738	$5,906	976	$7,808	846	$6,770	1,602	$12,820	2,324	$18,593
Waste/Disposal of excess material	CY	$5.00	1,393	$6,966	1,742	$8,709	1,552	$7,759	2,661	$13,304	3,719	$18,596
Subtotal - Earthwork				**$49,799**		**$66,115**		**$57,216**		**$109,128**		**$158,668**
Pump Station and Intake Facility												
Reinforced Concrete Structure	LS	$80,000	1	$80,000	1	$80,000	1	$80,000	1	$80,000	1	$80,000
Steel Supports for Screen	LS	$50,000	1	$50,000	1	$50,000	1	$50,000	1	$50,000	1	$50,000
Wedge Wire or Profile Bar Screen	SF	$300	64	$19,200	64	$19,200	64	$19,200	64	$19,200	64	$19,200
Air Blast or Other Screen Self-Cleaning System	LS	$115,000	1	$115,000	1	$115,000	1	$115,000	1	$115,000	1	$115,000
Vertical Turbine Pumps - 220-260 HP, VFD	EA	$160,000	3	$480,000	3	$480,000	3	$480,000	3	$480,000	3	$480,000
3-Phase Power Extension	LS	VARIES	1	$130,000	1	$60,000	1	$80,000	1	$60,000	1	$30,000
Electrical and Controls	LS	$160,000	1	$160,000	1	$160,000	1	$160,000	1	$160,000	1	$160,000
Piping, Valves, Meter and Appurtenances	LS	$60,000	1	$60,000	1	$60,000	1	$60,000	1	$60,000	1	$60,000
Subtotal - Pump Station and Intake Facility				**$1,094,200**		**$1,024,200**		**$1,044,200**		**$1,024,200**		**$994,200**
Delivery Pipeline												
30" CL 52 D.I. Pipe	LF	$160.00	1,391	$222,560	2,607	$417,120	1,654	$264,640	3,086	$493,760	4,876	$780,160
Fittings and Appurtenances	LF	$17.00	1,391	$23,647	2,607	$44,319	1,654	$28,118	3,086	$52,462	4,876	$82,892
U.S. Highway 2 Crossing	LS	VARIES	0	$0	1	$60,000	0	$0	1	$360,000	1	$360,000
Subtotal - Delivery Pipeline				**$246,207**		**$521,439**		**$292,758**		**$906,222**		**$1,223,052**
Outlet Structure												
Reinforced Concrete Outlet Structure	LS	$6,000.00	1	$6,000	1	$6,000	1	$6,000	1	$6,000	1	$6,000
Subtotal - Outlet Structure				**$6,000**		**$6,000**		**$6,000**		**$6,000**		**$6,000**
Construction Subtotal				**$1,480,000**		**$1,684,000**		**$1,474,000**		**$2,119,000**		**$2,443,000**
Mobilization / Demobilization	10.0%			$148,000		$168,400		$147,400		$211,900		$244,300
Contingency	30.0%			$488,400		$555,720		$486,420		$699,270		$806,190
Engineering, Permitting and Administration	20.0%			$325,600		$370,480		$324,280		$466,180		$537,460
Sales Tax	8.0%			$195,360		$222,288		$194,568		$279,708		$322,476
Allowance for Land Acquisition	LS	$50,000.00	1	$50,000	1	$50,000	1	$50,000	1	$50,000	1	$50,000
Total Project Cost				**$2,687,000**		**$3,051,000**		**$2,677,000**		**$3,826,000**		**$4,403,000**

Peshastin Irrigation District Pump Exchange Appraisal Study
Opinion of Probable Operating Costs
Design Flow Rate = 20 CFS

D. Rice
20-Sep-12

ITEM	UNIT	UNIT COST	ALIGNMENT 1 QTY	ALIGNMENT 1 COST	ALIGNMENT 2 QTY	ALIGNMENT 2 COST	ALIGNMENT 3 QTY	ALIGNMENT 3 COST	ALIGNMENT 4 QTY	ALIGNMENT 4 COST	ALIGNMENT 5 QTY	ALIGNMENT 5 COST
Annual Operations and Maintenance Cost[1]				**$14,220**		**$15,320**		**$14,120**		**$17,620**		**$19,320**
Pumping Power Costs[2]												
Monthly Basic Charge (3-Phase Power)	/EA/MO	$14.50	1	$14.50	1	$14.50	1	$14.50	1	$14.50	1	$14.50
Monthly Demand Charge	/HP/MO	$3.52	780	$2,745.60	786	$2,766.72	761	$2,678.72	716	$2,520.32	680	$2,393.60
Energy Charge												
2-Week Annual Pumping Duration	kWH	$0.0165	195,512	$3,225.94	197,016	$3,250.76	190,749	$3,147.36	179,470	$2,961.25	170,446	$2,812.36
4-Week Annual Pumping Duration	kWH	$0.0165	391,023	$6,451.89	394,031	$6,501.52	381,498	$6,294.72	358,939	$5,922.50	340,892	$5,624.72
6-Week Annual Pumping Duration	kWH	$0.0165	586,535	$9,677.83	591,047	$9,752.27	572,248	$9,442.09	538,409	$8,883.75	511,338	$8,437.08
8-Week Annual Pumping Duration	kWH	$0.0165	782,047	$12,903.77	788,062	$13,003.03	762,997	$12,589.45	717,879	$11,845.00	681,784	$11,249.44
Total Annual Pumping Costs												
2-Week Annual Pumping Duration				$17,026		$17,157		$16,613		$15,635		$14,853
4-Week Annual Pumping Duration				$20,252		$20,408		$19,761		$18,597		$17,665
6-Week Annual Pumping Duration				$23,478		$23,658		$22,908		$21,558		$20,478
8-Week Annual Pumping Duration				$26,704		$26,909		$26,056		$24,519		$23,290
Total Annual Operating Costs[3]												
2-Week Annual Pumping Duration				**$31,200**		**$32,500**		**$30,700**		**$33,300**		**$34,200**
4-Week Annual Pumping Duration				**$34,500**		**$35,700**		**$33,900**		**$36,200**		**$37,000**
6-Week Annual Pumping Duration				**$37,700**		**$39,000**		**$37,000**		**$39,200**		**$39,800**
8-Week Annual Pumping Duration				**$40,900**		**$42,200**		**$40,200**		**$42,100**		**$42,600**

Notes:
1) Annual Operations and Maintenance Costs include estimated salaries, benefits, transportation, maintenance, repairs, administration, insurance, and accounting, in 2012 dollars.
2) Pumping power costs are based on Chelan PUD Electrical Rate Schedule 5 (Irrigation Service), and are applied May through June, in 2012 dollars.
3) Rounded to nearest $100.

Peshastin Irrigation District Pump Exchange Appraisal Study
Opinion of Probable Costs
Design Flow Rate = 40 CFS

D. Rice
20-Sep-12

ITEM	UNIT	UNIT COST	ALIGNMENT 1 QTY	ALIGNMENT 1 COST	ALIGNMENT 2 QTY	ALIGNMENT 2 COST	ALIGNMENT 3 QTY	ALIGNMENT 3 COST	ALIGNMENT 4 QTY	ALIGNMENT 4 COST	ALIGNMENT 5 QTY	ALIGNMENT 5 COST
Micellaneous Site Work												
Diversion and care of water	LS	VARIES	1	$30,000	1	$30,000	1	$30,000	1	$30,000	1	$30,000
Temporary & permanent access	LS	VARIES	1	$18,000	1	$22,000	1	$18,000	1	$24,000	1	$31,000
Erosion and sediment control	LS	VARIES	1	$12,000	1	$15,000	1	$12,000	1	$18,000	1	$15,000
Clearing and grubbing	AC	$3,500	0.9	$2,989	1.0	$3,668	0.9	$3,053	1.8	$6,248	0.2	$592
Subtotal - Miscellaneous Site Work				**$62,989**		**$70,668**		**$63,053**		**$78,248**		**$76,592**
Earthwork												
Excavation and stockpile, soil	CY	$6.00	1,721	$10,326	2,146	$12,873	1,914	$11,484	3,265	$19,590	4,554	$27,326
Excavation and stockpile, rock	CY	$15.00	1,147	$17,209	1,430	$21,456	1,276	$19,140	2,177	$32,650	3,036	$45,543
Backfill (imported material)	CY	$30.00	667	$20,010	924	$27,719	771	$23,132	1,663	$49,890	2,514	$75,424
Backfill (native material)	CY	$8.00	914	$7,314	1,179	$9,429	1,034	$8,276	1,876	$15,005	2,678	$21,428
Waste/Disposal of excess material	CY	$5.00	1,954	$9,770	2,397	$11,986	2,155	$10,777	3,566	$17,830	4,912	$24,560
Subtotal - Earthwork				**$64,629**		**$83,464**		**$72,808**		**$134,965**		**$194,280**
Pump Station and Intake Facility												
Reinforced Concrete Structure	LS	$120,000	1	$120,000	1	$120,000	1	$120,000	1	$120,000	1	$120,000
Steel Supports for Screen	LS	$95,000	1	$95,000	1	$95,000	1	$95,000	1	$95,000	1	$95,000
Wedge Wire or Profile Bar Screen	SF	$300	128	$38,400	128	$38,400	128	$38,400	128	$38,400	128	$38,400
Air Blast or Other Screen Self-Cleaning System	LS	$185,000	1	$185,000	1	$185,000	1	$185,000	1	$185,000	1	$185,000
Vertical Turbine Pumps - 455-535 HP, VFD	EA	$250,000	3	$750,000	3	$750,000	3	$750,000	3	$750,000	3	$750,000
3-Phase Power Extension	LS	VARIES	1	$150,000	1	$70,000	1	$120,000	1	$70,000	1	$40,000
Electrical and Controls	LS	$250,000	1	$250,000	1	$250,000	1	$250,000	1	$250,000	1	$250,000
Piping, Valves, Meter and Appurtenances	LS	$110,000	1	$110,000	1	$110,000	1	$110,000	1	$110,000	1	$110,000
Subtotal - Pump Station and Intake Facility				**$1,698,400**		**$1,618,400**		**$1,668,400**		**$1,618,400**		**$1,588,400**
Delivery Pipeline												
36" CL 52 D.I. Pipe	LF	$210.00	1,391	$292,110	2,607	$547,470	1,654	$347,340	3,086	$648,060	4,876	$1,023,960
Fittings and Appurtenances	LF	$23.00	1,391	$31,993	2,607	$59,961	1,654	$38,042	3,086	$70,978	4,876	$112,148
U.S. Highway 2 Crossing	LS	VARIES	0	$0	1	$70,000	0	$0	1	$420,000	1	$420,000
Subtotal - Delivery Pipeline				**$324,103**		**$677,431**		**$385,382**		**$1,139,038**		**$1,556,108**
Outlet Structure												
Reinforced Concrete Outlet Structure	LS	$10,000.00	1	$10,000	1	$10,000	1	$10,000	1	$10,000	1	$10,000
Subtotal - Outlet Structure				**$10,000**		**$10,000**		**$10,000**		**$10,000**		**$10,000**
Construction Subtotal				**$2,160,000**		**$2,460,000**		**$2,200,000**		**$2,981,000**		**$3,425,000**
Mobilization / Demobilization	10.0%			$216,000		$246,000		$220,000		$298,100		$342,500
Contingency	30.0%			$712,800		$811,800		$726,000		$983,730		$1,130,250
Engineering, Permitting and Administration	20.0%			$475,200		$541,200		$484,000		$655,820		$753,500
Sales Tax	8.0%			$285,120		$324,720		$290,400		$393,492		$452,100
Allowance for Land Acquisition	LS	$50,000.00	1	$50,000	1	$50,000	1	$50,000	1	$50,000	1	$50,000
Total Project Cost				**$3,899,000**		**$4,434,000**		**$3,970,000**		**$5,362,000**		**$6,153,000**

Peshastin Irrigation District Pump Exchange Appraisal Study
Opinion of Probable Operating Costs
Design Flow Rate = 40 CFS

D. Rice
20-Sep-12

ITEM	UNIT	UNIT COST	ALIGNMENT 1 QTY	ALIGNMENT 1 COST	ALIGNMENT 2 QTY	ALIGNMENT 2 COST	ALIGNMENT 3 QTY	ALIGNMENT 3 COST	ALIGNMENT 4 QTY	ALIGNMENT 4 COST	ALIGNMENT 5 QTY	ALIGNMENT 5 COST
Annual Operations and Maintenance Cost[1]				**$17,820**		**$19,420**		**$18,020**		**$22,220**		**$24,620**
Pumping Power Costs[2]												
Monthly Basic Charge (3-Phase Power)	/EA/MO	$14.50	1	$14.50	1	$14.50	1	$14.50	1	$14.50	1	$14.50
Monthly Demand Charge	/HP/MO	$3.52	1,617	$5,691.84	1,633	$5,748.16	1,583	$5,572.16	1,501	$5,283.52	1,437	$5,058.24
Energy Charge												
2-Week Annual Pumping Duration	kWH	$0.0165	405,311	$6,687.63	409,321	$6,753.80	396,788	$6,547.01	376,235	$6,207.87	360,193	$5,943.18
4-Week Annual Pumping Duration	kWH	$0.0165	810,622	$13,375.25	818,642	$13,507.60	793,577	$13,094.02	752,469	$12,415.74	720,385	$11,886.36
6-Week Annual Pumping Duration	kWH	$0.0165	1,215,932	$20,062.88	1,227,964	$20,261.40	1,190,365	$19,641.03	1,128,704	$18,623.62	1,080,578	$17,829.54
8-Week Annual Pumping Duration	kWH	$0.0165	1,621,243	$26,750.51	1,637,285	$27,015.20	1,587,154	$26,188.04	1,504,939	$24,831.49	1,440,771	$23,772.72
Total Annual Pumping Costs												
2-Week Annual Pumping Duration				$35,219		$35,567		$34,480		$32,698		$31,307
4-Week Annual Pumping Duration				$41,907		$42,321		$41,027		$38,906		$37,250
6-Week Annual Pumping Duration				$48,595		$49,075		$47,574		$45,114		$43,193
8-Week Annual Pumping Duration				$55,282		$55,829		$54,121		$51,322		$49,136
Total Annual Operating Costs[3]												
2-Week Annual Pumping Duration				**$53,000**		**$55,000**		**$52,500**		**$54,900**		**$55,900**
4-Week Annual Pumping Duration				**$59,700**		**$61,700**		**$59,000**		**$61,100**		**$61,900**
6-Week Annual Pumping Duration				**$66,400**		**$68,500**		**$65,600**		**$67,300**		**$67,800**
8-Week Annual Pumping Duration				**$73,100**		**$75,200**		**$72,100**		**$73,500**		**$73,800**

Notes:
1) Annual Operations and Maintenance Costs include estimated salaries, benefits, transportation, maintenance, repairs, administration, insurance, and accounting, in 2012 dollars.
2) Pumping power costs are based on Chelan PUD Electrical Rate Schedule 5 (Irrigation Service), and are applied May through June, in 2012 dollars.
3) Rounded to nearest $100.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis
Alternative 1, Design Flow Rate = 10 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 50th Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$1,880,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$2,060,436
To Replace 50% After Life of Project		$4,120,872
To Replace 100% After Life of Project	$1,880,000	$8,241,743
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$52,607
To Replace 50% After Life of Project		$105,214
To Replace 100% After Life of Project	$48,000	$210,427
Total Replacement Cost:		
To Replace 25% After Life of Project		**$2,113,043**
To Replace 50% After Life of Project		**$4,226,085**
To Replace 100% After Life of Project	**$1,928,000**	**$8,452,171**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$18,733
To Replace 50% After Life of Project	$37,466
To Replace 100% After Life of Project	$74,933
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$9,929
To Replace 50% After Life of Project	$19,858
To Replace 100% After Life of Project	$39,717
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$20,184
To Replace 50% After Life of Project	$40,368
To Replace 100% After Life of Project	$80,736
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$42,261
To Replace 50% After Life of Project	$84,522
To Replace 100% After Life of Project	$169,043

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$482,000	$596,000	$432,908	**$1,510,908**
50% Replacement	$964,000	$596,000	$432,908	**$1,992,908**
100% Replacement	$1,928,000	$596,000	$432,908	**$2,956,908**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$482,000	$596,000	$514,590	**$1,592,590**
50% Replacement	$964,000	$596,000	$514,590	**$2,074,590**
100% Replacement	$1,928,000	$596,000	$514,590	**$3,038,590**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$482,000	$596,000	$596,273	**$1,674,273**
50% Replacement	$964,000	$596,000	$596,273	**$2,156,273**
100% Replacement	$1,928,000	$596,000	$596,273	**$3,120,273**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$482,000	$596,000	$677,955	**$1,755,955**
50% Replacement	$964,000	$596,000	$677,955	**$2,237,955**
100% Replacement	$1,928,000	$596,000	$677,955	**$3,201,955**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:	$1,880,000																							
Replacement Fund (For Funding Replacement of 25% of System):																								
Deposits		$9,929	$10,227	$10,534	$10,850	$11,175	$11,511	$11,856	$12,212	$12,578	$12,955	$13,344	$13,744	$14,157	$14,581	$15,019	$15,469	$15,933	$16,411	$16,904	$17,411	$17,933	$18,471	$19,025
Interest		$0	$298	$614	$948	$1,302	$1,676	$2,072	$2,490	$2,931	$3,396	$3,887	$4,404	$4,948	$5,521	$6,124	$6,758	$7,425	$8,126	$8,862	$9,635	$10,447	$11,298	$12,191
End of Year Balance		**$9,929**	**$20,454**	**$31,602**	**$43,400**	**$55,877**	**$69,064**	**$82,992**	**$97,693**	**$113,202**	**$129,554**	**$146,784**	**$164,932**	**$184,037**	**$204,139**	**$225,282**	**$247,510**	**$270,869**	**$295,406**	**$321,172**	**$348,218**	**$376,598**	**$406,367**	**$437,584**
Replacement Fund (For Funding Replacement of 50% of System):																								
Deposits		$19,858	$20,454	$21,068	$21,700	$22,351	$23,021	$23,712	$24,423	$25,156	$25,911	$26,688	$27,489	$28,313	$29,163	$30,038	$30,939	$31,867	$32,823	$33,808	$34,822	$35,866	$36,942	$38,051
Interest		$0	$596	$1,227	$1,896	$2,604	$3,353	$4,144	$4,980	$5,862	$6,792	$7,773	$8,807	$9,896	$11,042	$12,248	$13,517	$14,851	$16,252	$17,724	$19,270	$20,893	$22,596	$24,382
End of Year Balance		**$19,858**	**$40,908**	**$63,203**	**$86,799**	**$111,754**	**$138,128**	**$165,984**	**$195,387**	**$226,404**	**$259,107**	**$293,568**	**$329,864**	**$368,073**	**$408,278**	**$450,564**	**$495,020**	**$541,737**	**$590,812**	**$642,344**	**$696,436**	**$753,196**	**$812,734**	**$875,167**
Replacement Fund (For Funding Replacement of 100% of System):																								
Deposits		$39,717	$40,908	$42,136	$43,400	$44,702	$46,043	$47,424	$48,847	$50,312	$51,821	$53,376	$54,977	$56,627	$58,325	$60,075	$61,877	$63,734	$65,646	$67,615	$69,644	$71,733	$73,885	$76,101
Interest		$0	$1,192	$2,454	$3,792	$5,208	$6,705	$8,288	$9,959	$11,723	$13,584	$15,546	$17,614	$19,792	$22,084	$24,497	$27,034	$29,701	$32,504	$35,449	$38,541	$41,786	$45,192	$48,764
End of Year Balance		**$39,717**	**$81,817**	**$126,407**	**$173,598**	**$223,508**	**$276,256**	**$331,968**	**$390,773**	**$452,808**	**$518,214**	**$587,137**	**$659,728**	**$736,147**	**$816,556**	**$901,128**	**$990,040**	**$1,083,475**	**$1,181,625**	**$1,284,689**	**$1,392,873**	**$1,506,392**	**$1,625,469**	**$1,750,334**
Operations and Maintenance Expenses:																								
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]		$5,800	$5,974	$6,153	$6,338	$6,528	$6,724	$6,926	$7,133	$7,347	$7,568	$7,795	$8,029	$8,269	$8,517	$8,773	$9,036	$9,307	$9,587	$9,874	$10,170	$10,475	$10,790	$11,113
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$11,920**	**$12,278**	**$12,646**	**$13,025**	**$13,416**	**$13,819**	**$14,233**	**$14,660**	**$15,100**	**$15,553**	**$16,019**	**$16,500**	**$16,995**	**$17,505**	**$18,030**	**$18,571**	**$19,128**	**$19,702**	**$20,293**	**$20,902**	**$21,529**	**$22,175**	**$22,840**
Pumping Power Costs:																								
2-Week Annual Pumping Duration[8]		**$8,658**	**$8,918**	**$9,185**	**$9,461**	**$9,745**	**$10,037**	**$10,338**	**$10,648**	**$10,968**	**$11,297**	**$11,636**	**$11,985**	**$12,344**	**$12,715**	**$13,096**	**$13,489**	**$13,894**	**$14,311**	**$14,740**	**$15,182**	**$15,638**	**$16,107**	**$16,590**
4-Week Annual Pumping Duration[8]		**$10,292**	**$10,601**	**$10,919**	**$11,246**	**$11,584**	**$11,931**	**$12,289**	**$12,658**	**$13,037**	**$13,428**	**$13,831**	**$14,246**	**$14,674**	**$15,114**	**$15,567**	**$16,034**	**$16,515**	**$17,011**	**$17,521**	**$18,047**	**$18,588**	**$19,146**	**$19,720**
6-Week Annual Pumping Duration[8]		**$11,925**	**$12,283**	**$12,652**	**$13,031**	**$13,422**	**$13,825**	**$14,240**	**$14,667**	**$15,107**	**$15,560**	**$16,027**	**$16,508**	**$17,003**	**$17,513**	**$18,038**	**$18,579**	**$19,137**	**$19,711**	**$20,302**	**$20,911**	**$21,539**	**$22,185**	**$22,850**
8-Week Annual Pumping Duration[8]		**$13,559**	**$13,966**	**$14,385**	**$14,816**	**$15,261**	**$15,719**	**$16,190**	**$16,676**	**$17,176**	**$17,692**	**$18,222**	**$18,769**	**$19,332**	**$19,912**	**$20,509**	**$21,125**	**$21,758**	**$22,411**	**$23,083**	**$23,776**	**$24,489**	**$25,224**	**$25,981**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis (Cont.)

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$19,596	$20,184	$20,790	$21,413	$22,056	$22,717	$23,399	$24,101	$24,824	$25,569	$26,336	$27,126	$27,939	$28,778	$29,641	$30,530	$31,446	$32,389	$33,361	$34,362	$35,393	$36,455	$37,548	$38,675	$39,835	$41,030	$42,261
$13,128	$14,109	$15,138	$16,216	$17,345	$18,527	$19,764	$21,059	$22,414	$23,831	$25,313	$26,862	$28,482	$30,175	$31,943	$33,791	$35,720	$37,735	$39,839	$42,035	$44,327	$46,718	$49,214	$51,817	$54,531	$57,362	$60,314
$470,307	**$504,600**	**$540,528**	**$578,157**	**$617,557**	**$658,801**	**$701,964**	**$747,124**	**$794,362**	**$843,761**	**$895,409**	**$949,397**	**$1,005,819**	**$1,064,771**	**$1,126,355**	**$1,190,675**	**$1,257,842**	**$1,327,966**	**$1,401,167**	**$1,477,563**	**$1,557,283**	**$1,640,456**	**$1,727,218**	**$1,817,709**	**$1,912,076**	**$2,010,468**	**$2,113,043**
$39,192	$40,368	$41,579	$42,826	$44,111	$45,435	$46,798	$48,202	$49,648	$51,137	$52,671	$54,251	$55,879	$57,555	$59,282	$61,060	$62,892	$64,779	$66,722	$68,724	$70,786	$72,909	$75,096	$77,349	$79,670	$82,060	$84,522
$26,255	$28,218	$30,276	$32,432	$34,689	$37,053	$39,528	$42,118	$44,827	$47,662	$50,626	$53,725	$56,964	$60,349	$63,886	$67,581	$71,441	$75,471	$79,678	$84,070	$88,654	$93,437	$98,427	$103,633	$109,063	$114,725	$120,628
$940,614	**$1,009,201**	**$1,081,056**	**$1,156,314**	**$1,235,115**	**$1,317,603**	**$1,403,929**	**$1,494,248**	**$1,588,723**	**$1,687,522**	**$1,790,819**	**$1,898,794**	**$2,011,637**	**$2,129,541**	**$2,252,709**	**$2,381,351**	**$2,515,684**	**$2,655,933**	**$2,802,333**	**$2,955,127**	**$3,114,566**	**$3,280,913**	**$3,454,436**	**$3,635,419**	**$3,824,151**	**$4,020,936**	**$4,226,085**
$78,385	$80,736	$83,158	$85,653	$88,222	$90,869	$93,595	$96,403	$99,295	$102,274	$105,342	$108,503	$111,758	$115,110	$118,564	$122,121	$125,784	$129,558	$133,444	$137,448	$141,571	$145,818	$150,193	$154,699	$159,340	$164,120	$169,043
$52,510	$56,437	$60,552	$64,863	$69,379	$74,107	$79,056	$84,236	$89,655	$95,323	$101,251	$107,449	$113,928	$120,698	$127,772	$135,163	$142,881	$150,941	$159,356	$168,140	$177,308	$186,874	$196,855	$207,266	$218,125	$229,449	$241,256
$1,881,229	**$2,018,402**	**$2,162,112**	**$2,312,628**	**$2,470,230**	**$2,635,206**	**$2,807,857**	**$2,988,496**	**$3,177,446**	**$3,375,044**	**$3,581,637**	**$3,797,589**	**$4,023,274**	**$4,259,083**	**$4,505,419**	**$4,762,702**	**$5,031,367**	**$5,311,866**	**$5,604,666**	**$5,910,254**	**$6,229,133**	**$6,561,825**	**$6,908,873**	**$7,270,838**	**$7,648,302**	**$8,041,871**	**$8,452,171**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$11,447	$11,790	$12,144	$12,508	$12,883	$13,270	$13,668	$14,078	$14,500	$14,935	$15,384	$15,845	$16,320	$16,810	$17,314	$17,834	$18,369	$18,920	$19,487	$20,072	$20,674	$21,294	$21,933	$22,591	$23,269	$23,967	$24,686
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$23,525	**$24,231**	**$24,958**	**$25,707**	**$26,478**	**$27,272**	**$28,090**	**$28,933**	**$29,801**	**$30,695**	**$31,616**	**$32,564**	**$33,541**	**$34,547**	**$35,584**	**$36,651**	**$37,751**	**$38,883**	**$40,050**	**$41,251**	**$42,489**	**$43,764**	**$45,077**	**$46,429**	**$47,822**	**$49,256**	**$50,734**
$17,088	**$17,600**	**$18,128**	**$18,672**	**$19,232**	**$19,809**	**$20,403**	**$21,016**	**$21,646**	**$22,295**	**$22,964**	**$23,653**	**$24,363**	**$25,094**	**$25,847**	**$26,622**	**$27,421**	**$28,243**	**$29,091**	**$29,963**	**$30,862**	**$31,788**	**$32,742**	**$33,724**	**$34,736**	**$35,778**	**$36,851**
$20,312	**$20,921**	**$21,549**	**$22,195**	**$22,861**	**$23,547**	**$24,253**	**$24,981**	**$25,730**	**$26,502**	**$27,297**	**$28,116**	**$28,960**	**$29,829**	**$30,723**	**$31,645**	**$32,594**	**$33,572**	**$34,579**	**$35,617**	**$36,685**	**$37,786**	**$38,919**	**$40,087**	**$41,290**	**$42,528**	**$43,804**
$23,536	**$24,242**	**$24,969**	**$25,718**	**$26,490**	**$27,285**	**$28,103**	**$28,946**	**$29,815**	**$30,709**	**$31,630**	**$32,579**	**$33,557**	**$34,563**	**$35,600**	**$36,668**	**$37,768**	**$38,901**	**$40,068**	**$41,270**	**$42,508**	**$43,784**	**$45,097**	**$46,450**	**$47,844**	**$49,279**	**$50,757**
$26,760	**$27,563**	**$28,390**	**$29,241**	**$30,119**	**$31,022**	**$31,953**	**$32,911**	**$33,899**	**$34,916**	**$35,963**	**$37,042**	**$38,153**	**$39,298**	**$40,477**	**$41,691**	**$42,942**	**$44,230**	**$45,557**	**$46,924**	**$48,332**	**$49,782**	**$51,275**	**$52,813**	**$54,398**	**$56,030**	**$57,711**
24	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis
Alternative 2, Design Flow Rate = 10 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 5oth Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$2,133,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$2,337,718
To Replace 50% After Life of Project		$4,675,436
To Replace 100% After Life of Project	$2,133,000	$9,350,872
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$61,375
To Replace 50% After Life of Project		$122,749
To Replace 100% After Life of Project	$56,000	$245,499
Total Replacement Cost:		
To Replace 25% After Life of Project		**$2,399,093**
To Replace 50% After Life of Project		**$4,798,185**
To Replace 100% After Life of Project	**$2,189,000**	**$9,596,370**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$21,269
To Replace 50% After Life of Project	$42,538
To Replace 100% After Life of Project	$85,077
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$11,273
To Replace 50% After Life of Project	$22,547
To Replace 100% After Life of Project	$45,093
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$22,916
To Replace 50% After Life of Project	$45,833
To Replace 100% After Life of Project	$91,666
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$47,982
To Replace 50% After Life of Project	$95,964
To Replace 100% After Life of Project	$191,927

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$547,250	$641,000	$438,341	**$1,626,591**
50% Replacement	$1,094,500	$641,000	$438,341	**$2,173,841**
100% Replacement	$2,189,000	$641,000	$438,341	**$3,268,341**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$547,250	$641,000	$521,058	**$1,709,308**
50% Replacement	$1,094,500	$641,000	$521,058	**$2,256,558**
100% Replacement	$2,189,000	$641,000	$521,058	**$3,351,058**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$547,250	$641,000	$603,774	**$1,792,024**
50% Replacement	$1,094,500	$641,000	$603,774	**$2,339,274**
100% Replacement	$2,189,000	$641,000	$603,774	**$3,433,774**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$547,250	$641,000	$686,491	**$1,874,741**
50% Replacement	$1,094,500	$641,000	$686,491	**$2,421,991**
100% Replacement	$2,189,000	$641,000	$686,491	**$3,516,491**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Capital Expenses:	$2,133,000											
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits		$11,273	$11,612	$11,960	$12,319	$12,688	$13,069	$13,461	$13,865	$14,281	$14,709	$15,150
Interest		$0	$338	$697	$1,076	$1,478	$1,903	$2,352	$2,827	$3,328	$3,856	$4,413
End of Year Balance		**$11,273**	**$23,223**	**$35,880**	**$49,275**	**$63,441**	**$78,413**	**$94,227**	**$110,918**	**$128,527**	**$147,092**	**$166,655**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits		$22,547	$23,223	$23,920	$24,637	$25,377	$26,138	$26,922	$27,730	$28,561	$29,418	$30,301
Interest		$0	$676	$1,393	$2,153	$2,956	$3,806	$4,705	$5,654	$6,655	$7,712	$8,825
End of Year Balance		**$22,547**	**$46,446**	**$71,759**	**$98,550**	**$126,883**	**$156,827**	**$188,454**	**$221,837**	**$257,053**	**$294,183**	**$333,310**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits		$45,093	$46,446	$47,840	$49,275	$50,753	$52,276	$53,844	$55,459	$57,123	$58,837	$60,602
Interest		$0	$1,353	$2,787	$4,306	$5,913	$7,613	$9,410	$11,307	$13,310	$15,423	$17,651
End of Year Balance		**$45,093**	**$92,892**	**$143,519**	**$197,099**	**$253,765**	**$313,654**	**$376,907**	**$443,674**	**$514,107**	**$588,367**	**$666,619**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672
Maintenance and Small Repairs[7]		$6,700	$6,901	$7,108	$7,321	$7,541	$7,767	$8,000	$8,240	$8,487	$8,742	$9,004
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$12,820**	**$13,205**	**$13,601**	**$14,009**	**$14,429**	**$14,862**	**$15,308**	**$15,767**	**$16,240**	**$16,727**	**$17,229**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]		**$8,767**	**$9,030**	**$9,301**	**$9,580**	**$9,867**	**$10,163**	**$10,468**	**$10,782**	**$11,106**	**$11,439**	**$11,782**
4-Week Annual Pumping Duration[8]		**$10,421**	**$10,734**	**$11,056**	**$11,387**	**$11,729**	**$12,081**	**$12,443**	**$12,817**	**$13,201**	**$13,597**	**$14,005**
6-Week Annual Pumping Duration[8]		**$12,075**	**$12,438**	**$12,811**	**$13,195**	**$13,591**	**$13,999**	**$14,419**	**$14,851**	**$15,297**	**$15,756**	**$16,228**
8-Week Annual Pumping Duration[8]		**$13,730**	**$14,142**	**$14,566**	**$15,003**	**$15,453**	**$15,917**	**$16,394**	**$16,886**	**$17,393**	**$17,914**	**$18,452**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**

Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:												
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits	$15,605	$16,073	$16,555	$17,052	$17,564	$18,090	$18,633	$19,192	$19,768	$20,361	$20,972	$21,601
Interest	$5,000	$5,618	$6,269	$6,953	$7,673	$8,430	$9,226	$10,062	$10,940	$11,861	$12,827	$13,841
End of Year Balance	**$187,259**	**$208,950**	**$231,774**	**$255,779**	**$281,016**	**$307,537**	**$335,396**	**$364,650**	**$395,358**	**$427,579**	**$461,379**	**$496,821**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits	$31,210	$32,146	$33,111	$34,104	$35,127	$36,181	$37,266	$38,384	$39,536	$40,722	$41,944	$43,202
Interest	$9,999	$11,236	$12,537	$13,906	$15,347	$16,861	$18,452	$20,124	$21,879	$23,721	$25,655	$27,683
End of Year Balance	**$374,519**	**$417,901**	**$463,548**	**$511,559**	**$562,032**	**$615,074**	**$670,793**	**$729,301**	**$790,715**	**$855,159**	**$922,757**	**$993,642**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits	$62,420	$64,292	$66,221	$68,208	$70,254	$72,362	$74,533	$76,768	$79,072	$81,444	$83,887	$86,404
Interest	$19,999	$22,471	$25,074	$27,813	$30,694	$33,722	$36,904	$40,248	$43,758	$47,443	$51,310	$55,365
End of Year Balance	**$749,038**	**$835,801**	**$927,096**	**$1,023,117**	**$1,124,065**	**$1,230,148**	**$1,341,585**	**$1,458,601**	**$1,581,431**	**$1,710,318**	**$1,845,514**	**$1,987,283**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]	$9,274	$9,553	$9,839	$10,134	$10,438	$10,752	$11,074	$11,406	$11,748	$12,101	$12,464	$12,838
Administration, Insurance, Accounting	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses	**$17,746**	**$18,278**	**$18,827**	**$19,391**	**$19,973**	**$20,572**	**$21,190**	**$21,825**	**$22,480**	**$23,154**	**$23,849**	**$24,564**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]	**$12,135**	**$12,499**	**$12,874**	**$13,261**	**$13,658**	**$14,068**	**$14,490**	**$14,925**	**$15,373**	**$15,834**	**$16,309**	**$16,798**
4-Week Annual Pumping Duration[8]	**$14,425**	**$14,858**	**$15,304**	**$15,763**	**$16,236**	**$16,723**	**$17,225**	**$17,741**	**$18,274**	**$18,822**	**$19,386**	**$19,968**
6-Week Annual Pumping Duration[8]	**$16,715**	**$17,217**	**$17,733**	**$18,265**	**$18,813**	**$19,378**	**$19,959**	**$20,558**	**$21,174**	**$21,810**	**$22,464**	**$23,138**
8-Week Annual Pumping Duration[8]	**$19,005**	**$19,575**	**$20,163**	**$20,768**	**$21,391**	**$22,032**	**$22,693**	**$23,374**	**$24,075**	**$24,798**	**$25,542**	**$26,308**
Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

24	25	26	27	28	29	30	31	32	33	34	35	36	37
$22,249	$22,916	$23,604	$24,312	$25,041	$25,793	$26,566	$27,363	$28,184	$29,030	$29,901	$30,798	$31,722	$32,673
$14,905	$16,019	$17,187	$18,411	$19,693	$21,035	$22,440	$23,910	$25,448	$27,057	$28,740	$30,499	$32,338	$34,259
$533,974	**$572,910**	**$613,701**	**$656,424**	**$701,158**	**$747,986**	**$796,992**	**$848,265**	**$901,897**	**$957,984**	**$1,016,624**	**$1,077,920**	**$1,141,980**	**$1,208,912**
$44,498	$45,833	$47,208	$48,624	$50,083	$51,585	$53,133	$54,727	$56,369	$58,060	$59,801	$61,595	$63,443	$65,347
$29,809	$32,038	$34,375	$36,822	$39,385	$42,069	$44,879	$47,819	$50,896	$54,114	$57,479	$60,997	$64,675	$68,519
$1,067,949	**$1,145,820**	**$1,227,402**	**$1,312,848**	**$1,402,317**	**$1,495,971**	**$1,593,983**	**$1,696,530**	**$1,803,794**	**$1,915,967**	**$2,033,248**	**$2,155,841**	**$2,283,959**	**$2,417,825**
$88,996	$91,666	$94,416	$97,248	$100,165	$103,170	$106,266	$109,454	$112,737	$116,119	$119,603	$123,191	$126,887	$130,693
$59,618	$64,077	$68,749	$73,644	$78,771	$84,139	$89,758	$95,639	$101,792	$108,228	$114,958	$121,995	$129,350	$137,038
$2,135,897	**$2,291,640**	**$2,454,805**	**$2,625,697**	**$2,804,633**	**$2,991,943**	**$3,187,967**	**$3,393,059**	**$3,607,588**	**$3,831,935**	**$4,066,496**	**$4,311,681**	**$4,567,919**	**$4,835,649**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449
$13,223	$13,620	$14,028	$14,449	$14,883	$15,329	$15,789	$16,263	$16,751	$17,253	$17,771	$18,304	$18,853	$19,418
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$25,301	**$26,060**	**$26,842**	**$27,648**	**$28,477**	**$29,331**	**$30,211**	**$31,118**	**$32,051**	**$33,013**	**$34,003**	**$35,023**	**$36,074**	**$37,156**
$17,302	**$17,821**	**$18,356**	**$18,906**	**$19,474**	**$20,058**	**$20,660**	**$21,279**	**$21,918**	**$22,575**	**$23,253**	**$23,950**	**$24,669**	**$25,409**
$20,567	**$21,184**	**$21,820**	**$22,474**	**$23,148**	**$23,843**	**$24,558**	**$25,295**	**$26,054**	**$26,835**	**$27,640**	**$28,470**	**$29,324**	**$30,203**
$23,832	**$24,547**	**$25,283**	**$26,042**	**$26,823**	**$27,628**	**$28,457**	**$29,310**	**$30,190**	**$31,095**	**$32,028**	**$32,989**	**$33,979**	**$34,998**
$27,097	**$27,910**	**$28,747**	**$29,610**	**$30,498**	**$31,413**	**$32,355**	**$33,326**	**$34,326**	**$35,355**	**$36,416**	**$37,509**	**$38,634**	**$39,793**
24	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**

38	39	40	41	42	43	44	45	46	47	48	49	50
$33,654	$34,663	$35,703	$36,774	$37,877	$39,014	$40,184	$41,390	$42,631	$43,910	$45,227	$46,584	$47,982
$36,267	$38,365	$40,556	$42,844	$45,232	$47,725	$50,328	$53,043	$55,876	$58,831	$61,913	$65,128	$68,479
$1,278,833	**$1,351,861**	**$1,428,120**	**$1,507,738**	**$1,590,847**	**$1,677,586**	**$1,768,098**	**$1,862,530**	**$1,961,038**	**$2,063,779**	**$2,170,920**	**$2,282,632**	**$2,399,093**
$67,307	$69,326	$71,406	$73,548	$75,755	$78,027	$80,368	$82,779	$85,263	$87,820	$90,455	$93,169	$95,964
$72,535	$76,730	$81,112	$85,687	$90,464	$95,451	$100,655	$106,086	$111,752	$117,662	$123,827	$130,255	$136,958
$2,557,666	**$2,703,723**	**$2,856,240**	**$3,015,476**	**$3,181,695**	**$3,355,173**	**$3,536,196**	**$3,725,061**	**$3,922,075**	**$4,127,558**	**$4,341,840**	**$4,565,264**	**$4,798,185**
$134,614	$138,652	$142,812	$147,096	$151,509	$156,055	$160,736	$165,558	$170,525	$175,641	$180,910	$186,337	$191,927
$145,069	$153,460	$162,223	$171,374	$180,929	$190,902	$201,310	$212,172	$223,504	$235,325	$247,653	$260,510	$273,916
$5,115,333	**$5,407,445**	**$5,712,481**	**$6,030,951**	**$6,363,389**	**$6,710,345**	**$7,072,392**	**$7,450,122**	**$7,844,151**	**$8,255,116**	**$8,683,679**	**$9,130,527**	**$9,596,370**
$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$20,001	$20,601	$21,219	$21,856	$22,511	$23,187	$23,882	$24,599	$25,337	$26,097	$26,880	$27,686	$28,517
$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$38,271	**$39,419**	**$40,601**	**$41,819**	**$43,074**	**$44,366**	**$45,697**	**$47,068**	**$48,480**	**$49,934**	**$51,432**	**$52,975**	**$54,565**
$26,171	**$26,956**	**$27,765**	**$28,598**	**$29,456**	**$30,339**	**$31,250**	**$32,187**	**$33,153**	**$34,147**	**$35,172**	**$36,227**	**$37,314**
$31,110	**$32,043**	**$33,004**	**$33,994**	**$35,014**	**$36,064**	**$37,146**	**$38,261**	**$39,409**	**$40,591**	**$41,809**	**$43,063**	**$44,355**
$36,048	**$37,130**	**$38,243**	**$39,391**	**$40,572**	**$41,790**	**$43,043**	**$44,335**	**$45,665**	**$47,035**	**$48,446**	**$49,899**	**$51,396**
$40,987	**$42,216**	**$43,483**	**$44,787**	**$46,131**	**$47,515**	**$48,940**	**$50,408**	**$51,921**	**$53,478**	**$55,083**	**$56,735**	**$58,437**
38	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis
Alternative 3, Design Flow Rate = 10 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 50th Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$1,861,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$2,039,612
To Replace 50% After Life of Project		$4,079,225
To Replace 100% After Life of Project	$1,861,000	$8,158,449
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$52,607
To Replace 50% After Life of Project		$105,214
To Replace 100% After Life of Project	$48,000	$210,427
Total Replacement Cost:		
To Replace 25% After Life of Project		**$2,092,219**
To Replace 50% After Life of Project		**$4,184,438**
To Replace 100% After Life of Project	**$1,909,000**	**$8,368,877**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$18,549
To Replace 50% After Life of Project	$37,097
To Replace 100% After Life of Project	$74,194
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$9,831
To Replace 50% After Life of Project	$19,663
To Replace 100% After Life of Project	$39,325
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$19,985
To Replace 50% After Life of Project	$39,970
To Replace 100% After Life of Project	$79,940
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$41,844
To Replace 50% After Life of Project	$83,689
To Replace 100% After Life of Project	$167,378

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$477,250	$596,000	$424,213	**$1,497,463**
50% Replacement	$954,500	$596,000	$424,213	**$1,974,713**
100% Replacement	$1,909,000	$596,000	$424,213	**$2,929,213**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$477,250	$596,000	$504,241	**$1,577,491**
50% Replacement	$954,500	$596,000	$504,241	**$2,054,741**
100% Replacement	$1,909,000	$596,000	$504,241	**$3,009,241**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$477,250	$596,000	$584,270	**$1,657,520**
50% Replacement	$954,500	$596,000	$584,270	**$2,134,770**
100% Replacement	$1,909,000	$596,000	$584,270	**$3,089,270**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$477,250	$596,000	$664,298	**$1,737,548**
50% Replacement	$954,500	$596,000	$664,298	**$2,214,798**
100% Replacement	$1,909,000	$596,000	$664,298	**$3,169,298**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Capital Expenses:	$1,861,000											
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits		$9,831	$10,126	$10,430	$10,743	$11,065	$11,397	$11,739	$12,091	$12,454	$12,828	$13,213
Interest		$0	$295	$608	$939	$1,289	$1,660	$2,052	$2,465	$2,902	$3,363	$3,848
End of Year Balance		**$9,831**	**$20,253**	**$31,290**	**$42,972**	**$55,326**	**$68,383**	**$82,174**	**$96,731**	**$112,087**	**$128,277**	**$145,338**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits		$19,663	$20,253	$20,860	$21,486	$22,131	$22,794	$23,478	$24,183	$24,908	$25,655	$26,425
Interest		$0	$590	$1,215	$1,877	$2,578	$3,320	$4,103	$4,930	$5,804	$6,725	$7,697
End of Year Balance		**$19,663**	**$40,505**	**$62,580**	**$85,944**	**$110,653**	**$136,767**	**$164,348**	**$193,461**	**$224,173**	**$256,554**	**$290,675**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits		$39,325	$40,505	$41,720	$42,972	$44,261	$45,589	$46,957	$48,365	$49,816	$51,311	$52,850
Interest		$0	$1,180	$2,430	$3,755	$5,157	$6,639	$8,206	$9,861	$11,608	$13,450	$15,393
End of Year Balance		**$39,325**	**$81,010**	**$125,161**	**$171,888**	**$221,305**	**$273,534**	**$328,696**	**$386,922**	**$448,346**	**$513,107**	**$581,351**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672
Maintenance and Small Repairs[7]		$5,800	$5,974	$6,153	$6,338	$6,528	$6,724	$6,926	$7,133	$7,347	$7,568	$7,795
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$11,920**	**$12,278**	**$12,646**	**$13,025**	**$13,416**	**$13,819**	**$14,233**	**$14,660**	**$15,100**	**$15,553**	**$16,019**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]		**$8,484**	**$8,739**	**$9,001**	**$9,271**	**$9,549**	**$9,836**	**$10,131**	**$10,435**	**$10,748**	**$11,070**	**$11,402**
4-Week Annual Pumping Duration[8]		**$10,085**	**$10,387**	**$10,699**	**$11,020**	**$11,351**	**$11,691**	**$12,042**	**$12,403**	**$12,775**	**$13,158**	**$13,553**
6-Week Annual Pumping Duration[8]		**$11,685**	**$12,036**	**$12,397**	**$12,769**	**$13,152**	**$13,547**	**$13,953**	**$14,372**	**$14,803**	**$15,247**	**$15,704**
8-Week Annual Pumping Duration[8]		**$13,286**	**$13,685**	**$14,095**	**$14,518**	**$14,953**	**$15,402**	**$15,864**	**$16,340**	**$16,830**	**$17,335**	**$17,855**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**

Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:												
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits	$13,609	$14,017	$14,438	$14,871	$15,317	$15,776	$16,250	$16,737	$17,239	$17,757	$18,289	$18,838
Interest	$4,360	$4,899	$5,467	$6,064	$6,692	$7,352	$8,046	$8,775	$9,540	$10,344	$11,187	$12,071
End of Year Balance	**$163,307**	**$182,223**	**$202,127**	**$223,062**	**$245,071**	**$268,199**	**$292,495**	**$318,007**	**$344,787**	**$372,887**	**$402,363**	**$433,271**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits	$27,218	$28,034	$28,875	$29,742	$30,634	$31,553	$32,499	$33,474	$34,479	$35,513	$36,578	$37,676
Interest	$8,720	$9,798	$10,933	$12,128	$13,384	$14,704	$16,092	$17,550	$19,080	$20,687	$22,373	$24,142
End of Year Balance	**$326,613**	**$364,446**	**$404,255**	**$446,124**	**$490,142**	**$536,399**	**$584,990**	**$636,014**	**$689,573**	**$745,773**	**$804,725**	**$866,543**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits	$54,436	$56,069	$57,751	$59,483	$61,268	$63,106	$64,999	$66,949	$68,957	$71,026	$73,157	$75,352
Interest	$17,441	$19,597	$21,867	$24,255	$26,767	$29,408	$32,184	$35,099	$38,161	$41,374	$44,746	$48,284
End of Year Balance	**$653,227**	**$728,892**	**$808,509**	**$892,248**	**$980,283**	**$1,072,797**	**$1,169,980**	**$1,272,028**	**$1,379,147**	**$1,491,547**	**$1,609,450**	**$1,733,085**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]	$8,029	$8,269	$8,517	$8,773	$9,036	$9,307	$9,587	$9,874	$10,170	$10,475	$10,790	$11,113
Administration, Insurance, Accounting	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses	**$16,500**	**$16,995**	**$17,505**	**$18,030**	**$18,571**	**$19,128**	**$19,702**	**$20,293**	**$20,902**	**$21,529**	**$22,175**	**$22,840**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]	**$11,744**	**$12,097**	**$12,459**	**$12,833**	**$13,218**	**$13,615**	**$14,023**	**$14,444**	**$14,877**	**$15,324**	**$15,783**	**$16,257**
4-Week Annual Pumping Duration[8]	**$13,960**	**$14,379**	**$14,810**	**$15,254**	**$15,712**	**$16,183**	**$16,669**	**$17,169**	**$17,684**	**$18,214**	**$18,761**	**$19,324**
6-Week Annual Pumping Duration[8]	**$16,175**	**$16,661**	**$17,160**	**$17,675**	**$18,205**	**$18,752**	**$19,314**	**$19,894**	**$20,490**	**$21,105**	**$21,738**	**$22,390**
8-Week Annual Pumping Duration[8]	**$18,391**	**$18,943**	**$19,511**	**$20,096**	**$20,699**	**$21,320**	**$21,960**	**$22,618**	**$23,297**	**$23,996**	**$24,716**	**$25,457**
Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

	24	25	26	27	28	29	30	31	32	33	34	35	36	37
	$19,403	$19,985	$20,585	$21,202	$21,838	$22,493	$23,168	$23,863	$24,579	$25,317	$26,076	$26,858	$27,664	$28,494
	$12,998	$13,970	$14,989	$16,056	$17,174	$18,344	$19,569	$20,851	$22,193	$23,596	$25,063	$26,598	$28,201	$29,877
	$465,672	**$499,628**	**$535,201**	**$572,459**	**$611,472**	**$652,309**	**$695,047**	**$739,761**	**$786,533**	**$835,446**	**$886,585**	**$940,041**	**$995,906**	**$1,054,278**
	$38,806	$39,970	$41,169	$42,404	$43,677	$44,987	$46,336	$47,727	$49,158	$50,633	$52,152	$53,717	$55,328	$56,988
	$25,996	$27,940	$29,978	$32,112	$34,348	$36,688	$39,139	$41,703	$44,386	$47,192	$50,127	$53,195	$56,402	$59,754
	$931,345	**$999,256**	**$1,070,403**	**$1,144,919**	**$1,222,943**	**$1,304,618**	**$1,390,093**	**$1,479,523**	**$1,573,067**	**$1,670,892**	**$1,773,170**	**$1,880,082**	**$1,991,813**	**$2,108,555**
	$77,612	$79,940	$82,339	$84,809	$87,353	$89,974	$92,673	$95,453	$98,317	$101,266	$104,304	$107,433	$110,656	$113,976
	$51,993	$55,881	$59,955	$64,224	$68,695	$73,377	$78,277	$83,406	$88,771	$94,384	$100,253	$106,390	$112,805	$119,509
	$1,862,690	**$1,998,511**	**$2,140,805**	**$2,289,838**	**$2,445,886**	**$2,609,236**	**$2,780,186**	**$2,959,045**	**$3,146,133**	**$3,341,783**	**$3,546,341**	**$3,760,164**	**$3,983,626**	**$4,217,110**
	$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564
	$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826
	$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449
	$11,447	$11,790	$12,144	$12,508	$12,883	$13,270	$13,668	$14,078	$14,500	$14,935	$15,384	$15,845	$16,320	$16,810
	$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898
	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	$23,525	**$24,231**	**$24,958**	**$25,707**	**$26,478**	**$27,272**	**$28,090**	**$28,933**	**$29,801**	**$30,695**	**$31,616**	**$32,564**	**$33,541**	**$34,547**
	$16,744	**$17,247**	**$17,764**	**$18,297**	**$18,846**	**$19,411**	**$19,994**	**$20,594**	**$21,211**	**$21,848**	**$22,503**	**$23,178**	**$23,874**	**$24,590**
	$19,903	**$20,500**	**$21,115**	**$21,749**	**$22,401**	**$23,073**	**$23,766**	**$24,479**	**$25,213**	**$25,969**	**$26,748**	**$27,551**	**$28,377**	**$29,229**
	$23,062	**$23,754**	**$24,467**	**$25,201**	**$25,957**	**$26,735**	**$27,537**	**$28,364**	**$29,214**	**$30,091**	**$30,994**	**$31,923**	**$32,881**	**$33,868**
	$26,221	**$27,008**	**$27,818**	**$28,652**	**$29,512**	**$30,397**	**$31,309**	**$32,249**	**$33,216**	**$34,212**	**$35,239**	**$36,296**	**$37,385**	**$38,506**
	24	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**

	38	39	40	41	42	43	44	45	46	47	48	49	50
	$29,349	$30,229	$31,136	$32,070	$33,032	$34,023	$35,044	$36,095	$37,178	$38,294	$39,442	$40,626	$41,844
	$31,628	$33,458	$35,368	$37,363	$39,446	$41,621	$43,890	$46,258	$48,729	$51,306	$53,994	$56,797	$59,720
	$1,115,255	**$1,178,942**	**$1,245,446**	**$1,314,880**	**$1,387,358**	**$1,463,002**	**$1,541,937**	**$1,624,290**	**$1,710,197**	**$1,799,796**	**$1,893,233**	**$1,990,655**	**$2,092,219**
	$58,698	$60,459	$62,272	$64,140	$66,065	$68,047	$70,088	$72,191	$74,356	$76,587	$78,885	$81,251	$83,689
	$63,257	$66,915	$70,736	$74,727	$78,893	$83,242	$87,780	$92,516	$97,457	$102,612	$107,988	$113,594	$119,439
	$2,230,509	**$2,357,883**	**$2,490,892**	**$2,629,759**	**$2,774,717**	**$2,926,005**	**$3,083,873**	**$3,248,580**	**$3,420,394**	**$3,599,593**	**$3,786,465**	**$3,981,310**	**$4,184,438**
	$117,395	$120,917	$124,545	$128,281	$132,129	$136,093	$140,176	$144,381	$148,713	$153,174	$157,769	$162,502	$167,378
	$126,513	$133,831	$141,473	$149,454	$157,786	$166,483	$175,560	$185,032	$194,915	$205,224	$215,976	$227,188	$238,879
	$4,461,019	**$4,715,767**	**$4,981,784**	**$5,259,519**	**$5,549,434**	**$5,852,010**	**$6,167,746**	**$6,497,160**	**$6,840,787**	**$7,199,185**	**$7,572,930**	**$7,962,620**	**$8,368,877**
	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
	$17,314	$17,834	$18,369	$18,920	$19,487	$20,072	$20,674	$21,294	$21,933	$22,591	$23,269	$23,967	$24,686
	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	$35,584	**$36,651**	**$37,751**	**$38,883**	**$40,050**	**$41,251**	**$42,489**	**$43,764**	**$45,077**	**$46,429**	**$47,822**	**$49,256**	**$50,734**
	$25,327	**$26,087**	**$26,870**	**$27,676**	**$28,506**	**$29,361**	**$30,242**	**$31,150**	**$32,084**	**$33,047**	**$34,038**	**$35,059**	**$36,111**
	$30,105	**$31,009**	**$31,939**	**$32,897**	**$33,884**	**$34,901**	**$35,948**	**$37,026**	**$38,137**	**$39,281**	**$40,459**	**$41,673**	**$42,923**
	$34,884	**$35,930**	**$37,008**	**$38,118**	**$39,262**	**$40,440**	**$41,653**	**$42,902**	**$44,189**	**$45,515**	**$46,881**	**$48,287**	**$49,736**
	$39,662	**$40,851**	**$42,077**	**$43,339**	**$44,639**	**$45,979**	**$47,358**	**$48,779**	**$50,242**	**$51,749**	**$53,302**	**$54,901**	**$56,548**
	38	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis
Alternative 4, Design Flow Rate = 10 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 50th Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$2,755,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$3,019,415
To Replace 50% After Life of Project		$6,038,831
To Replace 100% After Life of Project	$2,755,000	$12,077,661
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$78,910
To Replace 50% After Life of Project		$157,821
To Replace 100% After Life of Project	$72,000	$315,641
Total Replacement Cost:		
To Replace 25% After Life of Project		**$3,098,326**
To Replace 50% After Life of Project		**$6,196,651**
To Replace 100% After Life of Project	**$2,827,000**	**$12,393,302**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$27,468
To Replace 50% After Life of Project	$54,936
To Replace 100% After Life of Project	$109,873
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$14,559
To Replace 50% After Life of Project	$29,118
To Replace 100% After Life of Project	$58,236
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$29,596
To Replace 50% After Life of Project	$59,191
To Replace 100% After Life of Project	$118,382
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$61,967
To Replace 50% After Life of Project	$123,933
To Replace 100% After Life of Project	$247,866

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$706,750	$736,000	$404,651	**$1,847,401**
50% Replacement	$1,413,500	$736,000	$404,651	**$2,554,151**
100% Replacement	$2,827,000	$736,000	$404,651	**$3,967,651**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$706,750	$736,000	$480,957	**$1,923,707**
50% Replacement	$1,413,500	$736,000	$480,957	**$2,630,457**
100% Replacement	$2,827,000	$736,000	$480,957	**$4,043,957**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$706,750	$736,000	$557,263	**$2,000,013**
50% Replacement	$1,413,500	$736,000	$557,263	**$2,706,763**
100% Replacement	$2,827,000	$736,000	$557,263	**$4,120,263**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$706,750	$736,000	$633,569	**$2,076,319**
50% Replacement	$1,413,500	$736,000	$633,569	**$2,783,069**
100% Replacement	$2,827,000	$736,000	$633,569	**$4,196,569**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:	$2,755,000																							
Replacement Fund (For Funding Replacement of 25% of System):																								
Deposits		$14,559	$14,996	$15,446	$15,909	$16,386	$16,878	$17,384	$17,906	$18,443	$18,996	$19,566	$20,153	$20,758	$21,380	$22,022	$22,683	$23,363	$24,064	$24,786	$25,529	$26,295	$27,084	$27,897
Interest		$0	$437	$900	$1,390	$1,909	$2,458	$3,038	$3,651	$4,297	$4,980	$5,699	$6,457	$7,255	$8,096	$8,980	$9,910	$10,888	$11,915	$12,995	$14,128	$15,318	$16,566	$17,876
End of Year Balance		**$14,559**	**$29,992**	**$46,337**	**$63,636**	**$81,932**	**$101,268**	**$121,690**	**$143,246**	**$165,987**	**$189,963**	**$215,228**	**$241,838**	**$269,850**	**$299,326**	**$330,328**	**$362,920**	**$397,171**	**$433,150**	**$470,930**	**$510,588**	**$552,201**	**$595,851**	**$641,623**
Replacement Fund (For Funding Replacement of 50% of System):																								
Deposits		$29,118	$29,992	$30,891	$31,818	$32,773	$33,756	$34,769	$35,812	$36,886	$37,993	$39,132	$40,306	$41,515	$42,761	$44,044	$45,365	$46,726	$48,128	$49,572	$51,059	$52,591	$54,168	$55,793
Interest		$0	$874	$1,799	$2,780	$3,818	$4,916	$6,076	$7,301	$8,595	$9,959	$11,398	$12,914	$14,510	$16,191	$17,960	$19,820	$21,775	$23,830	$25,989	$28,256	$30,635	$33,132	$35,751
End of Year Balance		**$29,118**	**$59,983**	**$92,674**	**$127,273**	**$163,863**	**$202,535**	**$243,380**	**$286,493**	**$331,973**	**$379,925**	**$430,455**	**$483,675**	**$539,701**	**$598,653**	**$660,656**	**$725,841**	**$794,342**	**$866,300**	**$941,861**	**$1,021,175**	**$1,104,401**	**$1,191,701**	**$1,283,246**
Replacement Fund (For Funding Replacement of 100% of System):																								
Deposits		$58,236	$59,983	$61,783	$63,636	$65,545	$67,512	$69,537	$71,623	$73,772	$75,985	$78,265	$80,613	$83,031	$85,522	$88,087	$90,730	$93,452	$96,256	$99,143	$102,118	$105,181	$108,336	$111,587
Interest		$0	$1,747	$3,599	$5,560	$7,636	$9,832	$12,152	$14,603	$17,190	$19,918	$22,796	$25,827	$29,021	$32,382	$35,919	$39,639	$43,550	$47,661	$51,978	$56,512	$61,271	$66,264	$71,502
End of Year Balance		**$58,236**	**$119,967**	**$185,348**	**$254,545**	**$327,727**	**$405,070**	**$486,759**	**$572,985**	**$663,947**	**$759,850**	**$860,910**	**$967,350**	**$1,079,402**	**$1,197,306**	**$1,321,312**	**$1,451,682**	**$1,588,684**	**$1,732,600**	**$1,883,721**	**$2,042,351**	**$2,208,802**	**$2,383,403**	**$2,566,491**
Operations and Maintenance Expenses:																								
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]		$8,600	$8,858	$9,124	$9,397	$9,679	$9,970	$10,269	$10,577	$10,894	$11,221	$11,558	$11,904	$12,262	$12,629	$13,008	$13,399	$13,800	$14,214	$14,641	$15,080	$15,533	$15,999	$16,478
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$14,720**	**$15,162**	**$15,616**	**$16,085**	**$16,567**	**$17,065**	**$17,576**	**$18,104**	**$18,647**	**$19,206**	**$19,782**	**$20,376**	**$20,987**	**$21,617**	**$22,265**	**$22,933**	**$23,621**	**$24,330**	**$25,060**	**$25,812**	**$26,586**	**$27,384**	**$28,205**
Pumping Power Costs:																								
2-Week Annual Pumping Duration[8]		**$8,093**	**$8,336**	**$8,586**	**$8,843**	**$9,109**	**$9,382**	**$9,663**	**$9,953**	**$10,252**	**$10,560**	**$10,876**	**$11,203**	**$11,539**	**$11,885**	**$12,241**	**$12,609**	**$12,987**	**$13,377**	**$13,778**	**$14,191**	**$14,617**	**$15,055**	**$15,507**
4-Week Annual Pumping Duration[8]		**$9,619**	**$9,908**	**$10,205**	**$10,511**	**$10,826**	**$11,151**	**$11,486**	**$11,830**	**$12,185**	**$12,551**	**$12,927**	**$13,315**	**$13,715**	**$14,126**	**$14,550**	**$14,986**	**$15,436**	**$15,899**	**$16,376**	**$16,867**	**$17,373**	**$17,894**	**$18,431**
6-Week Annual Pumping Duration[8]		**$11,145**	**$11,480**	**$11,824**	**$12,179**	**$12,544**	**$12,920**	**$13,308**	**$13,707**	**$14,118**	**$14,542**	**$14,978**	**$15,428**	**$15,890**	**$16,367**	**$16,858**	**$17,364**	**$17,885**	**$18,421**	**$18,974**	**$19,543**	**$20,130**	**$20,733**	**$21,355**
8-Week Annual Pumping Duration[8]		**$12,671**	**$13,052**	**$13,443**	**$13,846**	**$14,262**	**$14,690**	**$15,130**	**$15,584**	**$16,052**	**$16,533**	**$17,029**	**$17,540**	**$18,066**	**$18,608**	**$19,167**	**$19,742**	**$20,334**	**$20,944**	**$21,572**	**$22,219**	**$22,886**	**$23,572**	**$24,280**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$28,734	$29,596	$30,483	$31,398	$32,340	$33,310	$34,309	$35,339	$36,399	$37,491	$38,615	$39,774	$40,967	$42,196	$43,462	$44,766	$46,109	$47,492	$48,917	$50,384	$51,896	$53,453	$55,056	$56,708	$58,409	$60,162	$61,967
$19,249	$20,688	$22,197	$23,777	$25,432	$27,165	$28,980	$30,878	$32,865	$34,943	$37,116	$39,388	$41,763	$44,245	$46,838	$49,547	$52,376	$55,331	$58,415	$61,635	$64,996	$68,503	$72,161	$75,978	$79,958	$84,110	$88,438
$689,605	**$739,889**	**$792,569**	**$847,744**	**$905,516**	**$965,992**	**$1,029,281**	**$1,095,498**	**$1,164,761**	**$1,237,195**	**$1,312,926**	**$1,392,088**	**$1,474,818**	**$1,561,259**	**$1,651,558**	**$1,745,871**	**$1,844,356**	**$1,947,179**	**$2,054,511**	**$2,166,531**	**$2,283,423**	**$2,405,379**	**$2,532,596**	**$2,665,282**	**$2,803,650**	**$2,947,921**	**$3,098,326**
$57,467	$59,191	$60,967	$62,796	$64,680	$66,620	$68,619	$70,677	$72,798	$74,982	$77,231	$79,548	$81,934	$84,392	$86,924	$89,532	$92,218	$94,984	$97,834	$100,769	$103,792	$106,906	$110,113	$113,416	$116,819	$120,323	$123,933
$38,497	$41,376	$44,393	$47,554	$50,865	$54,331	$57,959	$61,757	$65,730	$69,886	$74,232	$78,776	$83,525	$88,489	$93,676	$99,094	$104,752	$110,661	$116,831	$123,271	$129,992	$137,005	$144,323	$151,956	$159,917	$168,219	$176,875
$1,379,210	**$1,479,778**	**$1,585,138**	**$1,695,488**	**$1,811,032**	**$1,931,983**	**$2,058,561**	**$2,190,995**	**$2,329,523**	**$2,474,390**	**$2,625,853**	**$2,784,176**	**$2,949,636**	**$3,122,517**	**$3,303,117**	**$3,491,742**	**$3,688,712**	**$3,894,358**	**$4,109,023**	**$4,333,062**	**$4,566,846**	**$4,810,757**	**$5,065,193**	**$5,330,565**	**$5,607,301**	**$5,895,843**	**$6,196,651**
$114,934	$118,382	$121,934	$125,592	$129,359	$133,240	$137,237	$141,355	$145,595	$149,963	$154,462	$159,096	$163,869	$168,785	$173,848	$179,064	$184,436	$189,969	$195,668	$201,538	$207,584	$213,811	$220,226	$226,833	$233,638	$240,647	$247,866
$76,995	$82,753	$88,787	$95,108	$101,729	$108,662	$115,919	$123,514	$131,460	$139,771	$148,463	$157,551	$167,051	$176,978	$187,351	$198,187	$209,505	$221,323	$233,661	$246,541	$259,984	$274,011	$288,645	$303,912	$319,834	$336,438	$353,751
$2,758,420	**$2,959,555**	**$3,170,275**	**$3,390,975**	**$3,622,064**	**$3,863,966**	**$4,117,123**	**$4,381,991**	**$4,659,046**	**$4,948,780**	**$5,251,705**	**$5,568,352**	**$5,899,272**	**$6,245,035**	**$6,606,234**	**$6,983,485**	**$7,377,425**	**$7,788,716**	**$8,218,045**	**$8,666,124**	**$9,133,692**	**$9,621,514**	**$10,130,386**	**$10,661,130**	**$11,214,601**	**$11,791,686**	**$12,393,302**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$16,973	$17,482	$18,006	$18,547	$19,103	$19,676	$20,266	$20,874	$21,501	$22,146	$22,810	$23,494	$24,199	$24,925	$25,673	$26,443	$27,236	$28,054	$28,895	$29,762	$30,655	$31,574	$32,522	$33,497	$34,502	$35,537	$36,603
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$29,051	**$29,923**	**$30,820**	**$31,745**	**$32,697**	**$33,678**	**$34,689**	**$35,729**	**$36,801**	**$37,905**	**$39,042**	**$40,214**	**$41,420**	**$42,663**	**$43,943**	**$45,261**	**$46,619**	**$48,017**	**$49,458**	**$50,941**	**$52,470**	**$54,044**	**$55,665**	**$57,335**	**$59,055**	**$60,827**	**$62,652**
$15,972	**$16,451**	**$16,945**	**$17,453**	**$17,977**	**$18,516**	**$19,072**	**$19,644**	**$20,233**	**$20,840**	**$21,465**	**$22,109**	**$22,773**	**$23,456**	**$24,159**	**$24,884**	**$25,631**	**$26,400**	**$27,192**	**$28,007**	**$28,848**	**$29,713**	**$30,605**	**$31,523**	**$32,468**	**$33,442**	**$34,446**
$18,984	**$19,554**	**$20,140**	**$20,745**	**$21,367**	**$22,008**	**$22,668**	**$23,348**	**$24,049**	**$24,770**	**$25,513**	**$26,279**	**$27,067**	**$27,879**	**$28,715**	**$29,577**	**$30,464**	**$31,378**	**$32,319**	**$33,289**	**$34,288**	**$35,316**	**$36,376**	**$37,467**	**$38,591**	**$39,749**	**$40,941**
$21,996	**$22,656**	**$23,336**	**$24,036**	**$24,757**	**$25,500**	**$26,265**	**$27,052**	**$27,864**	**$28,700**	**$29,561**	**$30,448**	**$31,361**	**$32,302**	**$33,271**	**$34,269**	**$35,297**	**$36,356**	**$37,447**	**$38,570**	**$39,727**	**$40,919**	**$42,147**	**$43,411**	**$44,714**	**$46,055**	**$47,437**
$25,008	**$25,758**	**$26,531**	**$27,327**	**$28,147**	**$28,991**	**$29,861**	**$30,757**	**$31,679**	**$32,630**	**$33,609**	**$34,617**	**$35,656**	**$36,725**	**$37,827**	**$38,962**	**$40,131**	**$41,335**	**$42,575**	**$43,852**	**$45,167**	**$46,522**	**$47,918**	**$49,356**	**$50,836**	**$52,361**	**$53,932**
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis
Alternative 5, Design Flow Rate = 10 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 50th Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$3,165,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$3,468,766
To Replace 50% After Life of Project		$6,937,531
To Replace 100% After Life of Project	$3,165,000	$13,875,063
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$90,966
To Replace 50% After Life of Project		$181,932
To Replace 100% After Life of Project	$83,000	$363,864
Total Replacement Cost:		
To Replace 25% After Life of Project		**$3,559,732**
To Replace 50% After Life of Project		**$7,119,463**
To Replace 100% After Life of Project	**$3,248,000**	**$14,238,927**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$31,559
To Replace 50% After Life of Project	$63,118
To Replace 100% After Life of Project	$126,235
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$16,727
To Replace 50% After Life of Project	$33,454
To Replace 100% After Life of Project	$66,909
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$34,003
To Replace 50% After Life of Project	$68,006
To Replace 100% After Life of Project	$136,012
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$71,195
To Replace 50% After Life of Project	$142,389
To Replace 100% After Life of Project	$284,779

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	Replacment Fund	O &M	Power	TOTAL
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$812,000	$806,000	$389,436	**$2,007,436**
50% Replacement	$1,624,000	$806,000	$389,436	**$2,819,436**
100% Replacement	$3,248,000	$806,000	$389,436	**$4,443,436**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$812,000	$806,000	$462,847	**$2,080,847**
50% Replacement	$1,624,000	$806,000	$462,847	**$2,892,847**
100% Replacement	$3,248,000	$806,000	$462,847	**$4,516,847**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$812,000	$806,000	$536,258	**$2,154,258**
50% Replacement	$1,624,000	$806,000	$536,258	**$2,966,258**
100% Replacement	$3,248,000	$806,000	$536,258	**$4,590,258**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$812,000	$806,000	$609,669	**$2,227,669**
50% Replacement	$1,624,000	$806,000	$609,669	**$3,039,669**
100% Replacement	$3,248,000	$806,000	$609,669	**$4,663,669**

LIFE CYCLE COSTS:

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Capital Expenses:	$3,165,000																							
Replacement Fund (For Funding Replacement of 25% of System):																								
Deposits		$16,727	$17,229	$17,746	$18,278	$18,827	$19,391	$19,973	$20,572	$21,190	$21,825	$22,480	$23,154	$23,849	$24,564	$25,301	$26,060	$26,842	$27,648	$28,477	$29,331	$30,211	$31,118	$32,051
Interest		$0	$502	$1,034	$1,597	$2,193	$2,824	$3,490	$4,194	$4,937	$5,721	$6,548	$7,418	$8,336	$9,301	$10,317	$11,386	$12,509	$13,690	$14,930	$16,232	$17,599	$19,033	$20,538
End of Year Balance		**$16,727**	**$34,458**	**$53,238**	**$73,113**	**$94,133**	**$116,348**	**$139,812**	**$164,579**	**$190,706**	**$218,252**	**$247,280**	**$277,852**	**$310,037**	**$343,902**	**$379,521**	**$416,967**	**$456,318**	**$497,655**	**$541,062**	**$586,625**	**$634,435**	**$684,585**	**$737,174**
Replacement Fund (For Funding Replacement of 50% of System):																								
Deposits		$33,454	$34,458	$35,492	$36,557	$37,653	$38,783	$39,946	$41,145	$42,379	$43,650	$44,960	$46,309	$47,698	$49,129	$50,603	$52,121	$53,684	$55,295	$56,954	$58,662	$60,422	$62,235	$64,102
Interest		$0	$1,004	$2,067	$3,194	$4,387	$5,648	$6,981	$8,389	$9,875	$11,442	$13,095	$14,837	$16,671	$18,602	$20,634	$22,771	$25,018	$27,379	$29,859	$32,464	$35,197	$38,066	$41,075
End of Year Balance		**$33,454**	**$68,916**	**$106,475**	**$146,226**	**$188,266**	**$232,697**	**$279,624**	**$329,158**	**$381,411**	**$436,504**	**$494,559**	**$555,705**	**$620,074**	**$687,805**	**$759,042**	**$833,934**	**$912,636**	**$995,310**	**$1,082,124**	**$1,173,250**	**$1,268,870**	**$1,369,171**	**$1,474,348**
Replacement Fund (For Funding Replacement of 100% of System):																								
Deposits		$66,909	$68,916	$70,984	$73,113	$75,306	$77,566	$79,893	$82,289	$84,758	$87,301	$89,920	$92,617	$95,396	$98,258	$101,206	$104,242	$107,369	$110,590	$113,908	$117,325	$120,845	$124,470	$128,204
Interest		$0	$2,007	$4,135	$6,389	$8,774	$11,296	$13,962	$16,777	$19,749	$22,885	$26,190	$29,674	$33,342	$37,204	$41,268	$45,543	$50,036	$54,758	$59,719	$64,927	$70,395	$76,132	$82,150
End of Year Balance		**$66,909**	**$137,832**	**$212,951**	**$292,452**	**$376,532**	**$465,394**	**$559,248**	**$658,315**	**$762,823**	**$873,008**	**$989,118**	**$1,111,409**	**$1,240,147**	**$1,375,610**	**$1,518,083**	**$1,667,868**	**$1,825,273**	**$1,990,621**	**$2,164,247**	**$2,346,500**	**$2,537,739**	**$2,738,342**	**$2,948,696**
Operations and Maintenance Expenses:																								
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]		$10,000	$10,300	$10,609	$10,927	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$13,439	$13,842	$14,258	$14,685	$15,126	$15,580	$16,047	$16,528	$17,024	$17,535	$18,061	$18,603	$19,161
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$16,120**	**$16,604**	**$17,102**	**$17,615**	**$18,143**	**$18,687**	**$19,248**	**$19,826**	**$20,420**	**$21,033**	**$21,664**	**$22,314**	**$22,983**	**$23,673**	**$24,383**	**$25,114**	**$25,868**	**$26,644**	**$27,443**	**$28,267**	**$29,115**	**$29,988**	**$30,888**
Pumping Power Costs:																								
2-Week Annual Pumping Duration[8]		**$7,789**	**$8,022**	**$8,263**	**$8,511**	**$8,766**	**$9,029**	**$9,300**	**$9,579**	**$9,867**	**$10,163**	**$10,467**	**$10,781**	**$11,105**	**$11,438**	**$11,781**	**$12,135**	**$12,499**	**$12,874**	**$13,260**	**$13,658**	**$14,067**	**$14,489**	**$14,924**
4-Week Annual Pumping Duration[8]		**$9,257**	**$9,535**	**$9,821**	**$10,115**	**$10,419**	**$10,731**	**$11,053**	**$11,385**	**$11,726**	**$12,078**	**$12,441**	**$12,814**	**$13,198**	**$13,594**	**$14,002**	**$14,422**	**$14,855**	**$15,300**	**$15,759**	**$16,232**	**$16,719**	**$17,221**	**$17,737**
6-Week Annual Pumping Duration[8]		**$10,725**	**$11,047**	**$11,378**	**$11,720**	**$12,071**	**$12,433**	**$12,806**	**$13,191**	**$13,586**	**$13,994**	**$14,414**	**$14,846**	**$15,292**	**$15,750**	**$16,223**	**$16,709**	**$17,211**	**$17,727**	**$18,259**	**$18,807**	**$19,371**	**$19,952**	**$20,551**
8-Week Annual Pumping Duration[8]		**$12,193**	**$12,559**	**$12,936**	**$13,324**	**$13,724**	**$14,135**	**$14,560**	**$14,996**	**$15,446**	**$15,910**	**$16,387**	**$16,878**	**$17,385**	**$17,906**	**$18,444**	**$18,997**	**$19,567**	**$20,154**	**$20,758**	**$21,381**	**$22,023**	**$22,683**	**$23,364**
Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis (Cont.)

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$33,013	$34,003	$35,023	$36,074	$37,156	$38,271	$39,419	$40,601	$41,819	$43,074	$44,366	$45,697	$47,068	$48,480	$49,934	$51,433	$52,975	$54,565	$56,202	$57,888	$59,624	$61,413	$63,256	$65,153	$67,108	$69,121	$71,195
$22,115	$23,769	$25,502	$27,318	$29,220	$31,211	$33,295	$35,477	$37,759	$40,147	$42,643	$45,253	$47,982	$50,833	$53,813	$56,925	$60,176	$63,571	$67,115	$70,814	$74,675	$78,704	$82,908	$87,293	$91,866	$96,635	$101,608
$792,302	**$850,074**	**$910,599**	**$973,991**	**$1,040,366**	**$1,109,848**	**$1,182,562**	**$1,258,640**	**$1,338,219**	**$1,421,440**	**$1,508,449**	**$1,599,399**	**$1,694,449**	**$1,793,763**	**$1,897,510**	**$2,005,868**	**$2,119,020**	**$2,237,155**	**$2,360,471**	**$2,489,173**	**$2,623,473**	**$2,763,590**	**$2,909,753**	**$3,062,199**	**$3,221,173**	**$3,386,929**	**$3,559,732**
$66,025	$68,006	$70,046	$72,147	$74,312	$76,541	$78,837	$81,203	$83,639	$86,148	$88,732	$91,394	$94,136	$96,960	$99,869	$102,865	$105,951	$109,130	$112,403	$115,776	$119,249	$122,826	$126,511	$130,306	$134,216	$138,242	$142,389
$44,230	$47,538	$51,004	$54,636	$58,439	$62,422	$66,591	$70,954	$75,518	$80,293	$85,286	$90,507	$95,964	$101,667	$107,626	$113,851	$120,352	$127,141	$134,229	$141,628	$149,350	$157,408	$165,815	$174,585	$183,732	$193,270	$203,216
$1,584,604	**$1,700,148**	**$1,821,198**	**$1,947,982**	**$2,080,733**	**$2,219,696**	**$2,365,125**	**$2,517,281**	**$2,676,438**	**$2,842,879**	**$3,016,898**	**$3,198,799**	**$3,388,899**	**$3,587,526**	**$3,795,021**	**$4,011,736**	**$4,238,039**	**$4,474,310**	**$4,720,943**	**$4,978,347**	**$5,246,946**	**$5,527,180**	**$5,819,507**	**$6,124,398**	**$6,442,346**	**$6,773,858**	**$7,119,463**
$132,050	$136,012	$140,092	$144,295	$148,624	$153,082	$157,675	$162,405	$167,277	$172,296	$177,465	$182,789	$188,272	$193,920	$199,738	$205,730	$211,902	$218,259	$224,807	$231,551	$238,498	$245,652	$253,022	$260,613	$268,431	$276,484	$284,779
$88,461	$95,076	$102,009	$109,272	$116,879	$124,844	$133,182	$141,907	$151,037	$160,586	$170,573	$181,014	$191,928	$203,334	$215,252	$227,701	$240,704	$254,282	$268,459	$283,257	$298,701	$314,817	$331,631	$349,170	$367,464	$386,541	$406,432
$3,169,207	**$3,400,295**	**$3,642,396**	**$3,895,963**	**$4,161,466**	**$4,439,392**	**$4,730,249**	**$5,034,562**	**$5,352,876**	**$5,685,758**	**$6,033,795**	**$6,397,598**	**$6,777,798**	**$7,175,052**	**$7,590,042**	**$8,023,473**	**$8,476,079**	**$8,948,620**	**$9,441,886**	**$9,956,693**	**$10,493,892**	**$11,054,361**	**$11,639,014**	**$12,248,797**	**$12,884,692**	**$13,547,717**	**$14,238,927**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$19,736	$20,328	$20,938	$21,566	$22,213	$22,879	$23,566	$24,273	$25,001	$25,751	$26,523	$27,319	$28,139	$28,983	$29,852	$30,748	$31,670	$32,620	$33,599	$34,607	$35,645	$36,715	$37,816	$38,950	$40,119	$41,323	$42,562
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$31,814	**$32,769**	**$33,752**	**$34,764**	**$35,807**	**$36,881**	**$37,988**	**$39,127**	**$40,301**	**$41,510**	**$42,756**	**$44,038**	**$45,359**	**$46,720**	**$48,122**	**$49,566**	**$51,052**	**$52,584**	**$54,162**	**$55,786**	**$57,460**	**$59,184**	**$60,959**	**$62,788**	**$64,672**	**$66,612**	**$68,610**
$15,372	**$15,833**	**$16,308**	**$16,797**	**$17,301**	**$17,820**	**$18,355**	**$18,905**	**$19,472**	**$20,057**	**$20,658**	**$21,278**	**$21,916**	**$22,574**	**$23,251**	**$23,949**	**$24,667**	**$25,407**	**$26,169**	**$26,954**	**$27,763**	**$28,596**	**$29,454**	**$30,337**	**$31,248**	**$32,185**	**$33,150**
$18,269	**$18,817**	**$19,382**	**$19,963**	**$20,562**	**$21,179**	**$21,815**	**$22,469**	**$23,143**	**$23,837**	**$24,552**	**$25,289**	**$26,048**	**$26,829**	**$27,634**	**$28,463**	**$29,317**	**$30,196**	**$31,102**	**$32,035**	**$32,997**	**$33,986**	**$35,006**	**$36,056**	**$37,138**	**$38,252**	**$39,400**
$21,167	**$21,802**	**$22,456**	**$23,130**	**$23,824**	**$24,538**	**$25,275**	**$26,033**	**$26,814**	**$27,618**	**$28,447**	**$29,300**	**$30,179**	**$31,084**	**$32,017**	**$32,978**	**$33,967**	**$34,986**	**$36,035**	**$37,116**	**$38,230**	**$39,377**	**$40,558**	**$41,775**	**$43,028**	**$44,319**	**$45,649**
$24,065	**$24,787**	**$25,530**	**$26,296**	**$27,085**	**$27,898**	**$28,734**	**$29,597**	**$30,484**	**$31,399**	**$32,341**	**$33,311**	**$34,310**	**$35,340**	**$36,400**	**$37,492**	**$38,617**	**$39,775**	**$40,968**	**$42,198**	**$43,463**	**$44,767**	**$46,110**	**$47,494**	**$48,919**	**$50,386**	**$51,898**
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis
Alternative 1, Design Flow Rate = 20 CFS

(yellow)	Input Cells - Assumed or Given Values
(blue)	Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 5oth Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$2,687,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$2,944,889
To Replace 50% After Life of Project		$5,889,778
To Replace 100% After Life of Project	$2,687,000	$11,779,555
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$73,430
To Replace 50% After Life of Project		$146,861
To Replace 100% After Life of Project	$67,000	$293,722
Total Replacement Cost:		
To Replace 25% After Life of Project		**$3,018,319**
To Replace 50% After Life of Project		**$6,036,639**
To Replace 100% After Life of Project	**$2,754,000**	**$12,073,277**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$26,759
To Replace 50% After Life of Project	$53,518
To Replace 100% After Life of Project	$107,036
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$14,183
To Replace 50% After Life of Project	$28,366
To Replace 100% After Life of Project	$56,732
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$28,831
To Replace 50% After Life of Project	$57,663
To Replace 100% After Life of Project	$115,325
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$60,366
To Replace 50% After Life of Project	$120,733
To Replace 100% After Life of Project	$241,466

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$688,500	$711,000	$851,322	**$2,250,822**
50% Replacement	$1,377,000	$711,000	$851,322	**$2,939,322**
100% Replacement	$2,754,000	$711,000	$851,322	**$4,316,322**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$688,500	$711,000	$1,012,619	**$2,412,119**
50% Replacement	$1,377,000	$711,000	$1,012,619	**$3,100,619**
100% Replacement	$2,754,000	$711,000	$1,012,619	**$4,477,619**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$688,500	$711,000	$1,173,916	**$2,573,416**
50% Replacement	$1,377,000	$711,000	$1,173,916	**$3,261,916**
100% Replacement	$2,754,000	$711,000	$1,173,916	**$4,638,916**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$688,500	$711,000	$1,335,214	**$2,734,714**
50% Replacement	$1,377,000	$711,000	$1,335,214	**$3,423,214**
100% Replacement	$2,754,000	$711,000	$1,335,214	**$4,800,214**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Capital Expenses:	$2,687,000											
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits		$14,183	$14,609	$15,047	$15,498	$15,963	$16,442	$16,935	$17,443	$17,967	$18,506	$19,061
Interest		$0	$425	$877	$1,354	$1,860	$2,394	$2,960	$3,556	$4,186	$4,851	$5,552
End of Year Balance		**$14,183**	**$29,217**	**$45,141**	**$61,993**	**$79,816**	**$98,653**	**$118,548**	**$139,547**	**$161,701**	**$185,057**	**$209,670**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits		$28,366	$29,217	$30,094	$30,997	$31,926	$32,884	$33,871	$34,887	$35,933	$37,011	$38,122
Interest		$0	$851	$1,753	$2,708	$3,720	$4,789	$5,919	$7,113	$8,373	$9,702	$11,103
End of Year Balance		**$28,366**	**$58,434**	**$90,281**	**$123,986**	**$159,632**	**$197,305**	**$237,095**	**$279,095**	**$323,401**	**$370,115**	**$419,340**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits		$56,732	$58,434	$60,187	$61,993	$63,853	$65,768	$67,741	$69,774	$71,867	$74,023	$76,244
Interest		$0	$1,702	$3,506	$5,417	$7,439	$9,578	$11,838	$14,226	$16,746	$19,404	$22,207
End of Year Balance		**$56,732**	**$116,869**	**$180,562**	**$247,972**	**$319,264**	**$394,610**	**$474,190**	**$558,190**	**$646,802**	**$740,229**	**$838,680**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672
Maintenance and Small Repairs[7]		$8,100	$8,343	$8,593	$8,851	$9,117	$9,390	$9,672	$9,962	$10,261	$10,569	$10,886
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$14,220**	**$14,647**	**$15,086**	**$15,539**	**$16,005**	**$16,485**	**$16,979**	**$17,489**	**$18,013**	**$18,554**	**$19,110**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]		**$17,026**	**$17,537**	**$18,063**	**$18,605**	**$19,163**	**$19,738**	**$20,330**	**$20,940**	**$21,569**	**$22,216**	**$22,882**
4-Week Annual Pumping Duration[8]		**$20,252**	**$20,860**	**$21,486**	**$22,130**	**$22,794**	**$23,478**	**$24,182**	**$24,908**	**$25,655**	**$26,425**	**$27,218**
6-Week Annual Pumping Duration[8]		**$23,478**	**$24,183**	**$24,908**	**$25,655**	**$26,425**	**$27,218**	**$28,034**	**$28,875**	**$29,742**	**$30,634**	**$31,553**
8-Week Annual Pumping Duration[8]		**$26,704**	**$27,505**	**$28,331**	**$29,180**	**$30,056**	**$30,958**	**$31,886**	**$32,843**	**$33,828**	**$34,843**	**$35,888**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**

Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:												
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits	$19,633	$20,222	$20,828	$21,453	$22,097	$22,760	$23,443	$24,146	$24,870	$25,616	$26,385	$27,176
Interest	$6,290	$7,068	$7,886	$8,748	$9,654	$10,606	$11,607	$12,659	$13,763	$14,922	$16,138	$17,414
End of Year Balance	**$235,593**	**$262,882**	**$291,597**	**$321,798**	**$353,549**	**$386,915**	**$421,965**	**$458,770**	**$497,403**	**$537,941**	**$580,464**	**$625,055**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits	$39,265	$40,443	$41,657	$42,906	$44,194	$45,519	$46,885	$48,292	$49,740	$51,233	$52,769	$54,353
Interest	$12,580	$14,136	$15,773	$17,496	$19,308	$21,213	$23,215	$25,318	$27,526	$29,844	$32,276	$34,828
End of Year Balance	**$471,185**	**$525,764**	**$583,194**	**$643,596**	**$707,098**	**$773,830**	**$843,930**	**$917,540**	**$994,806**	**$1,075,883**	**$1,160,929**	**$1,250,109**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits	$78,531	$80,887	$83,313	$85,813	$88,387	$91,039	$93,770	$96,583	$99,481	$102,465	$105,539	$108,705
Interest	$25,160	$28,271	$31,546	$34,992	$38,616	$42,426	$46,430	$50,636	$55,052	$59,688	$64,553	$69,656
End of Year Balance	**$942,371**	**$1,051,529**	**$1,166,388**	**$1,287,193**	**$1,414,196**	**$1,547,660**	**$1,687,860**	**$1,835,079**	**$1,989,612**	**$2,151,765**	**$2,321,857**	**$2,500,218**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]	$11,212	$11,549	$11,895	$12,252	$12,620	$12,998	$13,388	$13,790	$14,203	$14,630	$15,068	$15,520
Administration, Insurance, Accounting	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses	**$19,684**	**$20,274**	**$20,883**	**$21,509**	**$22,154**	**$22,819**	**$23,503**	**$24,209**	**$24,935**	**$25,683**	**$26,453**	**$27,247**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]	**$23,569**	**$24,276**	**$25,004**	**$25,754**	**$26,527**	**$27,322**	**$28,142**	**$28,986**	**$29,856**	**$30,752**	**$31,674**	**$32,624**
4-Week Annual Pumping Duration[8]	**$28,034**	**$28,875**	**$29,741**	**$30,634**	**$31,553**	**$32,499**	**$33,474**	**$34,478**	**$35,513**	**$36,578**	**$37,675**	**$38,806**
6-Week Annual Pumping Duration[8]	**$32,499**	**$33,474**	**$34,479**	**$35,513**	**$36,578**	**$37,676**	**$38,806**	**$39,970**	**$41,169**	**$42,404**	**$43,677**	**$44,987**
8-Week Annual Pumping Duration[8]	**$36,965**	**$38,074**	**$39,216**	**$40,393**	**$41,604**	**$42,853**	**$44,138**	**$45,462**	**$46,826**	**$48,231**	**$49,678**	**$51,168**
Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

24	25	26	27	28	29	30	31	32	33	34	35	36	37
$27,992	$28,831	$29,696	$30,587	$31,505	$32,450	$33,423	$34,426	$35,459	$36,523	$37,618	$38,747	$39,909	$41,107
$18,752	$20,154	$21,623	$23,163	$24,776	$26,464	$28,231	$30,081	$32,016	$34,041	$36,157	$38,371	$40,684	$43,102
$671,798	**$720,783**	**$772,103**	**$825,853**	**$882,133**	**$941,047**	**$1,002,702**	**$1,067,209**	**$1,134,684**	**$1,205,248**	**$1,279,023**	**$1,356,141**	**$1,436,734**	**$1,520,943**
$55,983	$57,663	$59,393	$61,174	$63,010	$64,900	$66,847	$68,852	$70,918	$73,045	$75,237	$77,494	$79,819	$82,213
$37,503	$40,308	$43,247	$46,326	$49,551	$52,928	$56,463	$60,162	$64,033	$68,081	$72,315	$76,741	$81,368	$86,204
$1,343,596	**$1,441,566**	**$1,544,206**	**$1,651,706**	**$1,764,267**	**$1,882,095**	**$2,005,404**	**$2,134,419**	**$2,269,369**	**$2,410,495**	**$2,558,047**	**$2,712,282**	**$2,873,469**	**$3,041,886**
$111,966	$115,325	$118,785	$122,349	$126,019	$129,800	$133,694	$137,704	$141,836	$146,091	$150,473	$154,988	$159,637	$164,426
$75,007	$80,616	$86,494	$92,652	$99,102	$105,856	$112,926	$120,324	$128,065	$136,162	$144,630	$153,483	$162,737	$172,408
$2,687,191	**$2,883,132**	**$3,088,411**	**$3,303,412**	**$3,528,534**	**$3,764,189**	**$4,010,808**	**$4,268,837**	**$4,538,738**	**$4,820,991**	**$5,116,094**	**$5,424,564**	**$5,746,938**	**$6,083,772**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449
$15,986	$16,466	$16,960	$17,468	$17,992	$18,532	$19,088	$19,661	$20,251	$20,858	$21,484	$22,128	$22,792	$23,476
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$28,064	**$28,906**	**$29,774**	**$30,667**	**$31,587**	**$32,534**	**$33,510**	**$34,516**	**$35,551**	**$36,618**	**$37,716**	**$38,848**	**$40,013**	**$41,214**
$33,603	**$34,611**	**$35,650**	**$36,719**	**$37,821**	**$38,955**	**$40,124**	**$41,328**	**$42,567**	**$43,844**	**$45,160**	**$46,515**	**$47,910**	**$49,347**
$39,970	**$41,169**	**$42,404**	**$43,676**	**$44,986**	**$46,336**	**$47,726**	**$49,158**	**$50,633**	**$52,152**	**$53,716**	**$55,328**	**$56,987**	**$58,697**
$46,337	**$47,727**	**$49,158**	**$50,633**	**$52,152**	**$53,717**	**$55,328**	**$56,988**	**$58,698**	**$60,459**	**$62,272**	**$64,141**	**$66,065**	**$68,047**
$52,703	**$54,284**	**$55,913**	**$57,590**	**$59,318**	**$61,097**	**$62,930**	**$64,818**	**$66,763**	**$68,766**	**$70,829**	**$72,954**	**$75,142**	**$77,396**
24	25	26	27	28	29	30	31	32	33	34	35	36	37

38	39	40	41	42	43	44	45	46	47	48	49	50
$42,340	$43,610	$44,918	$46,266	$47,654	$49,083	$50,556	$52,073	$53,635	$55,244	$56,901	$58,608	$60,366
$45,628	$48,267	$51,024	$53,902	$56,907	$60,044	$63,318	$66,734	$70,298	$74,016	$77,894	$81,938	$86,154
$1,608,911	**$1,700,788**	**$1,796,730**	**$1,896,898**	**$2,001,459**	**$2,110,586**	**$2,224,459**	**$2,343,266**	**$2,467,198**	**$2,596,458**	**$2,731,253**	**$2,871,799**	**$3,018,319**
$84,680	$87,220	$89,837	$92,532	$95,308	$98,167	$101,112	$104,145	$107,270	$110,488	$113,802	$117,216	$120,733
$91,257	$96,535	$102,047	$107,804	$113,814	$120,088	$126,635	$133,468	$140,596	$148,032	$155,788	$163,875	$172,308
$3,217,823	**$3,401,577**	**$3,593,461**	**$3,793,797**	**$4,002,918**	**$4,221,172**	**$4,448,919**	**$4,686,532**	**$4,934,398**	**$5,192,917**	**$5,462,507**	**$5,743,598**	**$6,036,639**
$169,359	$174,440	$179,673	$185,063	$190,615	$196,334	$202,224	$208,290	$214,539	$220,975	$227,604	$234,433	$241,466
$182,513	$193,069	$204,095	$215,608	$227,628	$240,175	$253,270	$266,935	$281,192	$296,064	$311,575	$327,750	$344,616
$6,435,645	**$6,803,154**	**$7,186,922**	**$7,587,592**	**$8,005,835**	**$8,442,344**	**$8,897,838**	**$9,373,063**	**$9,868,794**	**$10,385,833**	**$10,925,013**	**$11,487,196**	**$12,073,277**
$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$24,180	$24,906	$25,653	$26,423	$27,215	$28,032	$28,873	$29,739	$30,631	$31,550	$32,496	$33,471	$34,475
$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$42,450	**$43,723**	**$45,035**	**$46,386**	**$47,778**	**$49,211**	**$50,687**	**$52,208**	**$53,774**	**$55,388**	**$57,049**	**$58,761**	**$60,523**
$50,828	**$52,353**	**$53,923**	**$55,541**	**$57,207**	**$58,923**	**$60,691**	**$62,512**	**$64,387**	**$66,319**	**$68,308**	**$70,358**	**$72,468**
$60,458	**$62,272**	**$64,140**	**$66,064**	**$68,046**	**$70,087**	**$72,190**	**$74,356**	**$76,586**	**$78,884**	**$81,250**	**$83,688**	**$86,199**
$70,088	**$72,191**	**$74,356**	**$76,587**	**$78,885**	**$81,251**	**$83,689**	**$86,200**	**$88,786**	**$91,449**	**$94,193**	**$97,018**	**$99,929**
$79,718	**$82,110**	**$84,573**	**$87,110**	**$89,724**	**$92,415**	**$95,188**	**$98,043**	**$100,985**	**$104,014**	**$107,135**	**$110,349**	**$113,659**
38	39	40	41	42	43	44	45	46	47	48	49	50

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis
Alternative 2, Design Flow Rate = 20 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 50th Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$3,051,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$3,343,824
To Replace 50% After Life of Project		$6,687,649
To Replace 100% After Life of Project	$3,051,000	$13,375,297
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$83,294
To Replace 50% After Life of Project		$166,588
To Replace 100% After Life of Project	$76,000	$333,177
Total Replacement Cost:		
To Replace 25% After Life of Project		**$3,427,119**
To Replace 50% After Life of Project		**$6,854,237**
To Replace 100% After Life of Project	**$3,127,000**	**$13,708,474**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$30,383
To Replace 50% After Life of Project	$60,766
To Replace 100% After Life of Project	$121,532
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$16,104
To Replace 50% After Life of Project	$32,208
To Replace 100% After Life of Project	$64,416
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$32,736
To Replace 50% After Life of Project	$65,472
To Replace 100% After Life of Project	$130,945
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$68,542
To Replace 50% After Life of Project	$137,085
To Replace 100% After Life of Project	$274,169

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$781,750	$766,000	$857,843	**$2,405,593**
50% Replacement	$1,563,500	$766,000	$857,843	**$3,187,343**
100% Replacement	$3,127,000	$766,000	$857,843	**$4,750,843**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$781,750	$766,000	$1,020,381	**$2,568,131**
50% Replacement	$1,563,500	$766,000	$1,020,381	**$3,349,881**
100% Replacement	$3,127,000	$766,000	$1,020,381	**$4,913,381**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$781,750	$766,000	$1,182,919	**$2,730,669**
50% Replacement	$1,563,500	$766,000	$1,182,919	**$3,512,419**
100% Replacement	$3,127,000	$766,000	$1,182,919	**$5,075,919**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$781,750	$766,000	$1,345,457	**$2,893,207**
50% Replacement	$1,563,500	$766,000	$1,345,457	**$3,674,957**
100% Replacement	$3,127,000	$766,000	$1,345,457	**$5,238,457**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:	$3,051,000																							
Replacement Fund (For Funding Replacement of 25% of System):																								
Deposits		$16,104	$16,587	$17,085	$17,597	$18,125	$18,669	$19,229	$19,806	$20,400	$21,012	$21,642	$22,292	$22,961	$23,649	$24,359	$25,090	$25,842	$26,618	$27,416	$28,239	$29,086	$29,958	$30,857
Interest		$0	$483	$995	$1,538	$2,112	$2,719	$3,360	$4,038	$4,753	$5,508	$6,304	$7,142	$8,025	$8,955	$9,933	$10,961	$12,043	$13,180	$14,373	$15,627	$16,943	$18,324	$19,772
End of Year Balance		**$16,104**	**$33,174**	**$51,254**	**$70,389**	**$90,626**	**$112,014**	**$134,604**	**$158,448**	**$183,601**	**$210,121**	**$238,067**	**$267,501**	**$298,487**	**$331,091**	**$365,382**	**$401,433**	**$439,319**	**$479,116**	**$520,905**	**$564,771**	**$610,800**	**$659,082**	**$709,712**
Replacement Fund (For Funding Replacement of 50% of System):																								
Deposits		$32,208	$33,174	$34,170	$35,195	$36,250	$37,338	$38,458	$39,612	$40,800	$42,024	$43,285	$44,584	$45,921	$47,299	$48,718	$50,179	$51,685	$53,235	$54,832	$56,477	$58,171	$59,917	$61,714
Interest		$0	$966	$1,990	$3,075	$4,223	$5,438	$6,721	$8,076	$9,507	$11,016	$12,607	$14,284	$16,050	$17,909	$19,865	$21,923	$24,086	$26,359	$28,747	$31,254	$33,886	$36,648	$39,545
End of Year Balance		**$32,208**	**$66,349**	**$102,509**	**$140,779**	**$181,252**	**$224,028**	**$269,207**	**$316,895**	**$367,202**	**$420,243**	**$476,135**	**$535,003**	**$596,974**	**$662,182**	**$730,765**	**$802,867**	**$878,637**	**$958,231**	**$1,041,811**	**$1,129,542**	**$1,221,600**	**$1,318,164**	**$1,419,423**
Replacement Fund (For Funding Replacement of 100% of System):																								
Deposits		$64,416	$66,349	$68,339	$70,389	$72,501	$74,676	$76,916	$79,224	$81,601	$84,049	$86,570	$89,167	$91,842	$94,597	$97,435	$100,358	$103,369	$106,470	$109,664	$112,954	$116,343	$119,833	$123,428
Interest		$0	$1,932	$3,981	$6,151	$8,447	$10,875	$13,442	$16,152	$19,014	$22,032	$25,215	$28,568	$32,100	$35,818	$39,731	$43,846	$48,172	$52,718	$57,494	$62,509	$67,773	$73,296	$79,090
End of Year Balance		**$64,416**	**$132,697**	**$205,017**	**$281,557**	**$362,505**	**$448,056**	**$538,414**	**$633,790**	**$734,405**	**$840,485**	**$952,270**	**$1,070,005**	**$1,193,947**	**$1,324,363**	**$1,461,529**	**$1,605,733**	**$1,757,275**	**$1,916,463**	**$2,083,621**	**$2,259,084**	**$2,443,199**	**$2,636,328**	**$2,838,846**
Operations and Maintenance Expenses:																								
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]		$9,200	$9,476	$9,760	$10,053	$10,355	$10,665	$10,985	$11,315	$11,654	$12,004	$12,364	$12,735	$13,117	$13,511	$13,916	$14,333	$14,763	$15,206	$15,662	$16,132	$16,616	$17,115	$17,628
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$15,320**	**$15,780**	**$16,253**	**$16,741**	**$17,243**	**$17,760**	**$18,293**	**$18,842**	**$19,407**	**$19,989**	**$20,589**	**$21,206**	**$21,843**	**$22,498**	**$23,173**	**$23,868**	**$24,584**	**$25,322**	**$26,081**	**$26,864**	**$27,670**	**$28,500**	**$29,355**
Pumping Power Costs:																								
2-Week Annual Pumping Duration[8]		**$17,157**	**$17,672**	**$18,202**	**$18,748**	**$19,310**	**$19,890**	**$20,486**	**$21,101**	**$21,734**	**$22,386**	**$23,057**	**$23,749**	**$24,462**	**$25,195**	**$25,951**	**$26,730**	**$27,532**	**$28,358**	**$29,208**	**$30,085**	**$30,987**	**$31,917**	**$32,874**
4-Week Annual Pumping Duration[8]		**$20,408**	**$21,020**	**$21,650**	**$22,300**	**$22,969**	**$23,658**	**$24,368**	**$25,099**	**$25,852**	**$26,627**	**$27,426**	**$28,249**	**$29,096**	**$29,969**	**$30,868**	**$31,794**	**$32,748**	**$33,731**	**$34,743**	**$35,785**	**$36,858**	**$37,964**	**$39,103**
6-Week Annual Pumping Duration[8]		**$23,658**	**$24,368**	**$25,099**	**$25,852**	**$26,628**	**$27,427**	**$28,249**	**$29,097**	**$29,970**	**$30,869**	**$31,795**	**$32,749**	**$33,731**	**$34,743**	**$35,785**	**$36,859**	**$37,965**	**$39,104**	**$40,277**	**$41,485**	**$42,730**	**$44,012**	**$45,332**
8-Week Annual Pumping Duration[8]		**$26,909**	**$27,716**	**$28,548**	**$29,404**	**$30,286**	**$31,195**	**$32,131**	**$33,095**	**$34,088**	**$35,110**	**$36,164**	**$37,249**	**$38,366**	**$39,517**	**$40,702**	**$41,924**	**$43,181**	**$44,477**	**$45,811**	**$47,185**	**$48,601**	**$50,059**	**$51,561**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis (Cont.)

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$31,783	$32,736	$33,718	$34,730	$35,772	$36,845	$37,950	$39,089	$40,261	$41,469	$42,713	$43,995	$45,315	$46,674	$48,074	$49,516	$51,002	$52,532	$54,108	$55,731	$57,403	$59,125	$60,899	$62,726	$64,608	$66,546	$68,542
$21,291	$22,884	$24,552	$26,300	$28,131	$30,048	$32,055	$34,155	$36,353	$38,651	$41,055	$43,568	$46,194	$48,940	$51,808	$54,805	$57,934	$61,202	$64,614	$68,176	$71,893	$75,772	$79,819	$84,041	$88,444	$93,035	$97,823
$762,786	**$818,406**	**$876,676**	**$937,706**	**$1,001,609**	**$1,068,502**	**$1,138,508**	**$1,211,752**	**$1,288,366**	**$1,368,486**	**$1,452,254**	**$1,539,816**	**$1,631,325**	**$1,726,939**	**$1,826,821**	**$1,931,142**	**$2,040,079**	**$2,153,813**	**$2,272,535**	**$2,396,443**	**$2,525,739**	**$2,660,637**	**$2,801,355**	**$2,948,121**	**$3,101,173**	**$3,260,754**	**$3,427,119**
$63,565	$65,472	$67,437	$69,460	$71,543	$73,690	$75,900	$78,178	$80,523	$82,939	$85,427	$87,989	$90,629	$93,348	$96,148	$99,033	$102,004	$105,064	$108,216	$111,462	$114,806	$118,251	$121,798	$125,452	$129,216	$133,092	$137,085
$42,583	$45,767	$49,104	$52,601	$56,262	$60,097	$64,110	$68,310	$72,705	$77,302	$82,109	$87,135	$92,389	$97,879	$103,616	$109,609	$115,869	$122,405	$129,229	$136,352	$143,787	$151,544	$159,638	$168,081	$176,887	$186,070	$195,645
$1,525,571	**$1,636,811**	**$1,753,352**	**$1,875,412**	**$2,003,218**	**$2,137,004**	**$2,277,015**	**$2,423,503**	**$2,576,731**	**$2,736,971**	**$2,904,507**	**$3,079,632**	**$3,262,650**	**$3,453,877**	**$3,653,642**	**$3,862,284**	**$4,080,157**	**$4,307,626**	**$4,545,070**	**$4,792,885**	**$5,051,478**	**$5,321,273**	**$5,602,709**	**$5,896,242**	**$6,202,345**	**$6,521,507**	**$6,854,237**
$127,131	$130,945	$134,873	$138,919	$143,087	$147,380	$151,801	$156,355	$161,046	$165,877	$170,853	$175,979	$181,258	$186,696	$192,297	$198,066	$204,008	$210,128	$216,432	$222,925	$229,613	$236,501	$243,596	$250,904	$258,431	$266,184	$274,169
$85,165	$91,534	$98,209	$105,201	$112,525	$120,193	$128,220	$136,621	$145,410	$154,604	$164,218	$174,270	$184,778	$195,759	$207,233	$219,219	$231,737	$244,809	$258,458	$272,704	$287,573	$303,089	$319,276	$336,163	$353,775	$372,141	$391,290
$3,051,143	**$3,273,622**	**$3,506,704**	**$3,750,824**	**$4,006,436**	**$4,274,009**	**$4,554,030**	**$4,847,006**	**$5,153,462**	**$5,473,942**	**$5,809,014**	**$6,159,263**	**$6,525,300**	**$6,907,755**	**$7,307,284**	**$7,724,569**	**$8,160,314**	**$8,615,251**	**$9,090,141**	**$9,585,770**	**$10,102,955**	**$10,642,545**	**$11,205,417**	**$11,792,484**	**$12,404,689**	**$13,043,014**	**$13,708,474**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$18,157	$18,702	$19,263	$19,841	$20,436	$21,049	$21,680	$22,331	$23,001	$23,691	$24,401	$25,134	$25,888	$26,664	$27,464	$28,288	$29,137	$30,011	$30,911	$31,838	$32,794	$33,777	$34,791	$35,834	$36,909	$38,017	$39,157
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$30,235	**$31,142**	**$32,077**	**$33,039**	**$34,030**	**$35,051**	**$36,103**	**$37,186**	**$38,301**	**$39,450**	**$40,634**	**$41,853**	**$43,108**	**$44,402**	**$45,734**	**$47,106**	**$48,519**	**$49,974**	**$51,474**	**$53,018**	**$54,608**	**$56,247**	**$57,934**	**$59,672**	**$61,462**	**$63,306**	**$65,205**
$33,861	**$34,876**	**$35,923**	**$37,000**	**$38,110**	**$39,254**	**$40,431**	**$41,644**	**$42,894**	**$44,180**	**$45,506**	**$46,871**	**$48,277**	**$49,725**	**$51,217**	**$52,754**	**$54,336**	**$55,966**	**$57,645**	**$59,375**	**$61,156**	**$62,991**	**$64,880**	**$66,827**	**$68,832**	**$70,896**	**$73,023**
$40,276	**$41,484**	**$42,729**	**$44,011**	**$45,331**	**$46,691**	**$48,092**	**$49,535**	**$51,021**	**$52,551**	**$54,128**	**$55,752**	**$57,424**	**$59,147**	**$60,921**	**$62,749**	**$64,631**	**$66,570**	**$68,568**	**$70,625**	**$72,743**	**$74,926**	**$77,173**	**$79,489**	**$81,873**	**$84,329**	**$86,859**
$46,692	**$48,093**	**$49,535**	**$51,021**	**$52,552**	**$54,129**	**$55,753**	**$57,425**	**$59,148**	**$60,922**	**$62,750**	**$64,632**	**$66,571**	**$68,569**	**$70,626**	**$72,744**	**$74,927**	**$77,175**	**$79,490**	**$81,874**	**$84,331**	**$86,861**	**$89,466**	**$92,150**	**$94,915**	**$97,762**	**$100,695**
$53,107	**$54,701**	**$56,342**	**$58,032**	**$59,773**	**$61,566**	**$63,413**	**$65,316**	**$67,275**	**$69,293**	**$71,372**	**$73,513**	**$75,719**	**$77,990**	**$80,330**	**$82,740**	**$85,222**	**$87,779**	**$90,412**	**$93,124**	**$95,918**	**$98,796**	**$101,759**	**$104,812**	**$107,957**	**$111,195**	**$114,531**
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis
Alternative 3, Design Flow Rate = 20 CFS

(yellow)	Input Cells - Assumed or Given Values
(blue)	Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 5oth Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$2,677,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:			CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:				
To Replace	25%	After Life of Project		$2,933,929
To Replace	50%	After Life of Project		$5,867,858
To Replace	100%	After Life of Project	$2,677,000	$11,735,716
Disposal and Removal Cost:				
To Replace	25%	After Life of Project		$73,430
To Replace	50%	After Life of Project		$146,861
To Replace	100%	After Life of Project	$67,000	$293,722
Total Replacement Cost:				
To Replace	**25%**	**After Life of Project**		**$3,007,360**
To Replace	**50%**	**After Life of Project**		**$6,014,719**
To Replace	**100%**	**After Life of Project**	**$2,744,000**	**$12,029,438**

REPLACEMENT FUND SUMMARY			
Annual Deposit Required (Assume Equal Deposit Made Each Year):			
To Replace	25%	After Life of Project	$26,662
To Replace	50%	After Life of Project	$53,323
To Replace	100%	After Life of Project	$106,647
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):			
To Replace	25%	After Life of Project	$14,132
To Replace	50%	After Life of Project	$28,263
To Replace	100%	After Life of Project	$56,526
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):			
To Replace	25%	After Life of Project	$28,727
To Replace	50%	After Life of Project	$57,453
To Replace	100%	After Life of Project	$114,907
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):			
To Replace	25%	After Life of Project	$60,147
To Replace	50%	After Life of Project	$120,294
To Replace	100%	After Life of Project	$240,589

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$686,000	$706,000	$830,673	**$2,222,673**
50% Replacement	$1,372,000	$706,000	$830,673	**$2,908,673**
100% Replacement	$2,744,000	$706,000	$830,673	**$4,280,673**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$686,000	$706,000	$988,041	**$2,380,041**
50% Replacement	$1,372,000	$706,000	$988,041	**$3,066,041**
100% Replacement	$2,744,000	$706,000	$988,041	**$4,438,041**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$686,000	$706,000	$1,145,409	**$2,537,409**
50% Replacement	$1,372,000	$706,000	$1,145,409	**$3,223,409**
100% Replacement	$2,744,000	$706,000	$1,145,409	**$4,595,409**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$686,000	$706,000	$1,302,777	**$2,694,777**
50% Replacement	$1,372,000	$706,000	$1,302,777	**$3,380,777**
100% Replacement	$2,744,000	$706,000	$1,302,777	**$4,752,777**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Capital Expenses:	$2,677,000											
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits		$14,132	$14,556	$14,992	$15,442	$15,905	$16,382	$16,874	$17,380	$17,901	$18,439	$18,992
Interest		$0	$424	$873	$1,349	$1,853	$2,386	$2,949	$3,544	$4,171	$4,833	$5,532
End of Year Balance		**$14,132**	**$29,111**	**$44,977**	**$61,768**	**$79,526**	**$98,294**	**$118,117**	**$139,041**	**$161,113**	**$184,385**	**$208,909**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits		$28,263	$29,111	$29,984	$30,884	$31,810	$32,765	$33,748	$34,760	$35,803	$36,877	$37,983
Interest		$0	$848	$1,747	$2,699	$3,706	$4,772	$5,898	$7,087	$8,342	$9,667	$11,063
End of Year Balance		**$28,263**	**$58,222**	**$89,953**	**$123,536**	**$159,052**	**$196,589**	**$236,234**	**$278,081**	**$322,227**	**$368,771**	**$417,817**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits		$56,526	$58,222	$59,969	$61,768	$63,621	$65,530	$67,495	$69,520	$71,606	$73,754	$75,967
Interest		$0	$1,696	$3,493	$5,397	$7,412	$9,543	$11,795	$14,174	$16,685	$19,334	$22,126
End of Year Balance		**$56,526**	**$116,444**	**$179,907**	**$247,072**	**$318,105**	**$393,178**	**$472,468**	**$556,163**	**$644,454**	**$737,541**	**$835,634**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672
Maintenance and Small Repairs[7]		$8,000	$8,240	$8,487	$8,742	$9,004	$9,274	$9,552	$9,839	$10,134	$10,438	$10,751
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$14,120**	**$14,544**	**$14,980**	**$15,429**	**$15,892**	**$16,369**	**$16,860**	**$17,366**	**$17,887**	**$18,423**	**$18,976**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]		**$16,613**	**$17,112**	**$17,625**	**$18,154**	**$18,699**	**$19,260**	**$19,837**	**$20,432**	**$21,045**	**$21,677**	**$22,327**
4-Week Annual Pumping Duration[8]		**$19,761**	**$20,354**	**$20,964**	**$21,593**	**$22,241**	**$22,908**	**$23,595**	**$24,303**	**$25,032**	**$25,783**	**$26,557**
6-Week Annual Pumping Duration[8]		**$22,908**	**$23,595**	**$24,303**	**$25,032**	**$25,783**	**$26,557**	**$27,354**	**$28,174**	**$29,019**	**$29,890**	**$30,787**
8-Week Annual Pumping Duration[8]		**$26,056**	**$26,837**	**$27,642**	**$28,472**	**$29,326**	**$30,206**	**$31,112**	**$32,045**	**$33,006**	**$33,997**	**$35,016**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**

Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:												
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits	$19,561	$20,148	$20,753	$21,375	$22,017	$22,677	$23,357	$24,058	$24,780	$25,523	$26,289	$27,078
Interest	$6,267	$7,042	$7,858	$8,716	$9,619	$10,568	$11,565	$12,613	$13,713	$14,868	$16,080	$17,351
End of Year Balance	**$234,737**	**$261,928**	**$290,538**	**$320,630**	**$352,265**	**$385,510**	**$420,433**	**$457,104**	**$495,597**	**$535,988**	**$578,357**	**$622,785**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits	$39,123	$40,297	$41,505	$42,751	$44,033	$45,354	$46,715	$48,116	$49,560	$51,046	$52,578	$54,155
Interest	$12,535	$14,084	$15,716	$17,432	$19,238	$21,136	$23,131	$25,226	$27,426	$29,736	$32,159	$34,701
End of Year Balance	**$469,475**	**$523,855**	**$581,076**	**$641,259**	**$704,530**	**$771,020**	**$840,866**	**$914,208**	**$991,194**	**$1,071,976**	**$1,156,713**	**$1,245,570**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits	$78,246	$80,593	$83,011	$85,501	$88,066	$90,708	$93,430	$96,232	$99,119	$102,093	$105,156	$108,310
Interest	$25,069	$28,168	$31,431	$34,865	$38,476	$42,272	$46,261	$50,452	$54,852	$59,472	$64,319	$69,403
End of Year Balance	**$938,949**	**$1,047,711**	**$1,162,153**	**$1,282,519**	**$1,409,061**	**$1,542,041**	**$1,681,731**	**$1,828,416**	**$1,982,388**	**$2,143,952**	**$2,313,427**	**$2,491,140**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]	$11,074	$11,406	$11,748	$12,101	$12,464	$12,838	$13,223	$13,619	$14,028	$14,449	$14,882	$15,329
Administration, Insurance, Accounting	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses	**$19,545**	**$20,132**	**$20,736**	**$21,358**	**$21,998**	**$22,658**	**$23,338**	**$24,038**	**$24,760**	**$25,502**	**$26,267**	**$27,055**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]	**$22,997**	**$23,687**	**$24,397**	**$25,129**	**$25,883**	**$26,660**	**$27,460**	**$28,283**	**$29,132**	**$30,006**	**$30,906**	**$31,833**
4-Week Annual Pumping Duration[8]	**$27,354**	**$28,174**	**$29,019**	**$29,890**	**$30,787**	**$31,710**	**$32,662**	**$33,641**	**$34,651**	**$35,690**	**$36,761**	**$37,864**
6-Week Annual Pumping Duration[8]	**$31,710**	**$32,662**	**$33,641**	**$34,651**	**$35,690**	**$36,761**	**$37,864**	**$39,000**	**$40,170**	**$41,375**	**$42,616**	**$43,894**
8-Week Annual Pumping Duration[8]	**$36,067**	**$37,149**	**$38,263**	**$39,411**	**$40,594**	**$41,812**	**$43,066**	**$44,358**	**$45,689**	**$47,059**	**$48,471**	**$49,925**
Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis (Cont.)

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$27,890	$28,727	$29,588	$30,476	$31,390	$32,332	$33,302	$34,301	$35,330	$36,390	$37,482	$38,606	$39,764	$40,957	$42,186	$43,452	$44,755	$46,098	$47,481	$48,905	$50,372	$51,884	$53,440	$55,043	$56,695	$58,395	$60,147
$18,684	$20,081	$21,545	$23,079	$24,686	$26,368	$28,129	$29,972	$31,900	$33,917	$36,026	$38,231	$40,537	$42,946	$45,463	$48,092	$50,838	$53,706	$56,700	$59,826	$63,088	$66,491	$70,043	$73,747	$77,611	$81,640	$85,841
$669,359	**$718,166**	**$769,299**	**$822,854**	**$878,930**	**$937,630**	**$999,061**	**$1,063,334**	**$1,130,565**	**$1,200,871**	**$1,274,379**	**$1,351,217**	**$1,431,518**	**$1,515,421**	**$1,603,069**	**$1,694,613**	**$1,790,207**	**$1,890,011**	**$1,994,192**	**$2,102,923**	**$2,216,383**	**$2,334,758**	**$2,458,240**	**$2,587,031**	**$2,721,336**	**$2,861,372**	**$3,007,360**
$55,780	$57,453	$59,177	$60,952	$62,781	$64,664	$66,604	$68,602	$70,660	$72,780	$74,963	$77,212	$79,529	$81,915	$84,372	$86,903	$89,510	$92,196	$94,961	$97,810	$100,745	$103,767	$106,880	$110,086	$113,389	$116,791	$120,294
$37,367	$40,162	$43,090	$46,158	$49,371	$52,736	$56,258	$59,944	$63,800	$67,834	$72,052	$76,463	$81,073	$85,891	$90,925	$96,184	$101,677	$107,412	$113,401	$119,651	$126,175	$132,983	$140,085	$147,494	$155,222	$163,280	$171,682
$1,338,717	**$1,436,332**	**$1,538,598**	**$1,645,709**	**$1,757,861**	**$1,875,261**	**$1,998,122**	**$2,126,668**	**$2,261,129**	**$2,401,743**	**$2,548,758**	**$2,702,433**	**$2,863,035**	**$3,030,841**	**$3,206,138**	**$3,389,226**	**$3,580,413**	**$3,780,021**	**$3,988,383**	**$4,205,845**	**$4,432,765**	**$4,669,515**	**$4,916,480**	**$5,174,061**	**$5,442,672**	**$5,722,742**	**$6,014,719**
$111,560	$114,907	$118,354	$121,904	$125,561	$129,328	$133,208	$137,204	$141,321	$145,560	$149,927	$154,425	$159,058	$163,829	$168,744	$173,806	$179,021	$184,391	$189,923	$195,621	$201,489	$207,534	$213,760	$220,173	$226,778	$233,581	$240,589
$74,734	$80,323	$86,180	$92,316	$98,743	$105,472	$112,516	$119,887	$127,600	$135,668	$144,105	$152,926	$162,146	$171,782	$181,850	$192,368	$203,354	$214,825	$226,801	$239,303	$252,351	$265,966	$280,171	$294,989	$310,444	$326,560	$343,365
$2,677,434	**$2,872,663**	**$3,077,197**	**$3,291,417**	**$3,515,721**	**$3,750,521**	**$3,996,245**	**$4,253,337**	**$4,522,257**	**$4,803,485**	**$5,097,517**	**$5,404,867**	**$5,726,070**	**$6,061,682**	**$6,412,276**	**$6,778,451**	**$7,160,825**	**$7,560,041**	**$7,976,766**	**$8,411,689**	**$8,865,529**	**$9,339,029**	**$9,832,960**	**$10,348,121**	**$10,885,343**	**$11,445,485**	**$12,029,438**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$15,789	$16,262	$16,750	$17,253	$17,770	$18,303	$18,853	$19,418	$20,001	$20,601	$21,219	$21,855	$22,511	$23,186	$23,882	$24,598	$25,336	$26,096	$26,879	$27,686	$28,516	$29,372	$30,253	$31,160	$32,095	$33,058	$34,050
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$27,867	**$28,703**	**$29,564**	**$30,451**	**$31,365**	**$32,306**	**$33,275**	**$34,273**	**$35,301**	**$36,360**	**$37,451**	**$38,575**	**$39,732**	**$40,924**	**$42,151**	**$43,416**	**$44,718**	**$46,060**	**$47,442**	**$48,865**	**$50,331**	**$51,841**	**$53,396**	**$54,998**	**$56,648**	**$58,347**	**$60,098**
$32,788	**$33,772**	**$34,785**	**$35,828**	**$36,903**	**$38,010**	**$39,151**	**$40,325**	**$41,535**	**$42,781**	**$44,064**	**$45,386**	**$46,748**	**$48,150**	**$49,595**	**$51,083**	**$52,615**	**$54,194**	**$55,820**	**$57,494**	**$59,219**	**$60,996**	**$62,825**	**$64,710**	**$66,651**	**$68,651**	**$70,711**
$39,000	**$40,170**	**$41,375**	**$42,616**	**$43,895**	**$45,211**	**$46,568**	**$47,965**	**$49,404**	**$50,886**	**$52,412**	**$53,985**	**$55,604**	**$57,272**	**$58,991**	**$60,760**	**$62,583**	**$64,461**	**$66,394**	**$68,386**	**$70,438**	**$72,551**	**$74,727**	**$76,969**	**$79,278**	**$81,657**	**$84,106**
$45,211	**$46,568**	**$47,965**	**$49,404**	**$50,886**	**$52,412**	**$53,985**	**$55,604**	**$57,272**	**$58,990**	**$60,760**	**$62,583**	**$64,460**	**$66,394**	**$68,386**	**$70,438**	**$72,551**	**$74,727**	**$76,969**	**$79,278**	**$81,657**	**$84,106**	**$86,630**	**$89,228**	**$91,905**	**$94,662**	**$97,502**
$51,423	**$52,966**	**$54,555**	**$56,191**	**$57,877**	**$59,613**	**$61,402**	**$63,244**	**$65,141**	**$67,095**	**$69,108**	**$71,181**	**$73,317**	**$75,516**	**$77,782**	**$80,115**	**$82,519**	**$84,994**	**$87,544**	**$90,170**	**$92,875**	**$95,662**	**$98,532**	**$101,487**	**$104,532**	**$107,668**	**$110,898**
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis
Alternative 4, Design Flow Rate = 20 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 50th Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$3,826,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$4,193,206
To Replace 50% After Life of Project		$8,386,412
To Replace 100% After Life of Project	$3,826,000	$16,772,824
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$105,214
To Replace 50% After Life of Project		$210,427
To Replace 100% After Life of Project	$96,000	$420,855
Total Replacement Cost:		
To Replace 25% After Life of Project		**$4,298,420**
To Replace 50% After Life of Project		**$8,596,840**
To Replace 100% After Life of Project	**$3,922,000**	**$17,193,679**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$38,108
To Replace 50% After Life of Project	$76,215
To Replace 100% After Life of Project	$152,430
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$20,198
To Replace 50% After Life of Project	$40,397
To Replace 100% After Life of Project	$80,793
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$41,059
To Replace 50% After Life of Project	$82,118
To Replace 100% After Life of Project	$164,236
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$85,968
To Replace 50% After Life of Project	$171,937
To Replace 100% After Life of Project	$343,874

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	Replacment Fund	O &M	Power	TOTAL
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$980,500	$881,000	$781,767	**$2,643,267**
50% Replacement	$1,961,000	$881,000	$781,767	**$3,623,767**
100% Replacement	$3,922,000	$881,000	$781,767	**$5,584,767**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$980,500	$881,000	$929,830	**$2,791,330**
50% Replacement	$1,961,000	$881,000	$929,830	**$3,771,830**
100% Replacement	$3,922,000	$881,000	$929,830	**$5,732,830**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$980,500	$881,000	$1,077,892	**$2,939,392**
50% Replacement	$1,961,000	$881,000	$1,077,892	**$3,919,892**
100% Replacement	$3,922,000	$881,000	$1,077,892	**$5,880,892**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$980,500	$881,000	$1,225,955	**$3,087,455**
50% Replacement	$1,961,000	$881,000	$1,225,955	**$4,067,955**
100% Replacement	$3,922,000	$881,000	$1,225,955	**$6,028,955**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Capital Expenses:	$3,826,000											
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits		$20,198	$20,804	$21,428	$22,071	$22,733	$23,415	$24,118	$24,841	$25,587	$26,354	$27,145
Interest		$0	$606	$1,248	$1,929	$2,649	$3,410	$4,215	$5,065	$5,962	$6,908	$7,906
End of Year Balance		**$20,198**	**$41,608**	**$64,285**	**$88,285**	**$113,667**	**$140,492**	**$168,825**	**$198,731**	**$230,279**	**$263,542**	**$298,593**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits		$40,397	$41,608	$42,857	$44,142	$45,467	$46,831	$48,236	$49,683	$51,173	$52,708	$54,290
Interest		$0	$1,212	$2,497	$3,857	$5,297	$6,820	$8,430	$10,129	$11,924	$13,817	$15,813
End of Year Balance		**$40,397**	**$83,217**	**$128,570**	**$176,570**	**$227,334**	**$280,984**	**$337,650**	**$397,462**	**$460,559**	**$527,084**	**$597,186**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits		$80,793	$83,217	$85,714	$88,285	$90,933	$93,661	$96,471	$99,365	$102,346	$105,417	$108,579
Interest		$0	$2,424	$4,993	$7,714	$10,594	$13,640	$16,859	$20,259	$23,848	$27,634	$31,625
End of Year Balance		**$80,793**	**$166,434**	**$257,141**	**$353,140**	**$454,667**	**$561,969**	**$675,299**	**$794,924**	**$921,118**	**$1,054,168**	**$1,194,372**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672
Maintenance and Small Repairs[7]		$11,500	$11,845	$12,200	$12,566	$12,943	$13,332	$13,732	$14,144	$14,568	$15,005	$15,455
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$17,620**	**$18,149**	**$18,693**	**$19,254**	**$19,831**	**$20,426**	**$21,039**	**$21,670**	**$22,320**	**$22,990**	**$23,680**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]		**$15,635**	**$16,104**	**$16,588**	**$17,085**	**$17,598**	**$18,126**	**$18,669**	**$19,230**	**$19,806**	**$20,401**	**$21,013**
4-Week Annual Pumping Duration[8]		**$18,597**	**$19,154**	**$19,729**	**$20,321**	**$20,931**	**$21,559**	**$22,205**	**$22,871**	**$23,558**	**$24,264**	**$24,992**
6-Week Annual Pumping Duration[8]		**$21,558**	**$22,205**	**$22,871**	**$23,557**	**$24,264**	**$24,991**	**$25,741**	**$26,513**	**$27,309**	**$28,128**	**$28,972**
8-Week Annual Pumping Duration[8]		**$24,519**	**$25,255**	**$26,012**	**$26,793**	**$27,596**	**$28,424**	**$29,277**	**$30,155**	**$31,060**	**$31,992**	**$32,952**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**

Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:												
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits	$27,959	$28,798	$29,662	$30,552	$31,468	$32,412	$33,385	$34,386	$35,418	$36,480	$37,575	$38,702
Interest	$8,958	$10,065	$11,231	$12,458	$13,748	$15,105	$16,530	$18,028	$19,600	$21,251	$22,983	$24,799
End of Year Balance	**$335,510**	**$374,373**	**$415,266**	**$458,276**	**$503,493**	**$551,010**	**$600,925**	**$653,339**	**$708,357**	**$766,088**	**$826,645**	**$890,147**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits	$55,918	$57,596	$59,324	$61,103	$62,937	$64,825	$66,769	$68,773	$70,836	$72,961	$75,150	$77,404
Interest	$17,916	$20,131	$22,462	$24,916	$27,497	$30,210	$33,061	$36,055	$39,200	$42,501	$45,965	$49,599
End of Year Balance	**$671,020**	**$748,747**	**$830,533**	**$916,552**	**$1,006,985**	**$1,102,020**	**$1,201,850**	**$1,306,678**	**$1,416,714**	**$1,532,176**	**$1,653,291**	**$1,780,294**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits	$111,837	$115,192	$118,648	$122,207	$125,873	$129,649	$133,539	$137,545	$141,671	$145,922	$150,299	$154,808
Interest	$35,831	$40,261	$44,925	$49,832	$54,993	$60,419	$66,121	$72,111	$78,401	$85,003	$91,931	$99,197
End of Year Balance	**$1,342,040**	**$1,497,493**	**$1,661,065**	**$1,833,104**	**$2,013,971**	**$2,204,039**	**$2,403,699**	**$2,613,355**	**$2,833,427**	**$3,064,352**	**$3,306,581**	**$3,560,587**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]	$15,919	$16,396	$16,888	$17,395	$17,917	$18,454	$19,008	$19,578	$20,165	$20,770	$21,393	$22,035
Administration, Insurance, Accounting	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses	**$24,390**	**$25,122**	**$25,876**	**$26,652**	**$27,451**	**$28,275**	**$29,123**	**$29,997**	**$30,897**	**$31,824**	**$32,778**	**$33,762**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]	**$21,643**	**$22,292**	**$22,961**	**$23,650**	**$24,359**	**$25,090**	**$25,843**	**$26,618**	**$27,417**	**$28,239**	**$29,086**	**$29,959**
4-Week Annual Pumping Duration[8]	**$25,742**	**$26,514**	**$27,310**	**$28,129**	**$28,973**	**$29,842**	**$30,737**	**$31,659**	**$32,609**	**$33,588**	**$34,595**	**$35,633**
6-Week Annual Pumping Duration[8]	**$29,841**	**$30,736**	**$31,658**	**$32,608**	**$33,586**	**$34,594**	**$35,632**	**$36,701**	**$37,802**	**$38,936**	**$40,104**	**$41,307**
8-Week Annual Pumping Duration[8]	**$33,940**	**$34,958**	**$36,007**	**$37,087**	**$38,200**	**$39,346**	**$40,526**	**$41,742**	**$42,994**	**$44,284**	**$45,613**	**$46,981**
Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis (Cont.)

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$39,863	$41,059	$42,291	$43,559	$44,866	$46,212	$47,599	$49,027	$50,497	$52,012	$53,573	$55,180	$56,835	$58,540	$60,297	$62,105	$63,969	$65,888	$67,864	$69,900	$71,997	$74,157	$76,382	$78,673	$81,033	$83,464	$85,968
$26,704	$28,701	$30,794	$32,987	$35,283	$37,688	$40,205	$42,839	$45,595	$48,477	$51,492	$54,644	$57,939	$61,382	$64,980	$68,738	$72,663	$76,762	$81,042	$85,509	$90,171	$95,036	$100,112	$105,407	$110,929	$116,688	$122,693
$956,714	**$1,026,475**	**$1,099,560**	**$1,176,106**	**$1,256,255**	**$1,340,155**	**$1,427,959**	**$1,519,824**	**$1,615,916**	**$1,716,406**	**$1,821,471**	**$1,931,295**	**$2,046,069**	**$2,165,991**	**$2,291,267**	**$2,422,111**	**$2,558,743**	**$2,701,392**	**$2,850,298**	**$3,005,708**	**$3,167,876**	**$3,337,069**	**$3,513,563**	**$3,697,643**	**$3,889,606**	**$4,089,759**	**$4,298,420**
$79,726	$82,118	$84,582	$87,119	$89,733	$92,425	$95,197	$98,053	$100,995	$104,025	$107,145	$110,360	$113,670	$117,081	$120,593	$124,211	$127,937	$131,775	$135,728	$139,800	$143,994	$148,314	$152,764	$157,347	$162,067	$166,929	$171,937
$53,409	$57,403	$61,588	$65,974	$70,566	$75,375	$80,409	$85,678	$91,189	$96,955	$102,984	$109,288	$115,878	$122,764	$129,959	$137,476	$145,327	$153,525	$162,084	$171,018	$180,342	$190,073	$200,224	$210,814	$221,859	$233,376	$245,386
$1,913,429	**$2,052,949**	**$2,199,119**	**$2,352,212**	**$2,512,511**	**$2,680,311**	**$2,855,917**	**$3,039,648**	**$3,231,832**	**$3,432,812**	**$3,642,941**	**$3,862,589**	**$4,092,137**	**$4,331,982**	**$4,582,534**	**$4,844,221**	**$5,117,485**	**$5,402,785**	**$5,700,597**	**$6,011,415**	**$6,335,752**	**$6,674,139**	**$7,027,127**	**$7,395,287**	**$7,779,212**	**$8,179,518**	**$8,596,840**
$159,452	$164,236	$169,163	$174,238	$179,465	$184,849	$190,394	$196,106	$201,989	$208,049	$214,291	$220,719	$227,341	$234,161	$241,186	$248,422	$255,874	$263,550	$271,457	$279,601	$287,989	$296,628	$305,527	$314,693	$324,134	$333,858	$343,874
$106,818	$114,806	$123,177	$131,947	$141,133	$150,751	$160,819	$171,355	$182,379	$193,910	$205,969	$218,576	$231,755	$245,528	$259,919	$274,952	$290,653	$307,049	$324,167	$342,036	$360,685	$380,145	$400,448	$421,628	$443,717	$466,753	$490,771
$3,826,857	**$4,105,898**	**$4,398,238**	**$4,704,423**	**$5,025,021**	**$5,360,621**	**$5,711,834**	**$6,079,295**	**$6,463,664**	**$6,865,623**	**$7,285,882**	**$7,725,178**	**$8,184,274**	**$8,663,963**	**$9,165,068**	**$9,688,442**	**$10,234,970**	**$10,805,569**	**$11,401,193**	**$12,022,830**	**$12,671,503**	**$13,348,277**	**$14,054,252**	**$14,790,573**	**$15,558,424**	**$16,359,034**	**$17,193,679**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$22,696	$23,377	$24,078	$24,801	$25,545	$26,311	$27,101	$27,914	$28,751	$29,613	$30,502	$31,417	$32,359	$33,330	$34,330	$35,360	$36,421	$37,513	$38,639	$39,798	$40,992	$42,222	$43,488	$44,793	$46,137	$47,521	$48,947
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$34,775	**$35,818**	**$36,892**	**$37,999**	**$39,139**	**$40,313**	**$41,523**	**$42,768**	**$44,051**	**$45,373**	**$46,734**	**$48,136**	**$49,580**	**$51,068**	**$52,600**	**$54,178**	**$55,803**	**$57,477**	**$59,201**	**$60,977**	**$62,807**	**$64,691**	**$66,632**	**$68,631**	**$70,690**	**$72,810**	**$74,995**
$30,858	**$31,783**	**$32,737**	**$33,719**	**$34,731**	**$35,773**	**$36,846**	**$37,951**	**$39,090**	**$40,262**	**$41,470**	**$42,714**	**$43,996**	**$45,316**	**$46,675**	**$48,075**	**$49,518**	**$51,003**	**$52,533**	**$54,109**	**$55,732**	**$57,404**	**$59,127**	**$60,900**	**$62,727**	**$64,609**	**$66,547**
$36,702	**$37,803**	**$38,937**	**$40,105**	**$41,308**	**$42,548**	**$43,824**	**$45,139**	**$46,493**	**$47,888**	**$49,324**	**$50,804**	**$52,328**	**$53,898**	**$55,515**	**$57,181**	**$58,896**	**$60,663**	**$62,483**	**$64,357**	**$66,288**	**$68,277**	**$70,325**	**$72,435**	**$74,608**	**$76,846**	**$79,151**
$42,546	**$43,823**	**$45,137**	**$46,491**	**$47,886**	**$49,323**	**$50,802**	**$52,327**	**$53,896**	**$55,513**	**$57,179**	**$58,894**	**$60,661**	**$62,481**	**$64,355**	**$66,286**	**$68,274**	**$70,323**	**$72,432**	**$74,605**	**$76,843**	**$79,149**	**$81,523**	**$83,969**	**$86,488**	**$89,082**	**$91,755**
$48,391	**$49,842**	**$51,338**	**$52,878**	**$54,464**	**$56,098**	**$57,781**	**$59,514**	**$61,300**	**$63,139**	**$65,033**	**$66,984**	**$68,993**	**$71,063**	**$73,195**	**$75,391**	**$77,653**	**$79,982**	**$82,382**	**$84,853**	**$87,399**	**$90,021**	**$92,721**	**$95,503**	**$98,368**	**$101,319**	**$104,359**
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis
Alternative 5, Design Flow Rate = 20 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 50th Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$4,403,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$4,825,585
To Replace 50% After Life of Project		$9,651,169
To Replace 100% After Life of Project	$4,403,000	$19,302,338
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$120,557
To Replace 50% After Life of Project		$241,115
To Replace 100% After Life of Project	$110,000	$482,230
Total Replacement Cost:		
To Replace 25% After Life of Project		**$4,946,142**
To Replace 50% After Life of Project		**$9,892,284**
To Replace 100% After Life of Project	**$4,513,000**	**$19,784,568**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$43,850
To Replace 50% After Life of Project	$87,700
To Replace 100% After Life of Project	$175,400
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$23,242
To Replace 50% After Life of Project	$46,484
To Replace 100% After Life of Project	$92,968
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$47,246
To Replace 50% After Life of Project	$94,492
To Replace 100% After Life of Project	$188,984
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$98,923
To Replace 50% After Life of Project	$197,846
To Replace 100% After Life of Project	$395,691

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$1,128,250	$966,000	$742,643	**$2,836,893**
50% Replacement	$2,256,500	$966,000	$742,643	**$3,965,143**
100% Replacement	$4,513,000	$966,000	$742,643	**$6,221,643**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$1,128,250	$966,000	$883,261	**$2,977,511**
50% Replacement	$2,256,500	$966,000	$883,261	**$4,105,761**
100% Replacement	$4,513,000	$966,000	$883,261	**$6,362,261**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$1,128,250	$966,000	$1,023,879	**$3,118,129**
50% Replacement	$2,256,500	$966,000	$1,023,879	**$4,246,379**
100% Replacement	$4,513,000	$966,000	$1,023,879	**$6,502,879**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$1,128,250	$966,000	$1,164,497	**$3,258,747**
50% Replacement	$2,256,500	$966,000	$1,164,497	**$4,386,997**
100% Replacement	$4,513,000	$966,000	$1,164,497	**$6,643,497**

LIFE CYCLE COSTS:

Year	0	1	2	3	4	5	6	7	8	9	10	11
Capital Expenses:	$4,403,000											
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits		$23,242	$23,939	$24,657	$25,397	$26,159	$26,944	$27,752	$28,585	$29,442	$30,325	$31,235
Interest		$0	$697	$1,436	$2,219	$3,048	$3,924	$4,850	$5,828	$6,860	$7,949	$9,098
End of Year Balance		**$23,242**	**$47,878**	**$73,972**	**$101,588**	**$130,795**	**$161,663**	**$194,265**	**$228,677**	**$264,980**	**$303,255**	**$343,588**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits		$46,484	$47,878	$49,315	$50,794	$52,318	$53,888	$55,504	$57,169	$58,884	$60,651	$62,470
Interest		$0	$1,395	$2,873	$4,438	$6,095	$7,848	$9,700	$11,656	$13,721	$15,899	$18,195
End of Year Balance		**$46,484**	**$95,757**	**$147,944**	**$203,177**	**$261,590**	**$323,325**	**$388,529**	**$457,355**	**$529,960**	**$606,509**	**$687,175**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits		$92,968	$95,757	$98,630	$101,588	$104,636	$107,775	$111,008	$114,339	$117,769	$121,302	$124,941
Interest		$0	$2,789	$5,745	$8,877	$12,191	$15,695	$19,400	$23,312	$27,441	$31,798	$36,391
End of Year Balance		**$92,968**	**$191,514**	**$295,889**	**$406,354**	**$523,180**	**$646,651**	**$777,059**	**$914,709**	**$1,059,919**	**$1,213,019**	**$1,374,350**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672
Maintenance and Small Repairs[7]		$13,200	$13,596	$14,004	$14,424	$14,857	$15,302	$15,761	$16,234	$16,721	$17,223	$17,740
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$19,320**	**$19,900**	**$20,497**	**$21,111**	**$21,745**	**$22,397**	**$23,069**	**$23,761**	**$24,474**	**$25,208**	**$25,964**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]		**$14,853**	**$15,298**	**$15,757**	**$16,230**	**$16,717**	**$17,219**	**$17,735**	**$18,267**	**$18,815**	**$19,380**	**$19,961**
4-Week Annual Pumping Duration[8]		**$17,665**	**$18,195**	**$18,741**	**$19,303**	**$19,882**	**$20,479**	**$21,093**	**$21,726**	**$22,378**	**$23,049**	**$23,741**
6-Week Annual Pumping Duration[8]		**$20,478**	**$21,092**	**$21,725**	**$22,376**	**$23,048**	**$23,739**	**$24,451**	**$25,185**	**$25,940**	**$26,719**	**$27,520**
8-Week Annual Pumping Duration[8]		**$23,290**	**$23,989**	**$24,708**	**$25,450**	**$26,213**	**$26,999**	**$27,809**	**$28,644**	**$29,503**	**$30,388**	**$31,300**
Year	0	1	2	3	4	5	6	7	8	9	10	11

Year	12	13	14	15	16	17	18	19	20	21	22	23
Capital Expenses:												
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits	$32,172	$33,137	$34,132	$35,156	$36,210	$37,297	$38,415	$39,568	$40,755	$41,978	$43,237	$44,534
Interest	$10,308	$11,582	$12,924	$14,335	$15,820	$17,381	$19,021	$20,744	$22,554	$24,453	$26,446	$28,536
End of Year Balance	**$386,068**	**$430,787**	**$477,842**	**$527,333**	**$579,363**	**$634,041**	**$691,477**	**$751,789**	**$815,098**	**$881,528**	**$951,211**	**$1,024,282**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits	$64,345	$66,275	$68,263	$70,311	$72,420	$74,593	$76,831	$79,136	$81,510	$83,955	$86,474	$89,068
Interest	$20,615	$23,164	$25,847	$28,671	$31,640	$34,762	$38,042	$41,489	$45,107	$48,906	$52,892	$57,073
End of Year Balance	**$772,135**	**$861,574**	**$955,684**	**$1,054,666**	**$1,158,726**	**$1,268,081**	**$1,382,954**	**$1,503,579**	**$1,630,196**	**$1,763,057**	**$1,902,422**	**$2,048,563**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits	$128,689	$132,550	$136,526	$140,622	$144,841	$149,186	$153,662	$158,271	$163,020	$167,910	$172,947	$178,136
Interest	$41,231	$46,328	$51,694	$57,341	$63,280	$69,524	$76,085	$82,977	$90,215	$97,812	$105,783	$114,145
End of Year Balance	**$1,544,270**	**$1,723,148**	**$1,911,369**	**$2,109,332**	**$2,317,453**	**$2,536,162**	**$2,765,909**	**$3,007,158**	**$3,260,392**	**$3,526,114**	**$3,804,845**	**$4,097,126**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]	$18,272	$18,820	$19,385	$19,966	$20,565	$21,182	$21,818	$22,472	$23,146	$23,841	$24,556	$25,293
Administration, Insurance, Accounting	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses	**$26,743**	**$27,546**	**$28,372**	**$29,223**	**$30,100**	**$31,003**	**$31,933**	**$32,891**	**$33,878**	**$34,894**	**$35,941**	**$37,019**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]	**$20,560**	**$21,177**	**$21,812**	**$22,466**	**$23,140**	**$23,834**	**$24,550**	**$25,286**	**$26,045**	**$26,826**	**$27,631**	**$28,460**
4-Week Annual Pumping Duration[8]	**$24,453**	**$25,186**	**$25,942**	**$26,720**	**$27,522**	**$28,347**	**$29,198**	**$30,074**	**$30,976**	**$31,905**	**$32,863**	**$33,848**
6-Week Annual Pumping Duration[8]	**$28,346**	**$29,196**	**$30,072**	**$30,974**	**$31,903**	**$32,861**	**$33,846**	**$34,862**	**$35,908**	**$36,985**	**$38,094**	**$39,237**
8-Week Annual Pumping Duration[8]	**$32,239**	**$33,206**	**$34,202**	**$35,228**	**$36,285**	**$37,374**	**$38,495**	**$39,650**	**$40,839**	**$42,064**	**$43,326**	**$44,626**
Year	12	13	14	15	16	17	18	19	20	21	22	23

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis (Cont.)

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$45,870	$47,246	$48,663	$50,123	$51,627	$53,176	$54,771	$56,414	$58,107	$59,850	$61,645	$63,495	$65,400	$67,362	$69,382	$71,464	$73,608	$75,816	$78,091	$80,433	$82,846	$85,332	$87,892	$90,528	$93,244	$96,042	$98,923
$30,728	$33,026	$35,435	$37,958	$40,600	$43,367	$46,263	$49,294	$52,465	$55,782	$59,251	$62,878	$66,670	$70,632	$74,771	$79,096	$83,613	$88,329	$93,254	$98,394	$103,759	$109,357	$115,198	$121,290	$127,645	$134,272	$141,181
$1,100,880	**$1,181,152**	**$1,265,251**	**$1,353,331**	**$1,445,558**	**$1,542,101**	**$1,643,135**	**$1,748,844**	**$1,859,416**	**$1,975,048**	**$2,095,945**	**$2,222,318**	**$2,354,387**	**$2,492,381**	**$2,636,535**	**$2,787,095**	**$2,944,315**	**$3,108,461**	**$3,279,805**	**$3,458,633**	**$3,645,238**	**$3,839,927**	**$4,043,016**	**$4,254,835**	**$4,475,725**	**$4,706,038**	**$4,946,142**
$91,740	$94,492	$97,327	$100,247	$103,254	$106,352	$109,542	$112,829	$116,213	$119,700	$123,291	$126,990	$130,799	$134,723	$138,765	$142,928	$147,216	$151,632	$156,181	$160,867	$165,693	$170,663	$175,783	$181,057	$186,489	$192,083	$197,846
$61,457	$66,053	$70,869	$75,915	$81,200	$86,734	$92,526	$98,588	$104,931	$111,565	$118,503	$125,757	$133,339	$141,263	$149,543	$158,192	$167,226	$176,659	$186,508	$196,788	$207,518	$218,714	$230,396	$242,581	$255,290	$268,543	$282,362
$2,201,760	**$2,362,305**	**$2,530,501**	**$2,706,663**	**$2,891,117**	**$3,084,202**	**$3,286,271**	**$3,497,687**	**$3,718,832**	**$3,950,096**	**$4,191,890**	**$4,444,636**	**$4,708,775**	**$4,984,761**	**$5,273,069**	**$5,574,189**	**$5,888,631**	**$6,216,922**	**$6,559,611**	**$6,917,266**	**$7,290,476**	**$7,679,854**	**$8,086,033**	**$8,509,671**	**$8,951,449**	**$9,412,076**	**$9,892,284**
$183,480	$188,984	$194,654	$200,494	$206,508	$212,704	$219,085	$225,657	$232,427	$239,400	$246,582	$253,979	$261,599	$269,447	$277,530	$285,856	$294,432	$303,264	$312,362	$321,733	$331,385	$341,327	$351,567	$362,114	$372,977	$384,166	$395,691
$122,914	$132,106	$141,738	$151,830	$162,400	$173,467	$185,052	$197,176	$209,861	$223,130	$237,006	$251,513	$266,678	$282,526	$299,086	$316,384	$334,451	$353,318	$373,015	$393,577	$415,036	$437,429	$460,791	$485,162	$510,580	$537,087	$564,725
$4,403,520	**$4,724,610**	**$5,061,002**	**$5,413,326**	**$5,782,234**	**$6,168,405**	**$6,572,541**	**$6,995,375**	**$7,437,663**	**$7,900,193**	**$8,383,780**	**$8,889,273**	**$9,417,550**	**$9,969,523**	**$10,546,138**	**$11,148,378**	**$11,777,261**	**$12,433,844**	**$13,119,221**	**$13,834,531**	**$14,580,953**	**$15,359,708**	**$16,172,066**	**$17,019,341**	**$17,902,899**	**$18,824,152**	**$19,784,568**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$26,051	$26,833	$27,638	$28,467	$29,321	$30,201	$31,107	$32,040	$33,001	$33,991	$35,011	$36,061	$37,143	$38,257	$39,405	$40,587	$41,805	$43,059	$44,351	$45,681	$47,052	$48,463	$49,917	$51,415	$52,957	$54,546	$56,182
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$38,130	**$39,274**	**$40,452**	**$41,665**	**$42,915**	**$44,203**	**$45,529**	**$46,895**	**$48,302**	**$49,751**	**$51,243**	**$52,780**	**$54,364**	**$55,995**	**$57,675**	**$59,405**	**$61,187**	**$63,023**	**$64,913**	**$66,861**	**$68,866**	**$70,932**	**$73,060**	**$75,252**	**$77,510**	**$79,835**	**$82,230**
$29,313	**$30,193**	**$31,099**	**$32,032**	**$32,992**	**$33,982**	**$35,002**	**$36,052**	**$37,133**	**$38,247**	**$39,395**	**$40,577**	**$41,794**	**$43,048**	**$44,339**	**$45,669**	**$47,039**	**$48,451**	**$49,904**	**$51,401**	**$52,943**	**$54,532**	**$56,168**	**$57,853**	**$59,588**	**$61,376**	**$63,217**
$34,864	**$35,910**	**$36,987**	**$38,097**	**$39,240**	**$40,417**	**$41,629**	**$42,878**	**$44,164**	**$45,489**	**$46,854**	**$48,260**	**$49,708**	**$51,199**	**$52,735**	**$54,317**	**$55,946**	**$57,625**	**$59,353**	**$61,134**	**$62,968**	**$64,857**	**$66,803**	**$68,807**	**$70,871**	**$72,997**	**$75,187**
$40,414	**$41,627**	**$42,876**	**$44,162**	**$45,487**	**$46,851**	**$48,257**	**$49,704**	**$51,196**	**$52,731**	**$54,313**	**$55,943**	**$57,621**	**$59,350**	**$61,130**	**$62,964**	**$64,853**	**$66,799**	**$68,803**	**$70,867**	**$72,993**	**$75,182**	**$77,438**	**$79,761**	**$82,154**	**$84,619**	**$87,157**
$45,965	**$47,344**	**$48,764**	**$50,227**	**$51,734**	**$53,286**	**$54,884**	**$56,531**	**$58,227**	**$59,974**	**$61,773**	**$63,626**	**$65,535**	**$67,501**	**$69,526**	**$71,612**	**$73,760**	**$75,973**	**$78,252**	**$80,599**	**$83,017**	**$85,508**	**$88,073**	**$90,715**	**$93,437**	**$96,240**	**$99,127**
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis
Alternative 1, Design Flow Rate = 40 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 5oth Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$3,899,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$4,273,212
To Replace 50% After Life of Project		$8,546,425
To Replace 100% After Life of Project	$3,899,000	$17,092,850
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$107,406
To Replace 50% After Life of Project		$214,811
To Replace 100% After Life of Project	$98,000	$429,623
Total Replacement Cost:		
To Replace 25% After Life of Project		**$4,380,618**
To Replace 50% After Life of Project		**$8,761,236**
To Replace 100% After Life of Project	**$3,997,000**	**$17,522,472**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$38,836
To Replace 50% After Life of Project	$77,673
To Replace 100% After Life of Project	$155,345
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$20,585
To Replace 50% After Life of Project	$41,169
To Replace 100% After Life of Project	$82,338
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$41,844
To Replace 50% After Life of Project	$83,688
To Replace 100% After Life of Project	$167,377
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$87,612
To Replace 50% After Life of Project	$175,225
To Replace 100% After Life of Project	$350,449

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	Replacment Fund	O & M	Power	TOTAL
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$999,250	$891,000	$1,760,966	**$3,651,216**
50% Replacement	$1,998,500	$891,000	$1,760,966	**$4,650,466**
100% Replacement	$3,997,000	$891,000	$1,760,966	**$6,648,966**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$999,250	$891,000	$2,095,348	**$3,985,598**
50% Replacement	$1,998,500	$891,000	$2,095,348	**$4,984,848**
100% Replacement	$3,997,000	$891,000	$2,095,348	**$6,983,348**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$999,250	$891,000	$2,429,729	**$4,319,979**
50% Replacement	$1,998,500	$891,000	$2,429,729	**$5,319,229**
100% Replacement	$3,997,000	$891,000	$2,429,729	**$7,317,729**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$999,250	$891,000	$2,764,110	**$4,654,360**
50% Replacement	$1,998,500	$891,000	$2,764,110	**$5,653,610**
100% Replacement	$3,997,000	$891,000	$2,764,110	**$7,652,110**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:	$3,899,000																							
Replacement Fund (For Funding Replacement of 25% of System):																								
Deposits		$20,585	$21,202	$21,838	$22,493	$23,168	$23,863	$24,579	$25,316	$26,076	$26,858	$27,664	$28,494	$29,349	$30,229	$31,136	$32,070	$33,032	$34,023	$35,044	$36,095	$37,178	$38,293	$39,442
Interest		$0	$618	$1,272	$1,965	$2,699	$3,475	$4,295	$5,162	$6,076	$7,040	$8,057	$9,129	$10,258	$11,446	$12,696	$14,011	$15,394	$16,846	$18,372	$19,975	$21,657	$23,422	$25,274
End of Year Balance		**$20,585**	**$42,404**	**$65,514**	**$89,973**	**$115,840**	**$143,179**	**$172,053**	**$202,531**	**$234,683**	**$268,582**	**$304,303**	**$341,926**	**$381,532**	**$423,207**	**$467,040**	**$513,121**	**$561,547**	**$612,416**	**$665,833**	**$721,903**	**$780,738**	**$842,453**	**$907,169**
Replacement Fund (For Funding Replacement of 50% of System):																								
Deposits		$41,169	$42,404	$43,676	$44,987	$46,336	$47,726	$49,158	$50,633	$52,152	$53,716	$55,328	$56,988	$58,697	$60,458	$62,272	$64,140	$66,064	$68,046	$70,088	$72,190	$74,356	$76,587	$78,884
Interest		$0	$1,235	$2,544	$3,931	$5,398	$6,950	$8,591	$10,323	$12,152	$14,081	$16,115	$18,258	$20,516	$22,892	$25,392	$28,022	$30,787	$33,693	$36,745	$39,950	$43,314	$46,844	$50,547
End of Year Balance		**$41,169**	**$84,808**	**$131,029**	**$179,946**	**$231,681**	**$286,358**	**$344,106**	**$405,062**	**$469,366**	**$537,163**	**$608,606**	**$683,852**	**$763,065**	**$846,415**	**$934,079**	**$1,026,242**	**$1,123,093**	**$1,224,832**	**$1,331,665**	**$1,443,805**	**$1,561,475**	**$1,684,906**	**$1,814,338**
Replacement Fund (For Funding Replacement of 100% of System):																								
Deposits		$82,338	$84,808	$87,353	$89,973	$92,672	$95,453	$98,316	$101,266	$104,304	$107,433	$110,656	$113,975	$117,395	$120,916	$124,544	$128,280	$132,129	$136,092	$140,175	$144,381	$148,712	$153,173	$157,769
Interest		$0	$2,470	$5,089	$7,862	$10,797	$13,901	$17,181	$20,646	$24,304	$28,162	$32,230	$36,516	$41,031	$45,784	$50,785	$56,045	$61,575	$67,386	$73,490	$79,900	$86,628	$93,689	$101,094
End of Year Balance		**$82,338**	**$169,617**	**$262,058**	**$359,893**	**$463,362**	**$572,715**	**$688,213**	**$810,125**	**$938,732**	**$1,074,327**	**$1,217,212**	**$1,367,704**	**$1,526,130**	**$1,692,830**	**$1,868,159**	**$2,052,484**	**$2,246,187**	**$2,449,665**	**$2,663,330**	**$2,887,611**	**$3,122,951**	**$3,369,813**	**$3,628,676**
Operations and Maintenance Expenses:																								
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]		$11,700	$12,051	$12,413	$12,785	$13,168	$13,564	$13,970	$14,390	$14,821	$15,266	$15,724	$16,196	$16,681	$17,182	$17,697	$18,228	$18,775	$19,338	$19,918	$20,516	$21,132	$21,765	$22,418
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$17,820**	**$18,355**	**$18,905**	**$19,472**	**$20,057**	**$20,658**	**$21,278**	**$21,916**	**$22,574**	**$23,251**	**$23,949**	**$24,667**	**$25,407**	**$26,169**	**$26,954**	**$27,763**	**$28,596**	**$29,454**	**$30,337**	**$31,247**	**$32,185**	**$33,150**	**$34,145**
Pumping Power Costs:																								
2-Week Annual Pumping Duration[8]		**$35,219**	**$36,276**	**$37,364**	**$38,485**	**$39,640**	**$40,829**	**$42,054**	**$43,315**	**$44,615**	**$45,953**	**$47,332**	**$48,752**	**$50,214**	**$51,721**	**$53,272**	**$54,871**	**$56,517**	**$58,212**	**$59,959**	**$61,757**	**$63,610**	**$65,518**	**$67,484**
4-Week Annual Pumping Duration[8]		**$41,907**	**$43,164**	**$44,459**	**$45,793**	**$47,167**	**$48,582**	**$50,039**	**$51,540**	**$53,086**	**$54,679**	**$56,319**	**$58,009**	**$59,749**	**$61,542**	**$63,388**	**$65,290**	**$67,248**	**$69,266**	**$71,344**	**$73,484**	**$75,689**	**$77,959**	**$80,298**
6-Week Annual Pumping Duration[8]		**$48,595**	**$50,052**	**$51,554**	**$53,101**	**$54,694**	**$56,334**	**$58,024**	**$59,765**	**$61,558**	**$63,405**	**$65,307**	**$67,266**	**$69,284**	**$71,363**	**$73,504**	**$75,709**	**$77,980**	**$80,319**	**$82,729**	**$85,211**	**$87,767**	**$90,400**	**$93,112**
8-Week Annual Pumping Duration[8]		**$55,282**	**$56,941**	**$58,649**	**$60,408**	**$62,221**	**$64,087**	**$66,010**	**$67,990**	**$70,030**	**$72,131**	**$74,295**	**$76,524**	**$78,819**	**$81,184**	**$83,619**	**$86,128**	**$88,712**	**$91,373**	**$94,114**	**$96,938**	**$99,846**	**$102,841**	**$105,926**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
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4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis (Cont.)

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$40,625	$41,844	$43,099	$44,392	$45,724	$47,096	$48,509	$49,964	$51,463	$53,007	$54,597	$56,235	$57,922	$59,660	$61,450	$63,293	$65,192	$67,148	$69,162	$71,237	$73,374	$75,575	$77,842	$80,178	$82,583	$85,061	$87,612
$27,215	$29,250	$31,383	$33,618	$35,958	$38,408	$40,973	$43,658	$46,467	$49,405	$52,477	$55,689	$59,047	$62,556	$66,222	$70,052	$74,053	$78,230	$82,592	$87,144	$91,896	$96,854	$102,027	$107,423	$113,051	$118,920	$125,039
$975,009	**$1,046,104**	**$1,120,586**	**$1,198,596**	**$1,280,279**	**$1,365,783**	**$1,455,265**	**$1,548,887**	**$1,646,817**	**$1,749,228**	**$1,856,302**	**$1,968,226**	**$2,085,195**	**$2,207,411**	**$2,335,083**	**$2,468,428**	**$2,607,673**	**$2,753,051**	**$2,904,804**	**$3,063,185**	**$3,228,455**	**$3,400,884**	**$3,580,753**	**$3,768,353**	**$3,963,987**	**$4,167,967**	**$4,380,618**
$81,251	$83,688	$86,199	$88,785	$91,448	$94,192	$97,018	$99,928	$102,926	$106,014	$109,194	$112,470	$115,844	$119,320	$122,899	$126,586	$130,384	$134,295	$138,324	$142,474	$146,748	$151,150	$155,685	$160,355	$165,166	$170,121	$175,225
$54,430	$58,501	$62,766	$67,235	$71,916	$76,817	$81,947	$87,316	$92,933	$98,809	$104,954	$111,378	$118,094	$125,112	$132,445	$140,105	$148,106	$156,460	$165,183	$174,288	$183,791	$193,707	$204,053	$214,845	$226,101	$237,839	$250,078
$1,950,019	**$2,092,208**	**$2,241,173**	**$2,397,193**	**$2,560,557**	**$2,731,566**	**$2,910,530**	**$3,097,774**	**$3,293,634**	**$3,498,457**	**$3,712,605**	**$3,936,453**	**$4,170,391**	**$4,414,822**	**$4,670,166**	**$4,936,857**	**$5,215,346**	**$5,506,101**	**$5,809,609**	**$6,126,370**	**$6,456,910**	**$6,801,767**	**$7,161,505**	**$7,536,706**	**$7,927,973**	**$8,335,933**	**$8,761,236**
$162,502	$167,377	$172,398	$177,570	$182,897	$188,384	$194,035	$199,856	$205,852	$212,028	$218,389	$224,940	$231,688	$238,639	$245,798	$253,172	$260,767	$268,590	$276,648	$284,947	$293,496	$302,301	$311,370	$320,711	$330,332	$340,242	$350,449
$108,860	$117,001	$125,532	$134,470	$143,832	$153,633	$163,894	$174,632	$185,866	$197,618	$209,907	$222,756	$236,187	$250,223	$264,889	$280,210	$296,211	$312,921	$330,366	$348,577	$367,582	$387,415	$408,106	$429,690	$452,202	$475,678	$500,156
$3,900,037	**$4,184,415**	**$4,482,345**	**$4,794,386**	**$5,121,114**	**$5,463,131**	**$5,821,061**	**$6,195,549**	**$6,587,268**	**$6,996,913**	**$7,425,209**	**$7,872,906**	**$8,340,781**	**$8,829,644**	**$9,340,331**	**$9,873,713**	**$10,430,692**	**$11,012,203**	**$11,619,217**	**$12,252,741**	**$12,913,819**	**$13,603,534**	**$14,323,010**	**$15,073,411**	**$15,855,946**	**$16,671,867**	**$17,522,472**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$23,091	$23,784	$24,497	$25,232	$25,989	$26,769	$27,572	$28,399	$29,251	$30,128	$31,032	$31,963	$32,922	$33,910	$34,927	$35,975	$37,054	$38,166	$39,311	$40,490	$41,705	$42,956	$44,245	$45,572	$46,939	$48,347	$49,798
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$35,169	**$36,224**	**$37,311**	**$38,430**	**$39,583**	**$40,771**	**$41,994**	**$43,254**	**$44,551**	**$45,888**	**$47,265**	**$48,683**	**$50,143**	**$51,647**	**$53,197**	**$54,793**	**$56,436**	**$58,130**	**$59,873**	**$61,670**	**$63,520**	**$65,425**	**$67,388**	**$69,410**	**$71,492**	**$73,637**	**$75,846**
$69,508	**$71,594**	**$73,741**	**$75,954**	**$78,232**	**$80,579**	**$82,997**	**$85,487**	**$88,051**	**$90,693**	**$93,413**	**$96,216**	**$99,102**	**$102,075**	**$105,138**	**$108,292**	**$111,541**	**$114,887**	**$118,333**	**$121,883**	**$125,540**	**$129,306**	**$133,185**	**$137,181**	**$141,296**	**$145,535**	**$149,901**
$82,707	**$85,188**	**$87,744**	**$90,376**	**$93,087**	**$95,880**	**$98,756**	**$101,719**	**$104,771**	**$107,914**	**$111,151**	**$114,486**	**$117,920**	**$121,458**	**$125,102**	**$128,855**	**$132,720**	**$136,702**	**$140,803**	**$145,027**	**$149,378**	**$153,859**	**$158,475**	**$163,229**	**$168,126**	**$173,170**	**$178,365**
$95,906	**$98,783**	**$101,746**	**$104,799**	**$107,943**	**$111,181**	**$114,516**	**$117,952**	**$121,490**	**$125,135**	**$128,889**	**$132,756**	**$136,738**	**$140,841**	**$145,066**	**$149,418**	**$153,900**	**$158,517**	**$163,273**	**$168,171**	**$173,216**	**$178,413**	**$183,765**	**$189,278**	**$194,956**	**$200,805**	**$206,829**
$109,104	**$112,377**	**$115,749**	**$119,221**	**$122,798**	**$126,482**	**$130,276**	**$134,184**	**$138,210**	**$142,356**	**$146,627**	**$151,026**	**$155,557**	**$160,223**	**$165,030**	**$169,981**	**$175,080**	**$180,333**	**$185,743**	**$191,315**	**$197,054**	**$202,966**	**$209,055**	**$215,327**	**$221,786**	**$228,440**	**$235,293**
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis
Alternative 2, Design Flow Rate = 40 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 50th Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$4,434,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$4,859,560
To Replace 50% After Life of Project		$9,719,120
To Replace 100% After Life of Project	$4,434,000	$19,438,239
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$121,653
To Replace 50% After Life of Project		$243,307
To Replace 100% After Life of Project	$111,000	$486,614
Total Replacement Cost:		
To Replace 25% After Life of Project		**$4,981,213**
To Replace 50% After Life of Project		**$9,962,426**
To Replace 100% After Life of Project	**$4,545,000**	**$19,924,853**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$44,161
To Replace 50% After Life of Project	$88,322
To Replace 100% After Life of Project	$176,644
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$23,407
To Replace 50% After Life of Project	$46,813
To Replace 100% After Life of Project	$93,627
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$47,581
To Replace 50% After Life of Project	$95,162
To Replace 100% After Life of Project	$190,324
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$99,624
To Replace 50% After Life of Project	$199,249
To Replace 100% After Life of Project	$398,497

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	Replacment Fund	O &M	Power	TOTAL
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$1,136,250	$971,000	$1,778,355	**$3,885,605**
50% Replacement	$2,272,500	$971,000	$1,778,355	**$5,021,855**
100% Replacement	$4,545,000	$971,000	$1,778,355	**$7,294,355**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$1,136,250	$971,000	$2,116,045	**$4,223,295**
50% Replacement	$2,272,500	$971,000	$2,116,045	**$5,359,545**
100% Replacement	$4,545,000	$971,000	$2,116,045	**$7,632,045**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$1,136,250	$971,000	$2,453,735	**$4,560,985**
50% Replacement	$2,272,500	$971,000	$2,453,735	**$5,697,235**
100% Replacement	$4,545,000	$971,000	$2,453,735	**$7,969,735**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$1,136,250	$971,000	$2,791,425	**$4,898,675**
50% Replacement	$2,272,500	$971,000	$2,791,425	**$6,034,925**
100% Replacement	$4,545,000	$971,000	$2,791,425	**$8,307,425**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Capital Expenses:	$4,434,000											
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits		$23,407	$24,109	$24,832	$25,577	$26,345	$27,135	$27,949	$28,787	$29,651	$30,540	$31,457
Interest		$0	$702	$1,447	$2,235	$3,069	$3,952	$4,884	$5,869	$6,909	$8,006	$9,162
End of Year Balance		**$23,407**	**$48,218**	**$74,497**	**$102,309**	**$131,723**	**$162,809**	**$195,642**	**$230,299**	**$266,859**	**$305,405**	**$346,024**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits		$46,813	$48,218	$49,664	$51,154	$52,689	$54,270	$55,898	$57,575	$59,302	$61,081	$62,913
Interest		$0	$1,404	$2,893	$4,470	$6,139	$7,903	$9,769	$11,739	$13,818	$16,012	$18,324
End of Year Balance		**$46,813**	**$96,436**	**$148,993**	**$204,617**	**$263,445**	**$325,618**	**$391,284**	**$460,598**	**$533,717**	**$610,810**	**$692,048**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits		$93,627	$96,436	$99,329	$102,309	$105,378	$108,539	$111,796	$115,149	$118,604	$122,162	$125,827
Interest		$0	$2,809	$5,786	$8,940	$12,277	$15,807	$19,537	$23,477	$27,636	$32,023	$36,649
End of Year Balance		**$93,627**	**$192,872**	**$297,987**	**$409,235**	**$526,890**	**$651,236**	**$782,569**	**$921,195**	**$1,067,435**	**$1,221,620**	**$1,384,095**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672
Maintenance and Small Repairs[7]		$13,300	$13,699	$14,110	$14,533	$14,969	$15,418	$15,881	$16,357	$16,848	$17,353	$17,874
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$19,420**	**$20,003**	**$20,603**	**$21,221**	**$21,857**	**$22,513**	**$23,188**	**$23,884**	**$24,601**	**$25,339**	**$26,099**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]		**$35,567**	**$36,634**	**$37,733**	**$38,865**	**$40,031**	**$41,232**	**$42,469**	**$43,743**	**$45,055**	**$46,407**	**$47,799**
4-Week Annual Pumping Duration[8]		**$42,321**	**$43,591**	**$44,898**	**$46,245**	**$47,633**	**$49,062**	**$50,533**	**$52,049**	**$53,611**	**$55,219**	**$56,876**
6-Week Annual Pumping Duration[8]		**$49,075**	**$50,547**	**$52,063**	**$53,625**	**$55,234**	**$56,891**	**$58,598**	**$60,356**	**$62,166**	**$64,031**	**$65,952**
8-Week Annual Pumping Duration[8]		**$55,829**	**$57,503**	**$59,228**	**$61,005**	**$62,835**	**$64,721**	**$66,662**	**$68,662**	**$70,722**	**$72,844**	**$75,029**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**

Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:												
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits	$32,400	$33,372	$34,374	$35,405	$36,467	$37,561	$38,688	$39,848	$41,044	$42,275	$43,543	$44,850
Interest	$10,381	$11,664	$13,015	$14,437	$15,932	$17,504	$19,156	$20,891	$22,714	$24,626	$26,633	$28,739
End of Year Balance	**$388,805**	**$433,842**	**$481,230**	**$531,072**	**$583,471**	**$638,536**	**$696,380**	**$757,120**	**$820,878**	**$887,779**	**$957,956**	**$1,031,544**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits	$64,801	$66,745	$68,747	$70,810	$72,934	$75,122	$77,376	$79,697	$82,088	$84,550	$87,087	$89,700
Interest	$20,761	$23,328	$26,030	$28,874	$31,864	$35,008	$38,312	$41,783	$45,427	$49,253	$53,267	$57,477
End of Year Balance	**$777,610**	**$867,683**	**$962,461**	**$1,062,144**	**$1,166,942**	**$1,277,073**	**$1,392,760**	**$1,514,240**	**$1,641,755**	**$1,775,558**	**$1,915,912**	**$2,063,089**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits	$129,602	$133,490	$137,494	$141,619	$145,868	$150,244	$154,751	$159,394	$164,176	$169,101	$174,174	$179,399
Interest	$41,523	$46,657	$52,061	$57,748	$63,729	$70,017	$76,624	$83,566	$90,854	$98,505	$106,533	$114,955
End of Year Balance	**$1,555,220**	**$1,735,366**	**$1,924,922**	**$2,124,289**	**$2,333,885**	**$2,554,145**	**$2,785,521**	**$3,028,480**	**$3,283,510**	**$3,551,116**	**$3,831,824**	**$4,126,177**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]	$18,410	$18,963	$19,531	$20,117	$20,721	$21,343	$21,983	$22,642	$23,322	$24,021	$24,742	$25,484
Administration, Insurance, Accounting	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses	**$26,882**	**$27,688**	**$28,519**	**$29,374**	**$30,256**	**$31,163**	**$32,098**	**$33,061**	**$34,053**	**$35,075**	**$36,127**	**$37,211**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]	**$49,233**	**$50,710**	**$52,231**	**$53,798**	**$55,412**	**$57,075**	**$58,787**	**$60,551**	**$62,367**	**$64,238**	**$66,165**	**$68,150**
4-Week Annual Pumping Duration[8]	**$58,582**	**$60,339**	**$62,150**	**$64,014**	**$65,935**	**$67,913**	**$69,950**	**$72,049**	**$74,210**	**$76,436**	**$78,729**	**$81,091**
6-Week Annual Pumping Duration[8]	**$67,931**	**$69,969**	**$72,068**	**$74,230**	**$76,457**	**$78,750**	**$81,113**	**$83,546**	**$86,053**	**$88,634**	**$91,293**	**$94,032**
8-Week Annual Pumping Duration[8]	**$77,280**	**$79,598**	**$81,986**	**$84,446**	**$86,979**	**$89,588**	**$92,276**	**$95,044**	**$97,896**	**$100,832**	**$103,857**	**$106,973**
Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis (Cont.)

	24	25	26	27	28	29	30	31	32	33	34	35	36	37
	$46,195	$47,581	$49,009	$50,479	$51,993	$53,553	$55,160	$56,814	$58,519	$60,274	$62,083	$63,945	$65,863	$67,839
	$30,946	$33,261	$35,686	$38,227	$40,888	$43,674	$46,591	$49,644	$52,837	$56,178	$59,672	$63,324	$67,142	$71,132
	$1,108,686	**$1,189,528**	**$1,274,222**	**$1,362,927**	**$1,455,808**	**$1,553,036**	**$1,654,786**	**$1,761,244**	**$1,872,600**	**$1,989,052**	**$2,110,807**	**$2,238,076**	**$2,371,081**	**$2,510,053**
	$92,390	$95,162	$98,017	$100,958	$103,986	$107,106	$110,319	$113,629	$117,038	$120,549	$124,165	$127,890	$131,727	$135,679
	$61,893	$66,521	$71,372	$76,453	$81,776	$87,348	$93,182	$99,287	$105,675	$112,356	$119,343	$126,648	$134,285	$142,265
	$2,217,372	**$2,379,055**	**$2,548,444**	**$2,725,855**	**$2,911,617**	**$3,106,071**	**$3,309,572**	**$3,522,488**	**$3,745,200**	**$3,978,105**	**$4,221,613**	**$4,476,152**	**$4,742,163**	**$5,020,106**
	$184,781	$190,324	$196,034	$201,915	$207,973	$214,212	$220,638	$227,257	$234,075	$241,097	$248,330	$255,780	$263,454	$271,357
	$123,785	$133,042	$142,743	$152,907	$163,551	$174,697	$186,364	$198,574	$211,349	$224,712	$238,686	$253,297	$268,569	$284,530
	$4,434,744	**$4,758,110**	**$5,096,888**	**$5,451,710**	**$5,823,234**	**$6,212,142**	**$6,619,145**	**$7,044,976**	**$7,490,401**	**$7,956,210**	**$8,443,227**	**$8,952,303**	**$9,484,326**	**$10,040,213**
	$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564
	$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826
	$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449
	$26,249	$27,036	$27,847	$28,683	$29,543	$30,429	$31,342	$32,283	$33,251	$34,249	$35,276	$36,334	$37,424	$38,547
	$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898
	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	$38,327	**$39,477**	**$40,661**	**$41,881**	**$43,137**	**$44,432**	**$45,765**	**$47,137**	**$48,552**	**$50,008**	**$51,508**	**$53,054**	**$54,645**	**$56,285**
	$70,195	**$72,301**	**$74,470**	**$76,704**	**$79,005**	**$81,375**	**$83,816**	**$86,331**	**$88,921**	**$91,588**	**$94,336**	**$97,166**	**$100,081**	**$103,083**
	$83,524	**$86,030**	**$88,611**	**$91,269**	**$94,007**	**$96,827**	**$99,732**	**$102,724**	**$105,806**	**$108,980**	**$112,249**	**$115,617**	**$119,085**	**$122,658**
	$96,853	**$99,759**	**$102,752**	**$105,834**	**$109,009**	**$112,279**	**$115,648**	**$119,117**	**$122,691**	**$126,371**	**$130,163**	**$134,067**	**$138,089**	**$142,232**
	$110,182	**$113,488**	**$116,892**	**$120,399**	**$124,011**	**$127,732**	**$131,564**	**$135,510**	**$139,576**	**$143,763**	**$148,076**	**$152,518**	**$157,094**	**$161,807**
	24	25	26	27	28	29	30	31	32	33	34	35	36	37

	38	39	40	41	42	43	44	45	46	47	48	49	50
	$69,874	$71,971	$74,130	$76,354	$78,644	$81,004	$83,434	$85,937	$88,515	$91,170	$93,905	$96,723	$99,624
	$75,302	$79,657	$84,206	$88,956	$93,915	$99,092	$104,495	$110,133	$116,015	$122,151	$128,550	$135,224	$142,182
	$2,655,229	**$2,806,857**	**$2,965,192**	**$3,130,502**	**$3,303,061**	**$3,483,157**	**$3,671,085**	**$3,867,154**	**$4,071,684**	**$4,285,005**	**$4,507,460**	**$4,739,407**	**$4,981,213**
	$139,749	$143,941	$148,260	$152,707	$157,289	$162,007	$166,867	$171,874	$177,030	$182,341	$187,811	$193,445	$199,249
	$150,603	$159,314	$168,411	$177,912	$187,830	$198,184	$208,989	$220,265	$232,029	$244,301	$257,100	$270,448	$284,364
	$5,310,458	**$5,613,713**	**$5,930,384**	**$6,261,003**	**$6,606,122**	**$6,966,313**	**$7,342,170**	**$7,734,309**	**$8,143,368**	**$8,570,009**	**$9,014,920**	**$9,478,813**	**$9,962,426**
	$279,498	$287,883	$296,519	$305,415	$314,577	$324,015	$333,735	$343,747	$354,059	$364,681	$375,622	$386,890	$398,497
	$301,206	$318,628	$336,823	$355,823	$375,660	$396,367	$417,979	$440,530	$464,059	$488,602	$514,201	$540,895	$568,729
	$10,620,917	**$11,227,427**	**$11,860,769**	**$12,522,007**	**$13,212,245**	**$13,932,627**	**$14,684,341**	**$15,468,618**	**$16,286,736**	**$17,140,019**	**$18,029,842**	**$18,957,627**	**$19,924,853**
	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
	$39,704	$40,895	$42,121	$43,385	$44,687	$46,027	$47,408	$48,830	$50,295	$51,804	$53,358	$54,959	$56,608
	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	$57,973	**$59,712**	**$61,504**	**$63,349**	**$65,249**	**$67,207**	**$69,223**	**$71,300**	**$73,439**	**$75,642**	**$77,911**	**$80,248**	**$82,656**
	$106,176	**$109,361**	**$112,642**	**$116,021**	**$119,502**	**$123,087**	**$126,780**	**$130,583**	**$134,500**	**$138,535**	**$142,691**	**$146,972**	**$151,381**
	$126,337	**$130,128**	**$134,031**	**$138,052**	**$142,194**	**$146,460**	**$150,854**	**$155,379**	**$160,041**	**$164,842**	**$169,787**	**$174,881**	**$180,127**
	$146,499	**$150,894**	**$155,421**	**$160,084**	**$164,886**	**$169,833**	**$174,928**	**$180,175**	**$185,581**	**$191,148**	**$196,883**	**$202,789**	**$208,873**
	$166,661	**$171,661**	**$176,810**	**$182,115**	**$187,578**	**$193,205**	**$199,002**	**$204,972**	**$211,121**	**$217,454**	**$223,978**	**$230,697**	**$237,618**
	38	39	40	41	42	43	44	45	46	47	48	49	50

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis
Alternative 3, Design Flow Rate = 40 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 5oth Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$3,970,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$4,351,027
To Replace 50% After Life of Project		$8,702,053
To Replace 100% After Life of Project	$3,970,000	$17,404,107
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$108,502
To Replace 50% After Life of Project		$217,003
To Replace 100% After Life of Project	$99,000	$434,007
Total Replacement Cost:		
To Replace 25% After Life of Project		**$4,459,528**
To Replace 50% After Life of Project		**$8,919,057**
To Replace 100% After Life of Project	**$4,069,000**	**$17,838,114**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$39,536
To Replace 50% After Life of Project	$79,072
To Replace 100% After Life of Project	$158,144
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$20,955
To Replace 50% After Life of Project	$41,911
To Replace 100% After Life of Project	$83,821
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$42,598
To Replace 50% After Life of Project	$85,196
To Replace 100% After Life of Project	$170,392
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$89,191
To Replace 50% After Life of Project	$178,381
To Replace 100% After Life of Project	$356,762

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$1,017,250	$901,000	$1,724,015	**$3,642,265**
50% Replacement	$2,034,500	$901,000	$1,724,015	**$4,659,515**
100% Replacement	$4,069,000	$901,000	$1,724,015	**$6,694,015**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$1,017,250	$901,000	$2,051,366	**$3,969,616**
50% Replacement	$2,034,500	$901,000	$2,051,366	**$4,986,866**
100% Replacement	$4,069,000	$901,000	$2,051,366	**$7,021,366**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$1,017,250	$901,000	$2,378,716	**$4,296,966**
50% Replacement	$2,034,500	$901,000	$2,378,716	**$5,314,216**
100% Replacement	$4,069,000	$901,000	$2,378,716	**$7,348,716**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$1,017,250	$901,000	$2,706,067	**$4,624,317**
50% Replacement	$2,034,500	$901,000	$2,706,067	**$5,641,567**
100% Replacement	$4,069,000	$901,000	$2,706,067	**$7,676,067**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Capital Expenses:	$3,970,000											
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits		$20,955	$21,584	$22,232	$22,898	$23,585	$24,293	$25,022	$25,772	$26,546	$27,342	$28,162
Interest		$0	$629	$1,295	$2,001	$2,748	$3,538	$4,373	$5,255	$6,185	$7,167	$8,203
End of Year Balance		**$20,955**	**$43,168**	**$66,695**	**$91,594**	**$117,927**	**$145,758**	**$175,152**	**$206,179**	**$238,910**	**$273,420**	**$309,785**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits		$41,911	$43,168	$44,463	$45,797	$47,171	$48,586	$50,044	$51,545	$53,091	$54,684	$56,324
Interest		$0	$1,257	$2,590	$4,002	$5,496	$7,076	$8,745	$10,509	$12,371	$14,335	$16,405
End of Year Balance		**$41,911**	**$86,336**	**$133,389**	**$183,188**	**$235,854**	**$291,516**	**$350,305**	**$412,359**	**$477,821**	**$546,840**	**$619,569**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits		$83,821	$86,336	$88,926	$91,594	$94,342	$97,172	$100,087	$103,090	$106,182	$109,368	$112,649
Interest		$0	$2,515	$5,180	$8,003	$10,991	$14,151	$17,491	$21,018	$24,742	$28,669	$32,810
End of Year Balance		**$83,821**	**$172,672**	**$266,778**	**$366,376**	**$471,709**	**$583,032**	**$700,610**	**$824,718**	**$955,642**	**$1,093,679**	**$1,239,139**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672
Maintenance and Small Repairs[7]		$11,900	$12,257	$12,625	$13,003	$13,394	$13,795	$14,209	$14,635	$15,075	$15,527	$15,993
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$18,020**	**$18,561**	**$19,117**	**$19,691**	**$20,282**	**$20,890**	**$21,517**	**$22,162**	**$22,827**	**$23,512**	**$24,217**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]		**$34,480**	**$35,515**	**$36,580**	**$37,678**	**$38,808**	**$39,972**	**$41,171**	**$42,406**	**$43,679**	**$44,989**	**$46,339**
4-Week Annual Pumping Duration[8]		**$41,027**	**$42,258**	**$43,526**	**$44,832**	**$46,177**	**$47,562**	**$48,989**	**$50,458**	**$51,972**	**$53,531**	**$55,137**
6-Week Annual Pumping Duration[8]		**$47,574**	**$49,002**	**$50,472**	**$51,986**	**$53,545**	**$55,152**	**$56,806**	**$58,510**	**$60,266**	**$62,074**	**$63,936**
8-Week Annual Pumping Duration[8]		**$54,121**	**$55,745**	**$57,417**	**$59,140**	**$60,914**	**$62,741**	**$64,624**	**$66,562**	**$68,559**	**$70,616**	**$72,735**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**

Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:												
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits	$29,007	$29,877	$30,774	$31,697	$32,648	$33,627	$34,636	$35,675	$36,745	$37,848	$38,983	$40,153
Interest	$9,294	$10,443	$11,652	$12,925	$14,264	$15,671	$17,150	$18,703	$20,335	$22,047	$23,844	$25,729
End of Year Balance	**$348,085**	**$388,405**	**$430,831**	**$475,453**	**$522,364**	**$571,662**	**$623,448**	**$677,826**	**$734,907**	**$794,801**	**$857,629**	**$923,510**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits	$58,014	$59,755	$61,547	$63,394	$65,296	$67,254	$69,272	$71,350	$73,491	$75,695	$77,966	$80,305
Interest	$18,587	$20,885	$23,304	$25,850	$28,527	$31,342	$34,300	$37,407	$40,670	$44,094	$47,688	$51,458
End of Year Balance	**$696,171**	**$776,810**	**$861,662**	**$950,905**	**$1,044,728**	**$1,143,324**	**$1,246,896**	**$1,355,653**	**$1,469,813**	**$1,589,603**	**$1,715,257**	**$1,847,020**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits	$116,028	$119,509	$123,095	$126,787	$130,591	$134,509	$138,544	$142,700	$146,981	$151,391	$155,932	$160,610
Interest	$37,174	$41,770	$46,609	$51,700	$57,054	$62,684	$68,599	$74,814	$81,339	$88,189	$95,376	$102,915
End of Year Balance	**$1,392,341**	**$1,553,621**	**$1,723,324**	**$1,901,811**	**$2,089,456**	**$2,286,649**	**$2,493,792**	**$2,711,306**	**$2,939,627**	**$3,179,206**	**$3,430,515**	**$3,694,041**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]	$16,472	$16,967	$17,476	$18,000	$18,540	$19,096	$19,669	$20,259	$20,867	$21,493	$22,138	$22,802
Administration, Insurance, Accounting	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses	**$24,944**	**$25,692**	**$26,463**	**$27,257**	**$28,075**	**$28,917**	**$29,784**	**$30,678**	**$31,598**	**$32,546**	**$33,523**	**$34,528**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]	**$47,729**	**$49,161**	**$50,635**	**$52,155**	**$53,719**	**$55,331**	**$56,991**	**$58,700**	**$60,461**	**$62,275**	**$64,144**	**$66,068**
4-Week Annual Pumping Duration[8]	**$56,791**	**$58,495**	**$60,250**	**$62,058**	**$63,919**	**$65,837**	**$67,812**	**$69,846**	**$71,942**	**$74,100**	**$76,323**	**$78,613**
6-Week Annual Pumping Duration[8]	**$65,854**	**$67,830**	**$69,865**	**$71,960**	**$74,119**	**$76,343**	**$78,633**	**$80,992**	**$83,422**	**$85,925**	**$88,502**	**$91,157**
8-Week Annual Pumping Duration[8]	**$74,917**	**$77,164**	**$79,479**	**$81,863**	**$84,319**	**$86,849**	**$89,454**	**$92,138**	**$94,902**	**$97,749**	**$100,682**	**$103,702**
Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis (Cont.)

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$41,357	$42,598	$43,876	$45,192	$46,548	$47,944	$49,383	$50,864	$52,390	$53,962	$55,581	$57,248	$58,965	$60,734	$62,556	$64,433	$66,366	$68,357	$70,408	$72,520	$74,696	$76,937	$79,245	$81,622	$84,071	$86,593	$89,191
$27,705	$29,777	$31,948	$34,223	$36,606	$39,100	$41,712	$44,444	$47,304	$50,294	$53,422	$56,692	$60,110	$63,683	$67,415	$71,314	$75,387	$79,639	$84,079	$88,714	$93,551	$98,598	$103,864	$109,358	$115,087	$121,062	$127,291
$992,573	**$1,064,948**	**$1,140,772**	**$1,220,187**	**$1,303,341**	**$1,390,385**	**$1,481,480**	**$1,576,788**	**$1,676,482**	**$1,780,738**	**$1,889,741**	**$2,003,681**	**$2,122,757**	**$2,247,174**	**$2,377,146**	**$2,512,893**	**$2,654,646**	**$2,802,643**	**$2,957,130**	**$3,118,364**	**$3,286,610**	**$3,462,145**	**$3,645,254**	**$3,836,234**	**$4,035,392**	**$4,243,046**	**$4,459,528**
$82,714	$85,196	$87,752	$90,384	$93,096	$95,889	$98,765	$101,728	$104,780	$107,924	$111,161	$114,496	$117,931	$121,469	$125,113	$128,866	$132,732	$136,714	$140,816	$145,040	$149,391	$153,873	$158,489	$163,244	$168,141	$173,186	$178,381
$55,411	$59,554	$63,897	$68,446	$73,211	$78,200	$83,423	$88,889	$94,607	$100,589	$106,844	$113,384	$120,221	$127,365	$134,830	$142,629	$150,774	$159,279	$168,159	$177,428	$187,102	$197,197	$207,729	$218,715	$230,174	$242,124	$254,583
$1,985,145	**$2,129,896**	**$2,281,544**	**$2,440,375**	**$2,606,682**	**$2,780,771**	**$2,962,959**	**$3,153,576**	**$3,352,964**	**$3,561,476**	**$3,779,482**	**$4,007,362**	**$4,245,514**	**$4,494,348**	**$4,754,292**	**$5,025,787**	**$5,309,293**	**$5,605,286**	**$5,914,260**	**$6,236,728**	**$6,573,221**	**$6,924,291**	**$7,290,509**	**$7,672,469**	**$8,070,784**	**$8,486,093**	**$8,919,057**
$165,429	$170,392	$175,503	$180,769	$186,192	$191,777	$197,531	$203,457	$209,560	$215,847	$222,322	$228,992	$235,862	$242,938	$250,226	$257,733	$265,465	$273,429	$281,631	$290,080	$298,783	$307,746	$316,979	$326,488	$336,283	$346,371	$356,762
$110,821	$119,109	$127,794	$136,893	$146,422	$156,401	$166,846	$177,778	$189,215	$201,178	$213,689	$226,769	$240,442	$254,731	$269,661	$285,258	$301,547	$318,558	$336,317	$354,856	$374,204	$394,393	$415,457	$437,431	$460,348	$484,247	$509,166
$3,970,291	**$4,259,791**	**$4,563,088**	**$4,880,750**	**$5,213,364**	**$5,561,542**	**$5,925,919**	**$6,307,153**	**$6,705,928**	**$7,122,953**	**$7,558,964**	**$8,014,725**	**$8,491,028**	**$8,988,697**	**$9,508,584**	**$10,051,574**	**$10,618,586**	**$11,210,572**	**$11,828,520**	**$12,473,456**	**$13,146,443**	**$13,848,582**	**$14,581,019**	**$15,344,937**	**$16,141,568**	**$16,972,186**	**$17,838,114**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$23,486	$24,190	$24,916	$25,663	$26,433	$27,226	$28,043	$28,884	$29,751	$30,643	$31,563	$32,510	$33,485	$34,490	$35,524	$36,590	$37,688	$38,818	$39,983	$41,182	$42,418	$43,690	$45,001	$46,351	$47,742	$49,174	$50,649
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$35,564	**$36,631**	**$37,730**	**$38,862**	**$40,028**	**$41,228**	**$42,465**	**$43,739**	**$45,051**	**$46,403**	**$47,795**	**$49,229**	**$50,706**	**$52,227**	**$53,794**	**$55,408**	**$57,070**	**$58,782**	**$60,545**	**$62,362**	**$64,233**	**$66,160**	**$68,144**	**$70,189**	**$72,294**	**$74,463**	**$76,697**
$68,050	**$70,091**	**$72,194**	**$74,360**	**$76,591**	**$78,888**	**$81,255**	**$83,693**	**$86,204**	**$88,790**	**$91,453**	**$94,197**	**$97,023**	**$99,934**	**$102,932**	**$106,019**	**$109,200**	**$112,476**	**$115,850**	**$119,326**	**$122,906**	**$126,593**	**$130,391**	**$134,302**	**$138,331**	**$142,481**	**$146,756**
$80,971	**$83,400**	**$85,902**	**$88,479**	**$91,134**	**$93,868**	**$96,684**	**$99,584**	**$102,572**	**$105,649**	**$108,818**	**$112,083**	**$115,445**	**$118,909**	**$122,476**	**$126,150**	**$129,935**	**$133,833**	**$137,848**	**$141,983**	**$146,243**	**$150,630**	**$155,149**	**$159,803**	**$164,597**	**$169,535**	**$174,621**
$93,892	**$96,709**	**$99,610**	**$102,598**	**$105,676**	**$108,847**	**$112,112**	**$115,475**	**$118,940**	**$122,508**	**$126,183**	**$129,969**	**$133,868**	**$137,884**	**$142,020**	**$146,281**	**$150,669**	**$155,189**	**$159,845**	**$164,640**	**$169,579**	**$174,667**	**$179,907**	**$185,304**	**$190,863**	**$196,589**	**$202,487**
$106,813	**$110,018**	**$113,318**	**$116,718**	**$120,219**	**$123,826**	**$127,540**	**$131,367**	**$135,308**	**$139,367**	**$143,548**	**$147,854**	**$152,290**	**$156,859**	**$161,564**	**$166,411**	**$171,404**	**$176,546**	**$181,842**	**$187,297**	**$192,916**	**$198,704**	**$204,665**	**$210,805**	**$217,129**	**$223,643**	**$230,352**
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis
Alternative 4, Design Flow Rate = 40 CFS

(yellow)	Input Cells - Assumed or Given Values
(blue)	Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 5oth Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$5,362,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$5,876,626
To Replace 50% After Life of Project		$11,753,252
To Replace 100% After Life of Project	$5,362,000	$23,506,504
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$146,861
To Replace 50% After Life of Project		$293,722
To Replace 100% After Life of Project	$134,000	$587,443
Total Replacement Cost:		
To Replace 25% After Life of Project		**$6,023,487**
To Replace 50% After Life of Project		**$12,046,974**
To Replace 100% After Life of Project	**$5,496,000**	**$24,093,947**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$53,401
To Replace 50% After Life of Project	$106,802
To Replace 100% After Life of Project	$213,605
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$28,304
To Replace 50% After Life of Project	$56,609
To Replace 100% After Life of Project	$113,218
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$57,537
To Replace 50% After Life of Project	$115,074
To Replace 100% After Life of Project	$230,148
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$120,470
To Replace 50% After Life of Project	$240,939
To Replace 100% After Life of Project	$481,879

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	Replacment Fund	O &M	Power	TOTAL
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$1,374,000	$1,111,000	$1,634,899	**$4,119,899**
50% Replacement	$2,748,000	$1,111,000	$1,634,899	**$5,493,899**
100% Replacement	$5,496,000	$1,111,000	$1,634,899	**$8,241,899**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$1,374,000	$1,111,000	$1,945,292	**$4,430,292**
50% Replacement	$2,748,000	$1,111,000	$1,945,292	**$5,804,292**
100% Replacement	$5,496,000	$1,111,000	$1,945,292	**$8,552,292**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$1,374,000	$1,111,000	$2,255,686	**$4,740,686**
50% Replacement	$2,748,000	$1,111,000	$2,255,686	**$6,114,686**
100% Replacement	$5,496,000	$1,111,000	$2,255,686	**$8,862,686**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$1,374,000	$1,111,000	$2,566,079	**$5,051,079**
50% Replacement	$2,748,000	$1,111,000	$2,566,079	**$6,425,079**
100% Replacement	$5,496,000	$1,111,000	$2,566,079	**$9,173,079**

LIFE CYCLE COSTS:

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Capital Expenses:	$5,362,000																							
Replacement Fund (For Funding Replacement of 25% of System):																								
Deposits		$28,304	$29,154	$30,028	$30,929	$31,857	$32,813	$33,797	$34,811	$35,855	$36,931	$38,039	$39,180	$40,355	$41,566	$42,813	$44,097	$45,420	$46,783	$48,186	$49,632	$51,121	$52,655	$54,234
Interest		$0	$849	$1,749	$2,703	$3,711	$4,779	$5,906	$7,097	$8,355	$9,681	$11,079	$12,553	$14,105	$15,739	$17,458	$19,266	$21,167	$23,164	$25,263	$27,466	$29,779	$32,206	$34,752
End of Year Balance		**$28,304**	**$58,307**	**$90,084**	**$123,716**	**$159,284**	**$196,875**	**$236,579**	**$278,487**	**$322,697**	**$369,308**	**$418,426**	**$470,159**	**$524,619**	**$581,924**	**$642,194**	**$705,557**	**$772,144**	**$842,092**	**$915,541**	**$992,639**	**$1,073,539**	**$1,158,400**	**$1,247,386**
Replacement Fund (For Funding Replacement of 50% of System):																								
Deposits		$56,609	$58,307	$60,056	$61,858	$63,714	$65,625	$67,594	$69,622	$71,710	$73,862	$76,077	$78,360	$80,711	$83,132	$85,626	$88,195	$90,841	$93,566	$96,373	$99,264	$102,242	$105,309	$108,468
Interest		$0	$1,698	$3,498	$5,405	$7,423	$9,557	$11,813	$14,195	$16,709	$19,362	$22,158	$25,106	$28,210	$31,477	$34,915	$38,532	$42,333	$46,329	$50,525	$54,932	$59,558	$64,412	$69,504
End of Year Balance		**$56,609**	**$116,614**	**$180,169**	**$247,432**	**$318,569**	**$393,751**	**$473,157**	**$556,973**	**$645,393**	**$738,616**	**$836,852**	**$940,318**	**$1,049,238**	**$1,163,847**	**$1,284,388**	**$1,411,115**	**$1,544,289**	**$1,684,183**	**$1,831,081**	**$1,985,278**	**$2,147,078**	**$2,316,799**	**$2,494,771**
Replacement Fund (For Funding Replacement of 100% of System):																								
Deposits		$113,218	$116,614	$120,113	$123,716	$127,427	$131,250	$135,188	$139,243	$143,421	$147,723	$152,155	$156,720	$161,421	$166,264	$171,252	$176,389	$181,681	$187,131	$192,745	$198,528	$204,484	$210,618	$216,937
Interest		$0	$3,397	$6,997	$10,810	$14,846	$19,114	$23,625	$28,389	$33,418	$38,724	$44,317	$50,211	$56,419	$62,954	$69,831	$77,063	$84,667	$92,657	$101,051	$109,865	$119,117	$128,825	$139,008
End of Year Balance		**$113,218**	**$233,228**	**$360,338**	**$494,864**	**$637,137**	**$787,501**	**$946,314**	**$1,113,947**	**$1,290,786**	**$1,477,233**	**$1,673,705**	**$1,880,636**	**$2,098,476**	**$2,327,694**	**$2,568,777**	**$2,822,229**	**$3,088,577**	**$3,368,366**	**$3,662,162**	**$3,970,555**	**$4,294,155**	**$4,633,598**	**$4,989,542**
Operations and Maintenance Expenses:																								
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]		$16,100	$16,583	$17,080	$17,593	$18,121	$18,664	$19,224	$19,801	$20,395	$21,007	$21,637	$22,286	$22,955	$23,643	$24,353	$25,083	$25,836	$26,611	$27,409	$28,231	$29,078	$29,951	$30,849
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$22,220**	**$22,887**	**$23,573**	**$24,280**	**$25,009**	**$25,759**	**$26,532**	**$27,328**	**$28,148**	**$28,992**	**$29,862**	**$30,758**	**$31,680**	**$32,631**	**$33,610**	**$34,618**	**$35,657**	**$36,726**	**$37,828**	**$38,963**	**$40,132**	**$41,336**	**$42,576**
Pumping Power Costs:																								
2-Week Annual Pumping Duration[8]		**$32,698**	**$33,679**	**$34,689**	**$35,730**	**$36,802**	**$37,906**	**$39,043**	**$40,214**	**$41,421**	**$42,663**	**$43,943**	**$45,262**	**$46,619**	**$48,018**	**$49,459**	**$50,942**	**$52,471**	**$54,045**	**$55,666**	**$57,336**	**$59,056**	**$60,828**	**$62,653**
4-Week Annual Pumping Duration[8]		**$38,906**	**$40,073**	**$41,275**	**$42,513**	**$43,789**	**$45,103**	**$46,456**	**$47,849**	**$49,285**	**$50,763**	**$52,286**	**$53,855**	**$55,470**	**$57,135**	**$58,849**	**$60,614**	**$62,432**	**$64,305**	**$66,235**	**$68,222**	**$70,268**	**$72,376**	**$74,548**
6-Week Annual Pumping Duration[8]		**$45,114**	**$46,467**	**$47,861**	**$49,297**	**$50,776**	**$52,299**	**$53,868**	**$55,484**	**$57,149**	**$58,863**	**$60,629**	**$62,448**	**$64,321**	**$66,251**	**$68,239**	**$70,286**	**$72,394**	**$74,566**	**$76,803**	**$79,107**	**$81,480**	**$83,925**	**$86,443**
8-Week Annual Pumping Duration[8]		**$51,322**	**$52,861**	**$54,447**	**$56,080**	**$57,763**	**$59,496**	**$61,281**	**$63,119**	**$65,013**	**$66,963**	**$68,972**	**$71,041**	**$73,172**	**$75,367**	**$77,629**	**$79,957**	**$82,356**	**$84,827**	**$87,372**	**$89,993**	**$92,692**	**$95,473**	**$98,337**
Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

24	25	26	27	28	29	30	31	32	33	34	35	36	37
$55,861	$57,537	$59,263	$61,041	$62,872	$64,758	$66,701	$68,702	$70,763	$72,886	$75,073	$77,325	$79,645	$82,034
$37,422	$40,220	$43,153	$46,225	$49,443	$52,813	$56,340	$60,031	$63,893	$67,933	$72,157	$76,574	$81,191	$86,016
$1,340,668	**$1,438,425**	**$1,540,841**	**$1,648,108**	**$1,760,423**	**$1,877,994**	**$2,001,035**	**$2,129,768**	**$2,264,425**	**$2,405,244**	**$2,552,474**	**$2,706,373**	**$2,867,209**	**$3,035,259**
$111,722	$115,074	$118,526	$122,082	$125,745	$129,517	$133,402	$137,404	$141,527	$145,772	$150,146	$154,650	$159,289	$164,068
$74,843	$80,440	$86,306	$92,450	$98,886	$105,625	$112,680	$120,062	$127,786	$135,865	$144,315	$153,148	$162,382	$172,033
$2,681,337	**$2,876,851**	**$3,081,683**	**$3,296,215**	**$3,520,846**	**$3,755,988**	**$4,002,070**	**$4,259,537**	**$4,528,850**	**$4,810,487**	**$5,104,948**	**$5,412,746**	**$5,734,418**	**$6,070,518**
$223,445	$230,148	$237,053	$244,164	$251,489	$259,034	$266,805	$274,809	$283,053	$291,545	$300,291	$309,300	$318,579	$328,136
$149,686	$160,880	$172,611	$184,901	$197,773	$211,251	$225,359	$240,124	$255,572	$271,731	$288,629	$306,297	$324,765	$344,065
$5,362,673	**$5,753,702**	**$6,163,365**	**$6,592,430**	**$7,041,692**	**$7,511,977**	**$8,004,141**	**$8,519,074**	**$9,057,699**	**$9,620,975**	**$10,209,895**	**$10,825,491**	**$11,468,835**	**$12,141,036**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449
$31,775	$32,728	$33,710	$34,721	$35,763	$36,836	$37,941	$39,079	$40,251	$41,459	$42,703	$43,984	$45,303	$46,662
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$43,853	**$45,169**	**$46,524**	**$47,919**	**$49,357**	**$50,838**	**$52,363**	**$53,934**	**$55,552**	**$57,218**	**$58,935**	**$60,703**	**$62,524**	**$64,400**
$64,532	**$66,468**	**$68,462**	**$70,516**	**$72,632**	**$74,811**	**$77,055**	**$79,367**	**$81,748**	**$84,200**	**$86,726**	**$89,328**	**$92,008**	**$94,768**
$76,784	**$79,088**	**$81,460**	**$83,904**	**$86,421**	**$89,014**	**$91,684**	**$94,435**	**$97,268**	**$100,186**	**$103,191**	**$106,287**	**$109,476**	**$112,760**
$89,036	**$91,707**	**$94,458**	**$97,292**	**$100,211**	**$103,217**	**$106,313**	**$109,503**	**$112,788**	**$116,172**	**$119,657**	**$123,246**	**$126,944**	**$130,752**
$101,288	**$104,326**	**$107,456**	**$110,680**	**$114,000**	**$117,420**	**$120,943**	**$124,571**	**$128,308**	**$132,157**	**$136,122**	**$140,206**	**$144,412**	**$148,744**
24	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**

38	39	40	41	42	43	44	45	46	47	48	49	50
$84,495	$87,030	$89,641	$92,330	$95,100	$97,953	$100,892	$103,918	$107,036	$110,247	$113,554	$116,961	$120,470
$91,058	$96,324	$101,825	$107,569	$113,566	$119,826	$126,359	$133,177	$140,290	$147,709	$155,448	$163,518	$171,933
$3,210,812	**$3,394,166**	**$3,585,632**	**$3,785,531**	**$3,994,197**	**$4,211,976**	**$4,439,226**	**$4,676,322**	**$4,923,647**	**$5,181,603**	**$5,450,606**	**$5,731,085**	**$6,023,487**
$168,990	$174,060	$179,282	$184,660	$190,200	$195,906	$201,783	$207,837	$214,072	$220,494	$227,109	$233,922	$240,939
$182,116	$192,649	$203,650	$215,138	$227,132	$239,652	$252,719	$266,354	$280,579	$295,419	$310,896	$327,036	$343,865
$6,421,624	**$6,788,332**	**$7,171,264**	**$7,571,062**	**$7,988,394**	**$8,423,951**	**$8,878,453**	**$9,352,643**	**$9,847,294**	**$10,363,207**	**$10,901,211**	**$11,462,169**	**$12,046,974**
$337,980	$348,120	$358,563	$369,320	$380,400	$391,812	$403,566	$415,673	$428,143	$440,987	$454,217	$467,844	$481,879
$364,231	$385,297	$407,300	$430,276	$454,264	$479,304	$505,437	$532,707	$561,159	$590,838	$621,792	$654,073	$687,730
$12,843,247	**$13,576,664**	**$14,342,527**	**$15,142,123**	**$15,976,787**	**$16,847,902**	**$17,756,905**	**$18,705,285**	**$19,694,587**	**$20,726,412**	**$21,802,422**	**$22,924,338**	**$24,093,947**
$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$48,062	$49,504	$50,989	$52,519	$54,094	$55,717	$57,389	$59,110	$60,884	$62,710	$64,592	$66,529	$68,525
$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$66,332	**$68,322**	**$70,371**	**$72,482**	**$74,657**	**$76,897**	**$79,204**	**$81,580**	**$84,027**	**$86,548**	**$89,144**	**$91,819**	**$94,573**
$97,611	**$100,539**	**$103,555**	**$106,662**	**$109,862**	**$113,158**	**$116,552**	**$120,049**	**$123,651**	**$127,360**	**$131,181**	**$135,116**	**$139,170**
$116,143	**$119,627**	**$123,216**	**$126,912**	**$130,720**	**$134,641**	**$138,681**	**$142,841**	**$147,126**	**$151,540**	**$156,086**	**$160,769**	**$165,592**
$134,675	**$138,715**	**$142,876**	**$147,163**	**$151,578**	**$156,125**	**$160,809**	**$165,633**	**$170,602**	**$175,720**	**$180,991**	**$186,421**	**$192,014**
$153,207	**$157,803**	**$162,537**	**$167,413**	**$172,435**	**$177,608**	**$182,937**	**$188,425**	**$194,078**	**$199,900**	**$205,897**	**$212,074**	**$218,436**
38	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis
Alternative 5, Design Flow Rate = 40 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 50th Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$6,153,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:			CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:				
To Replace	25%	After Life of Project		$6,743,543
To Replace	50%	After Life of Project		$13,487,087
To Replace	100%	After Life of Project	$6,153,000	$26,974,174
Disposal and Removal Cost:				
To Replace	25%	After Life of Project		$168,780
To Replace	50%	After Life of Project		$337,561
To Replace	100%	After Life of Project	$154,000	$675,122
Total Replacement Cost:				
To Replace	**25%**	**After Life of Project**		**$6,912,324**
To Replace	**50%**	**After Life of Project**		**$13,824,648**
To Replace	**100%**	**After Life of Project**	**$6,307,000**	**$27,649,295**

REPLACEMENT FUND SUMMARY			
Annual Deposit Required (Assume Equal Deposit Made Each Year):			
To Replace	25%	After Life of Project	$61,281
To Replace	50%	After Life of Project	$122,562
To Replace	100%	After Life of Project	$245,125
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):			
To Replace	25%	After Life of Project	$32,481
To Replace	50%	After Life of Project	$64,962
To Replace	100%	After Life of Project	$129,924
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):			
To Replace	25%	After Life of Project	$66,027
To Replace	50%	After Life of Project	$132,055
To Replace	100%	After Life of Project	$264,109
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):			
To Replace	25%	After Life of Project	$138,246
To Replace	50%	After Life of Project	$276,493
To Replace	100%	After Life of Project	$552,986

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$1,576,750	$1,231,000	$1,565,344	**$4,373,094**
50% Replacement	$3,153,500	$1,231,000	$1,565,344	**$5,949,844**
100% Replacement	$6,307,000	$1,231,000	$1,565,344	**$9,103,344**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$1,576,750	$1,231,000	$1,862,503	**$4,670,253**
50% Replacement	$3,153,500	$1,231,000	$1,862,503	**$6,247,003**
100% Replacement	$6,307,000	$1,231,000	$1,862,503	**$9,400,503**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$1,576,750	$1,231,000	$2,159,662	**$4,967,412**
50% Replacement	$3,153,500	$1,231,000	$2,159,662	**$6,544,162**
100% Replacement	$6,307,000	$1,231,000	$2,159,662	**$9,697,662**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$1,576,750	$1,231,000	$2,456,821	**$5,264,571**
50% Replacement	$3,153,500	$1,231,000	$2,456,821	**$6,841,321**
100% Replacement	$6,307,000	$1,231,000	$2,456,821	**$9,994,821**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:	$6,153,000																							
Replacement Fund (For Funding Replacement of 25% of System):																								
Deposits		$32,481	$33,455	$34,459	$35,493	$36,558	$37,654	$38,784	$39,948	$41,146	$42,380	$43,652	$44,961	$46,310	$47,700	$49,131	$50,604	$52,123	$53,686	$55,297	$56,956	$58,664	$60,424	$62,237
Interest		$0	$974	$2,007	$3,101	$4,259	$5,484	$6,778	$8,145	$9,587	$11,109	$12,714	$14,405	$16,186	$18,061	$20,034	$22,109	$24,290	$26,583	$28,991	$31,519	$34,173	$36,959	$39,880
End of Year Balance		**$32,481**	**$66,911**	**$103,377**	**$141,972**	**$182,789**	**$225,927**	**$271,489**	**$319,581**	**$370,314**	**$423,804**	**$480,170**	**$539,536**	**$602,033**	**$667,793**	**$736,958**	**$809,671**	**$886,083**	**$966,352**	**$1,050,639**	**$1,139,114**	**$1,231,952**	**$1,329,335**	**$1,431,452**
Replacement Fund (For Funding Replacement of 50% of System):																								
Deposits		$64,962	$66,911	$68,918	$70,986	$73,115	$75,309	$77,568	$79,895	$82,292	$84,761	$87,304	$89,923	$92,620	$95,399	$98,261	$101,209	$104,245	$107,372	$110,594	$113,911	$117,329	$120,849	$124,474
Interest		$0	$1,949	$4,015	$6,203	$8,518	$10,967	$13,556	$16,289	$19,175	$22,219	$25,428	$28,810	$32,372	$36,122	$40,068	$44,217	$48,580	$53,165	$57,981	$63,038	$68,347	$73,917	$79,760
End of Year Balance		**$64,962**	**$133,822**	**$206,755**	**$283,943**	**$365,577**	**$451,853**	**$542,977**	**$639,162**	**$740,628**	**$847,608**	**$960,340**	**$1,079,073**	**$1,204,066**	**$1,335,587**	**$1,473,915**	**$1,619,341**	**$1,772,167**	**$1,932,704**	**$2,101,279**	**$2,278,229**	**$2,463,904**	**$2,658,670**	**$2,862,904**
Replacement Fund (For Funding Replacement of 100% of System):																								
Deposits		$129,924	$133,822	$137,837	$141,972	$146,231	$150,618	$155,136	$159,790	$164,584	$169,522	$174,607	$179,845	$185,241	$190,798	$196,522	$202,418	$208,490	$214,745	$221,187	$227,823	$234,658	$241,697	$248,948
Interest		$0	$3,898	$8,029	$12,405	$17,037	$21,935	$27,111	$32,579	$38,350	$44,438	$50,856	$57,620	$64,744	$72,244	$80,135	$88,435	$97,160	$106,330	$115,962	$126,077	$136,694	$147,834	$159,520
End of Year Balance		**$129,924**	**$267,644**	**$413,510**	**$567,887**	**$731,154**	**$903,707**	**$1,085,954**	**$1,278,323**	**$1,481,257**	**$1,695,216**	**$1,920,680**	**$2,158,146**	**$2,408,131**	**$2,671,173**	**$2,947,830**	**$3,238,683**	**$3,544,333**	**$3,865,408**	**$4,202,558**	**$4,556,457**	**$4,927,809**	**$5,317,340**	**$5,725,809**
Operations and Maintenance Expenses:																								
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]		$18,500	$19,055	$19,627	$20,215	$20,822	$21,447	$22,090	$22,753	$23,435	$24,138	$24,862	$25,608	$26,377	$27,168	$27,983	$28,822	$29,687	$30,578	$31,495	$32,440	$33,413	$34,415	$35,448
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$24,620**	**$25,359**	**$26,119**	**$26,903**	**$27,710**	**$28,541**	**$29,398**	**$30,279**	**$31,188**	**$32,124**	**$33,087**	**$34,080**	**$35,102**	**$36,155**	**$37,240**	**$38,357**	**$39,508**	**$40,693**	**$41,914**	**$43,171**	**$44,466**	**$45,800**	**$47,174**
Pumping Power Costs:																								
2-Week Annual Pumping Duration[8]		**$31,307**	**$32,246**	**$33,213**	**$34,210**	**$35,236**	**$36,293**	**$37,382**	**$38,504**	**$39,659**	**$40,848**	**$42,074**	**$43,336**	**$44,636**	**$45,975**	**$47,354**	**$48,775**	**$50,238**	**$51,746**	**$53,298**	**$54,897**	**$56,544**	**$58,240**	**$59,987**
4-Week Annual Pumping Duration[8]		**$37,250**	**$38,368**	**$39,519**	**$40,704**	**$41,925**	**$43,183**	**$44,479**	**$45,813**	**$47,187**	**$48,603**	**$50,061**	**$51,563**	**$53,110**	**$54,703**	**$56,344**	**$58,034**	**$59,775**	**$61,569**	**$63,416**	**$65,318**	**$67,278**	**$69,296**	**$71,375**
6-Week Annual Pumping Duration[8]		**$43,193**	**$44,489**	**$45,824**	**$47,198**	**$48,614**	**$50,073**	**$51,575**	**$53,122**	**$54,716**	**$56,357**	**$58,048**	**$59,790**	**$61,583**	**$63,431**	**$65,334**	**$67,294**	**$69,312**	**$71,392**	**$73,534**	**$75,740**	**$78,012**	**$80,352**	**$82,763**
8-Week Annual Pumping Duration[8]		**$49,136**	**$50,611**	**$52,129**	**$53,693**	**$55,303**	**$56,963**	**$58,671**	**$60,432**	**$62,245**	**$64,112**	**$66,035**	**$68,016**	**$70,057**	**$72,158**	**$74,323**	**$76,553**	**$78,850**	**$81,215**	**$83,651**	**$86,161**	**$88,746**	**$91,408**	**$94,150**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis (Cont.)

	24	25	26	27	28	29	30	31	32	33	34	35	36	37
	$64,104	$66,027	$68,008	$70,048	$72,150	$74,314	$76,544	$78,840	$81,205	$83,641	$86,151	$88,735	$91,397	$94,139
	$42,944	$46,155	$49,520	$53,046	$56,739	$60,606	$64,653	$68,889	$73,321	$77,957	$82,805	$87,874	$93,172	$98,709
	$1,538,500	**$1,650,682**	**$1,768,211**	**$1,891,305**	**$2,020,194**	**$2,155,115**	**$2,296,312**	**$2,444,041**	**$2,598,568**	**$2,760,166**	**$2,929,122**	**$3,105,730**	**$3,290,300**	**$3,483,148**
	$128,208	$132,055	$136,016	$140,097	$144,300	$148,629	$153,087	$157,680	$162,410	$167,283	$172,301	$177,470	$182,794	$188,278
	$85,887	$92,310	$99,041	$106,093	$113,478	$121,212	$129,307	$137,779	$146,642	$155,914	$165,610	$175,747	$186,344	$197,418
	$3,077,000	**$3,301,364**	**$3,536,422**	**$3,782,611**	**$4,040,389**	**$4,310,229**	**$4,592,623**	**$4,888,082**	**$5,197,135**	**$5,520,332**	**$5,858,243**	**$6,211,461**	**$6,580,599**	**$6,966,295**
	$256,417	$264,109	$272,032	$280,193	$288,599	$297,257	$306,175	$315,360	$324,821	$334,566	$344,603	$354,941	$365,589	$376,556
	$171,774	$184,620	$198,082	$212,185	$226,957	$242,423	$258,614	$275,557	$293,285	$311,828	$331,220	$351,495	$372,688	$394,836
	$6,154,000	**$6,602,729**	**$7,072,843**	**$7,565,222**	**$8,080,777**	**$8,620,458**	**$9,185,247**	**$9,776,164**	**$10,394,270**	**$11,040,664**	**$11,716,486**	**$12,422,921**	**$13,161,198**	**$13,932,590**
	$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564
	$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826
	$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449
	$36,511	$37,607	$38,735	$39,897	$41,094	$42,327	$43,596	$44,904	$46,251	$47,639	$49,068	$50,540	$52,056	$53,618
	$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898
	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	$48,590	**$50,047**	**$51,549**	**$53,095**	**$54,688**	**$56,329**	**$58,019**	**$59,759**	**$61,552**	**$63,399**	**$65,300**	**$67,260**	**$69,277**	**$71,356**
	$61,787	**$63,640**	**$65,550**	**$67,516**	**$69,542**	**$71,628**	**$73,777**	**$75,990**	**$78,270**	**$80,618**	**$83,036**	**$85,527**	**$88,093**	**$90,736**
	$73,516	**$75,722**	**$77,993**	**$80,333**	**$82,743**	**$85,225**	**$87,782**	**$90,416**	**$93,128**	**$95,922**	**$98,800**	**$101,764**	**$104,817**	**$107,961**
	$85,246	**$87,803**	**$90,437**	**$93,150**	**$95,945**	**$98,823**	**$101,788**	**$104,841**	**$107,987**	**$111,226**	**$114,563**	**$118,000**	**$121,540**	**$125,186**
	$96,975	**$99,884**	**$102,881**	**$105,967**	**$109,146**	**$112,421**	**$115,793**	**$119,267**	**$122,845**	**$126,530**	**$130,326**	**$134,236**	**$138,263**	**$142,411**
	24	25	26	27	28	29	30	31	32	33	34	35	36	37

	38	39	40	41	42	43	44	45	46	47	48	49	50
	$96,963	$99,872	$102,868	$105,954	$109,133	$112,407	$115,779	$119,253	$122,830	$126,515	$130,311	$134,220	$138,246
	$104,494	$110,538	$116,850	$123,442	$130,324	$137,508	$145,005	$152,829	$160,991	$169,506	$178,386	$187,647	$197,303
	$3,684,605	**$3,895,016**	**$4,114,735**	**$4,344,131**	**$4,583,588**	**$4,833,503**	**$5,094,287**	**$5,366,368**	**$5,650,190**	**$5,946,210**	**$6,254,907**	**$6,576,774**	**$6,912,324**
	$193,927	$199,744	$205,737	$211,909	$218,266	$224,814	$231,559	$238,505	$245,660	$253,030	$260,621	$268,440	$276,493
	$208,989	$221,076	$233,701	$246,884	$260,648	$275,015	$290,010	$305,657	$321,982	$339,011	$356,773	$375,294	$394,606
	$7,369,211	**$7,790,031**	**$8,229,469**	**$8,688,262**	**$9,167,176**	**$9,667,005**	**$10,188,574**	**$10,732,737**	**$11,300,379**	**$11,892,421**	**$12,509,814**	**$13,153,549**	**$13,824,648**
	$387,853	$399,489	$411,473	$423,818	$436,532	$449,628	$463,117	$477,010	$491,321	$506,060	$521,242	$536,880	$552,986
	$417,978	$442,153	$467,402	$493,768	$521,296	$550,031	$580,020	$611,314	$643,964	$678,023	$713,545	$750,589	$789,213
	$14,738,421	**$15,580,062**	**$16,458,938**	**$17,376,524**	**$18,334,351**	**$19,334,010**	**$20,377,147**	**$21,465,472**	**$22,600,757**	**$23,784,840**	**$25,019,628**	**$26,307,096**	**$27,649,295**
	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
	$55,227	$56,883	$58,590	$60,348	$62,158	$64,023	$65,944	$67,922	$69,960	$72,058	$74,220	$76,447	$78,740
	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	$73,496	**$75,701**	**$77,972**	**$80,311**	**$82,721**	**$85,202**	**$87,758**	**$90,391**	**$93,103**	**$95,896**	**$98,773**	**$101,736**	**$104,788**
	$93,458	**$96,262**	**$99,150**	**$102,124**	**$105,188**	**$108,344**	**$111,594**	**$114,942**	**$118,390**	**$121,942**	**$125,600**	**$129,368**	**$133,249**
	$111,200	**$114,536**	**$117,972**	**$121,511**	**$125,156**	**$128,911**	**$132,778**	**$136,762**	**$140,865**	**$145,091**	**$149,443**	**$153,927**	**$158,544**
	$128,942	**$132,810**	**$136,794**	**$140,898**	**$145,125**	**$149,479**	**$153,963**	**$158,582**	**$163,339**	**$168,240**	**$173,287**	**$178,485**	**$183,840**
	$146,683	**$151,084**	**$155,616**	**$160,285**	**$165,093**	**$170,046**	**$175,148**	**$180,402**	**$185,814**	**$191,388**	**$197,130**	**$203,044**	**$209,135**
	38	39	40	41	42	43	44	45	46	47	48	49	50

APPENDIX H
PRELIMINARY ANALYSIS – DELIVERY TO IID CANAL

SYSTEM CURVE CALCULATION

PROJECT: PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY

ALTERNATIVE: ALTERNATIVE ALIGNMENT 1 - 10 CFS DESIGN FLOW - BOOSTER PUMP FOR EXTENDING DELIVERY TO ICICLE IRRIGATION DISTRICT

BY: David Rice, P.E.

DATE: 14-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	1146.0 feet	PID Canal Bottom
HWL	1148.5 feet	PID Canal (High Flow)
LWL	1146.5 feet	PID Canal (Low Flow)

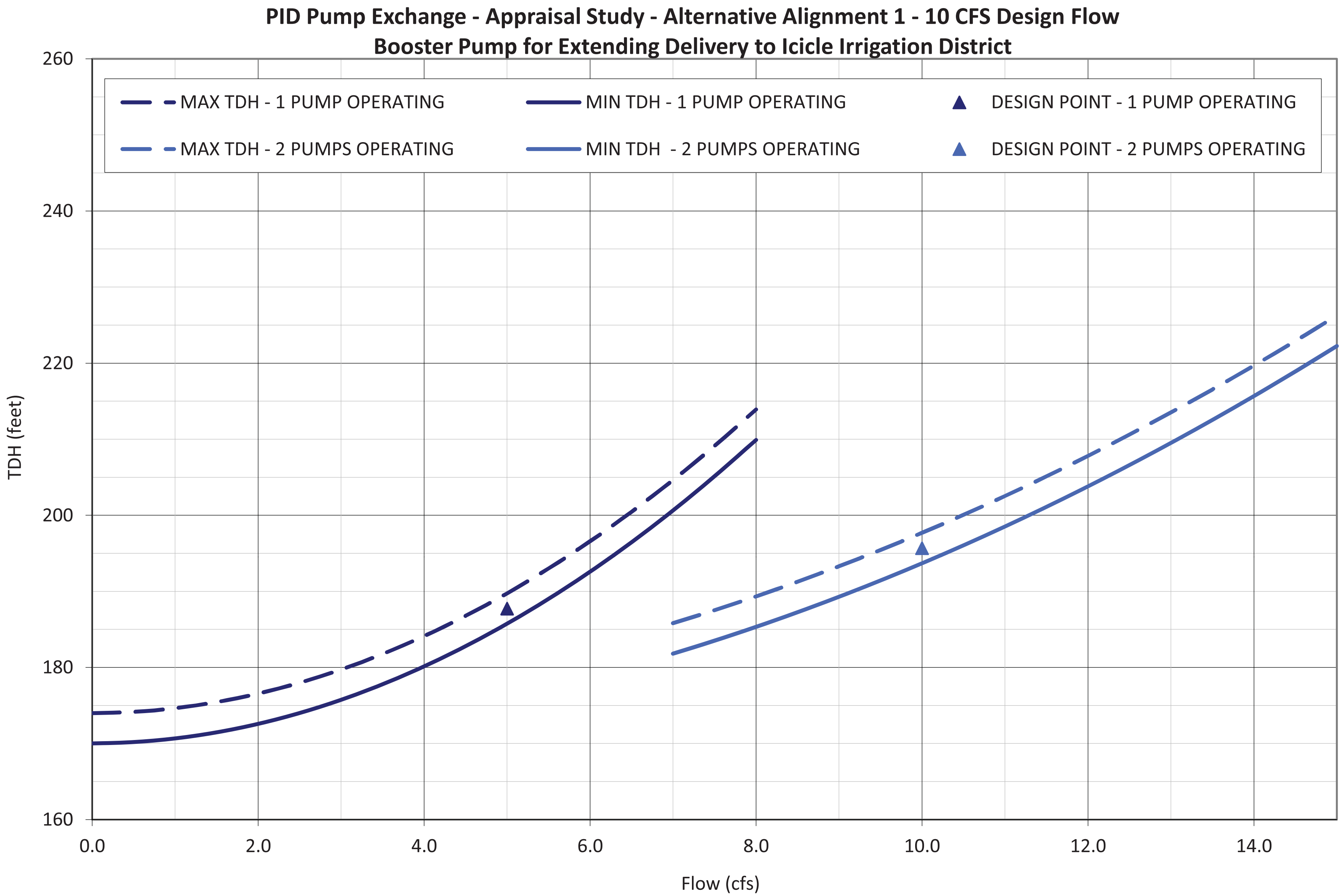
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1318.0 feet	IID Canal Bottom
HIGH	1320.5 feet	IID Canal (High Flow)
LWL	1318.5 feet	IID Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					12	12		20
O.D. (in)					12	12		20
I.D. (in)					12	12		20
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	8		2,250
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	2244	5.0	188	152.1
2	4488	10.0	196	317.1
*Assumes	70%	Efficiency		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		12-inch	12-inch	-inch	20-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0			170.0	174.0	172.0	170.0	174.0	172.0			
224	0.5	0.64	0.64		0.23			0.0	0.0	0.1	0.0	0.0	0.0			170.2	174.2	172.2	170.1	174.1	172.1			
449	1.0	1.27	1.27		0.46			0.0	0.1	0.5	0.0	0.1	0.0			170.7	174.7	172.7	170.3	174.3	172.3			
673	1.5	1.91	1.91		0.69			0.1	0.2	1.1	0.0	0.3	0.0			171.5	175.5	173.5	170.6	174.6	172.6			
898	2.0	2.55	2.55		0.92			0.1	0.4	2.0	0.0	0.5	0.0			172.6	176.6	174.6	171.0	175.0	173.0			
1122	2.5	3.18	3.18		1.15			0.2	0.6	3.1	0.1	0.8	0.0			174.0	178.0	176.0	171.6	175.6	173.6			
1346	3.0	3.82	3.82		1.37			0.3	0.8	4.5	0.1	1.1	0.0			175.7	179.7	177.7	172.3	176.3	174.3			
1571	3.5	4.46	4.46		1.60			0.4	1.1	6.2	0.1	1.5	0.0			177.8	181.8	179.8	173.1	177.1	175.1			
1795	4.0	5.09	5.09		1.83			0.5	1.4	8.1	0.2	2.0	0.0			180.1	184.1	182.1	174.0	178.0	176.0			
2020	4.5	5.73	5.73		2.06			0.7	1.7	10.2	0.2	2.5	0.1			182.8	186.8	184.8	175.0	179.0	177.0			
2244	**5.0**	**6.37**	**6.37**		**2.29**			**0.8**	**2.1**	**12.6**	**0.2**	**3.1**	**0.1**			**185.8**	**189.8**	**187.8**	**176.1**	**180.1**	**178.1**			
2468	5.5	7.00	7.00		2.52			1.0	2.5	15.2	0.3	3.8	0.1			189.0	193.0	191.0	177.4	181.4	179.4			
2693	6.0	7.64	7.64		2.75			1.2	3.0	18.1	0.3	4.5	0.1			192.6	196.6	194.6	178.8	182.8	180.8			
2917	6.5	8.27	8.27		2.98			1.4	3.4	21.3	0.4	5.3	0.1			196.5	200.5	198.5	180.2	184.2	182.2			
3142	7.0	8.91	8.91		3.21			1.6	3.9	24.7	0.5	6.2	0.1			200.6	204.6	202.6	181.8	185.8	183.8			
3366	7.5	9.55	9.55		3.44			1.8	4.5	28.3	0.5	7.1	0.1			205.1	209.1	207.1	183.5	187.5	185.5			
3590	8.0	10.18	10.18		3.67			2.1	5.0	32.2	0.6	8.1	0.2			209.9	213.9	211.9	185.3	189.3	187.3			
3815	8.5	10.82	10.82		3.90			2.4	5.6	36.4	0.7	9.1	0.2			215.0	219.0	217.0	187.3	191.3	189.3			
4039	9.0	11.46	11.46		4.12			2.6	6.2	40.8	0.7	10.2	0.2			220.4	224.4	222.4	189.3	193.3	191.3			
4264	9.5	12.09	12.09		4.35			2.9	6.9	45.4	0.8	11.4	0.2			226.1	230.1	228.1	191.4	195.4	193.4			
4488	**10.0**	**12.73**	**12.73**		**4.58**			**3.3**	**7.6**	**50.3**	**0.9**	**12.6**	**0.2**			**232.1**	**236.1**	**234.1**	**193.7**	**197.7**	**195.7**			
4712	10.5	13.37	13.37		4.81			3.6	8.3	55.5	1.0	13.9	0.3			238.4	242.4	240.4	196.0	200.0	198.0			
4937	11.0	14.00	14.00		5.04			3.9	9.1	60.9	1.1	15.2	0.3			245.0	249.0	247.0	198.5	202.5	200.5			
5161	11.5	14.64	14.64		5.27			4.3	9.8	66.6	1.1	16.6	0.3			251.9	255.9	253.9	201.1	205.1	203.1			
5386	12.0	15.28	15.28		5.50			4.7	10.6	72.5	1.2	18.1	0.3			259.1	263.1	261.1	203.8	207.8	205.8			
5610	12.5	15.91	15.91		5.73			5.1	11.5	78.6	1.3	19.7	0.4			266.6	270.6	268.6	206.6	210.6	208.6			
5834	13.0	16.55	16.55		5.96			5.5	12.3	85.1	1.4	21.3	0.4			274.3	278.3	276.3	209.5	213.5	211.5			
6059	13.5	17.19	17.19		6.19			5.9	13.2	91.7	1.5	22.9	0.4			282.4	286.4	284.4	212.5	216.5	214.5			
6283	14.0	17.82	17.82		6.42			6.4	14.1	98.7	1.6	24.7	0.5			290.8	294.8	292.8	215.7	219.7	217.7			
6508	14.5	18.46	18.46		6.65			6.9	15.1	105.8	1.8	26.5	0.5			299.5	303.5	301.5	218.9	222.9	220.9			
6732	15.0	19.10	19.10		6.87			7.3	16.1	113.2	1.9	28.3	0.5			308.5	312.5	310.5	222.2	226.2	224.2			


PID Pump Exchange - Appraisal Study - Alternative Alignment 1 - 10 CFS Design Flow
Booster Pump for Extending Delivery to Icicle Irrigation District
MAX TDH - 1 PUMP OPERATING
MIN TDH - 1 PUMP OPERATING
DESIGN POINT - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MIN TDH - 2 PUMPS OPERATING
DESIGN POINT - 2 PUMPS OPERATING
TDH (feet)
260
240
220
200
180
160
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
Flow (cfs)

SYSTEM CURVE CALCULATION

PROJECT: **PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY**

ALTERNATIVE: **ALTERNATIVE ALIGNMENT 1 - 20 CFS DESIGN FLOW - BOOSTER PUMP FOR EXTENDING DELIVERY TO ICICLE IRRIGATION DISTRICT**

BY: David Rice, P.E.

DATE: 14-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	1146.0 feet	PID Canal Bottom
HWL	1148.5 feet	PID Canal (High Flow)
LWL	1146.5 feet	PID Canal (Low Flow)

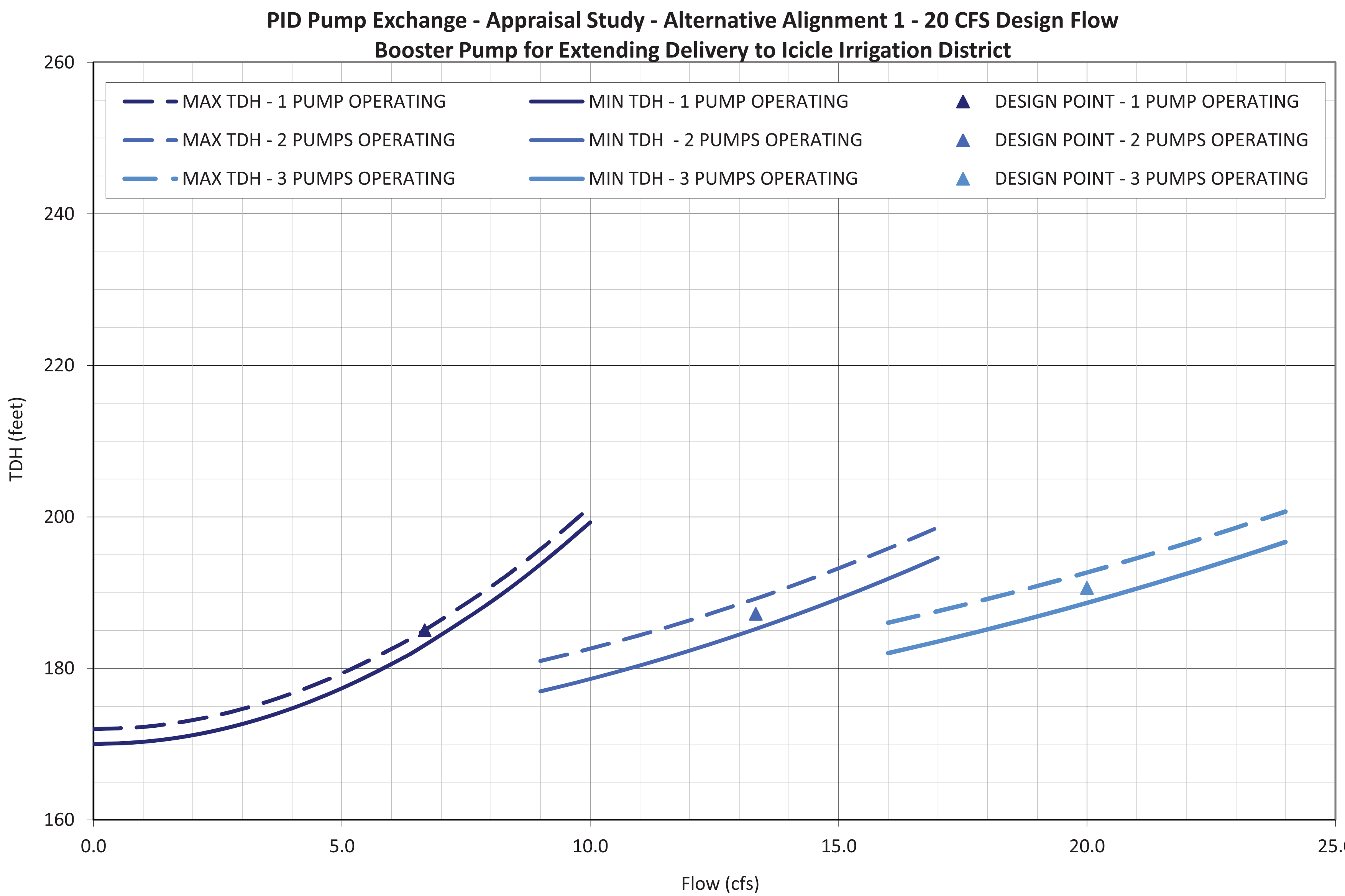
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1318.0 feet	IID Canal Bottom
HIGH	1320.5 feet	IID Canal (High Flow)
LWL	1318.5 feet	IID Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					14	14		30
O.D. (in)					14	14		30
I.D. (in)					14	14		30
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	8		2,250
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	2992	6.7	185	199.9
2	5984	13.3	187	404.5
3	8976	20.0	191	617.9
*Assumes	70%	Efficiency		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		14-inch	14-inch	-inch	30-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	170.0	174.0	172.0	170.0	174.0	172.0	170.0	174.0	172.0
449	1.0	0.94	0.94		0.20			0.0	0.0	0.3	0.0	0.1	0.0	0.0	0.0	170.3	174.3	172.3	170.1	174.1	172.1	170.1	174.1	172.1
898	2.0	1.87	1.87		0.41			0.0	0.1	1.1	0.0	0.3	0.0	0.1	0.0	171.2	175.2	173.2	170.4	174.4	172.4	170.2	174.2	172.2
1346	3.0	2.81	2.81		0.61			0.1	0.1	2.4	0.0	0.6	0.0	0.3	0.0	172.7	176.7	174.7	170.8	174.8	172.8	170.4	174.4	172.4
1795	4.0	3.74	3.74		0.81			0.1	0.2	4.3	0.1	1.1	0.0	0.5	0.0	174.7	178.7	176.7	171.4	175.4	173.4	170.8	174.8	172.8
2244	5.0	4.68	4.68		1.02			0.2	0.3	6.8	0.1	1.7	0.0	0.8	0.0	177.4	181.4	179.4	172.2	176.2	174.2	171.2	175.2	173.2
2693	6.0	5.61	5.61		1.22			0.2	0.4	9.8	0.2	2.4	0.0	1.1	0.0	180.6	184.6	182.6	173.1	177.1	175.1	171.7	175.7	173.7
2992	**6.7**	**6.24**	**6.24**		**1.36**			**0.3**	**0.5**	**12.1**	**0.2**	**3.0**	**0.1**	**1.3**	**0.0**	**183.1**	**187.1**	**185.1**	**173.9**	**177.9**	**175.9**	**172.2**	**176.2**	**174.2**
3590	8.0	7.48	7.48		1.63			0.4	0.7	17.4	0.3	4.3	0.1	1.9	0.0	188.8	192.8	190.8	175.5	179.5	177.5	173.1	177.1	175.1
4039	9.0	8.42	8.42		1.83			0.5	0.9	22.0	0.3	5.5	0.1	2.4	0.0	193.7	197.7	195.7	177.0	181.0	179.0	173.9	177.9	175.9
4488	10.0	9.35	9.35		2.04			0.6	1.1	27.2	0.4	6.8	0.1	3.0	0.1	199.3	203.3	201.3	178.6	182.6	180.6	174.8	178.8	176.8
4937	11.0	10.29	10.29		2.24			0.8	1.3	32.9	0.5	8.2	0.1	3.7	0.1	205.4	209.4	207.4	180.4	184.4	182.4	175.8	179.8	177.8
5386	12.0	11.22	11.22		2.44			0.9	1.5	39.1	0.6	9.8	0.2	4.3	0.1	212.1	216.1	214.1	182.3	186.3	184.3	176.8	180.8	178.8
5984	**13.3**	**12.47**	**12.47**		**2.72**			**1.1**	**1.8**	**48.3**	**0.7**	**12.1**	**0.2**	**5.4**	**0.1**	**222.0**	**226.0**	**224.0**	**185.2**	**189.2**	**187.2**	**178.4**	**182.4**	**180.4**
6283	14.0	13.09	13.09		2.85			1.3	2.0	53.2	0.8	13.3	0.2	5.9	0.1	227.3	231.3	229.3	186.8	190.8	188.8	179.2	183.2	181.2
6732	15.0	14.03	14.03		3.06			1.4	2.2	61.1	0.9	15.3	0.2	6.8	0.1	235.7	239.7	237.7	189.2	193.2	191.2	180.6	184.6	182.6
7181	16.0	14.97	14.97		3.26			1.6	2.5	69.6	1.0	17.4	0.3	7.7	0.1	244.7	248.7	246.7	191.8	195.8	193.8	182.0	186.0	184.0
7630	17.0	15.90	15.90		3.46			1.9	2.8	78.5	1.1	19.6	0.3	8.7	0.1	254.3	258.3	256.3	194.6	198.6	196.6	183.5	187.5	185.5
8078	18.0	16.84	16.84		3.67			2.1	3.1	88.0	1.2	22.0	0.3	9.8	0.2	264.5	268.5	266.5	197.6	201.6	199.6	185.2	189.2	187.2
8527	19.0	17.77	17.77		3.87			2.3	3.5	98.1	1.4	24.5	0.4	10.9	0.2	275.2	279.2	277.2	200.7	204.7	202.7	186.9	190.9	188.9
8976	**20.0**	**18.71**	**18.71**		**4.07**			**2.6**	**3.8**	**108.7**	**1.5**	**27.2**	**0.4**	**12.1**	**0.2**	**286.6**	**290.6**	**288.6**	**204.0**	**208.0**	**206.0**	**188.6**	**192.6**	**190.6**
9425	21.0	19.64	19.64		4.28			2.8	4.2	119.8	1.6	30.0	0.5	13.3	0.2	298.5	302.5	300.5	207.4	211.4	209.4	190.5	194.5	192.5
9874	22.0	20.58	20.58		4.48			3.1	4.5	131.5	1.8	32.9	0.5	14.6	0.2	310.9	314.9	312.9	211.0	215.0	213.0	192.5	196.5	194.5
10322	23.0	21.51	21.51		4.68			3.4	4.9	143.7	2.0	35.9	0.5	16.0	0.3	324.0	328.0	326.0	214.8	218.8	216.8	194.6	198.6	196.6
10771	24.0	22.45	22.45		4.89			3.7	5.3	156.5	2.1	39.1	0.6	17.4	0.3	337.6	341.6	339.6	218.7	222.7	220.7	196.7	200.7	198.7
11220	25.0	23.38	23.38		5.09			4.0	5.7	169.8	2.3	42.5	0.6	18.9	0.3	351.8	355.8	353.8	222.8	226.8	224.8	198.9	202.9	200.9
11669	26.0	24.32	24.32		5.30			4.4	6.2	183.7	2.4	45.9	0.7	20.4	0.3	366.6	370.6	368.6	227.1	231.1	229.1	201.3	205.3	203.3
12118	27.0	25.25	25.25		5.50			4.7	6.6	198.1	2.6	49.5	0.7	22.0	0.3	382.0	386.0	384.0	231.6	235.6	233.6	203.7	207.7	205.7
12566	28.0	26.19	26.19		5.70			5.1	7.1	213.0	2.8	53.2	0.8	23.7	0.4	397.9	401.9	399.9	236.2	240.2	238.2	206.2	210.2	208.2
13015	29.0	27.12	27.12		5.91			5.4	7.6	228.5	3.0	57.1	0.8	25.4	0.4	414.5	418.5	416.5	240.9	244.9	242.9	208.8	212.8	210.8
13464	30.0	28.06	28.06		6.11			5.8	8.0	244.5	3.2	61.1	0.9	27.2	0.4	431.5	435.5	433.5	245.9	249.9	247.9	211.4	215.4	213.4



PID Pump Exchange - Appraisal Study - Alternative Alignment 1 - 20 CFS Design Flow
Booster Pump for Extending Delivery to Icicle Irrigation District
MAX TDH - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MAX TDH - 3 PUMPS OPERATING
MIN TDH - 1 PUMP OPERATING
MIN TDH - 2 PUMPS OPERATING
MIN TDH - 3 PUMPS OPERATING
DESIGN POINT - 1 PUMP OPERATING
DESIGN POINT - 2 PUMPS OPERATING
DESIGN POINT - 3 PUMPS OPERATING
TDH (feet)
260
240
220
200
180
160
0.0
5.0
10.0
15.0
20.0
25.0
Flow (cfs)

SYSTEM CURVE CALCULATION

PROJECT: **PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY**

ALTERNATIVE: **ALTERNATIVE ALIGNMENT 1 - 40 CFS DESIGN FLOW - BOOSTER PUMP FOR EXTENDING DELIVERY TO ICICLE IRRIGATION DISTRICT**

BY: David Rice, P.E.

DATE: 14-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	1146.0 feet	PID Canal Bottom
HWL	1148.5 feet	PID Canal (High Flow)
LWL	1146.5 feet	PID Canal (Low Flow)

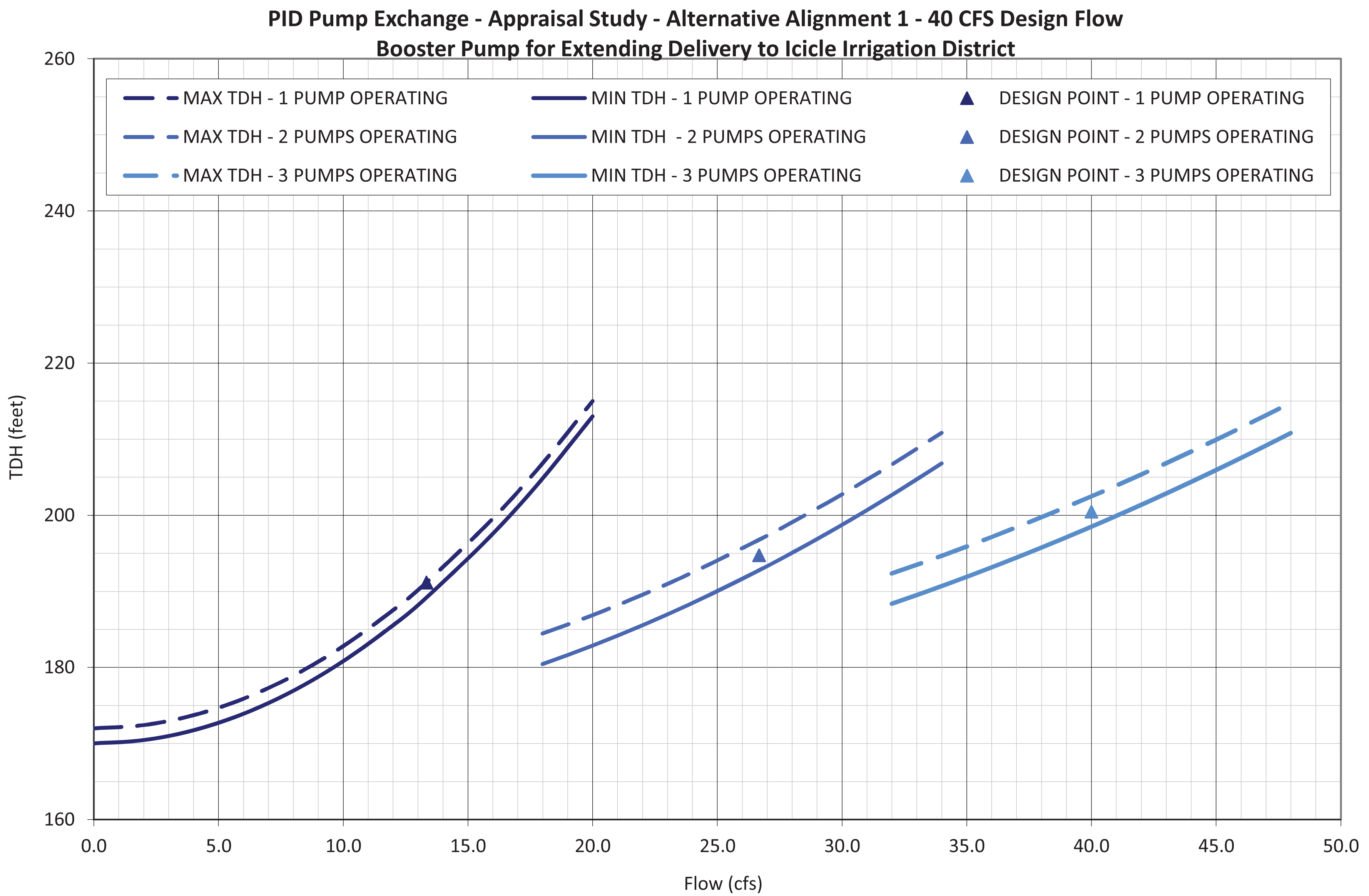
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1318.0 feet	IID Canal Bottom
HIGH	1320.5 feet	IID Canal (High Flow)
LWL	1318.5 feet	IID Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					18	18		36
O.D. (in)					18	18		36
I.D. (in)					18	18		36
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	8		2,250
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	5985	13.3	191	413.2
2	11970	26.7	195	841.8
3	17952	40.0	200	1299.6
Assumes	*70%*	*Efficiency*		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		18-inch	18-inch	-inch	36-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	170.0	174.0	172.0	170.0	174.0	172.0	170.0	174.0	172.0
898	2.0	1.13	1.13		0.28			0.0	0.0	0.4	0.0	0.1	0.0	0.0	0.0	170.4	174.4	172.4	170.1	174.1	172.1	170.1	174.1	172.1
1795	4.0	2.26	2.26		0.57			0.0	0.1	1.6	0.0	0.4	0.0	0.2	0.0	171.7	175.7	173.7	170.5	174.5	172.5	170.3	174.3	172.3
2693	6.0	3.39	3.39		0.85			0.1	0.2	3.6	0.0	0.9	0.0	0.4	0.0	173.9	177.9	175.9	171.2	175.2	173.2	170.7	174.7	172.7
3590	8.0	4.53	4.53		1.13			0.2	0.3	6.4	0.1	1.6	0.0	0.7	0.0	176.9	180.9	178.9	172.1	176.1	174.1	171.2	175.2	173.2
4488	10.0	5.66	5.66		1.41			0.3	0.4	9.9	0.1	2.5	0.0	1.1	0.0	180.8	184.8	182.8	173.3	177.3	175.3	171.9	175.9	173.9
5386	12.0	6.79	6.79		1.70			0.4	0.6	14.3	0.2	3.6	0.0	1.6	0.0	185.5	189.5	187.5	174.7	178.7	176.7	172.7	176.7	174.7
5985	**13.3**	**7.55**	**7.55**		**1.89**			**0.6**	**0.7**	**17.7**	**0.2**	**4.4**	**0.1**	**2.0**	**0.0**	**189.2**	**193.2**	**191.2**	**175.8**	**179.8**	**177.8**	**173.3**	**177.3**	**175.3**
7181	16.0	9.05	9.05		2.26			0.8	1.0	25.5	0.3	6.4	0.1	2.8	0.0	197.6	201.6	199.6	178.3	182.3	180.3	174.7	178.7	176.7
8078	18.0	10.18	10.18		2.55			1.0	1.3	32.2	0.4	8.1	0.1	3.6	0.0	204.9	208.9	206.9	180.4	184.4	182.4	175.9	179.9	177.9
8976	20.0	11.32	11.32		2.83			1.2	1.6	39.8	0.4	9.9	0.1	4.4	0.1	213.0	217.0	215.0	182.9	186.9	184.9	177.3	181.3	179.3
9874	22.0	12.45	12.45		3.11			1.5	1.9	48.1	0.5	12.0	0.1	5.3	0.1	222.0	226.0	224.0	185.5	189.5	187.5	178.8	182.8	180.8
10771	24.0	13.58	13.58		3.39			1.8	2.2	57.3	0.6	14.3	0.2	6.4	0.1	231.9	235.9	233.9	188.5	192.5	190.5	180.4	184.4	182.4
11970	**26.7**	**15.09**	**15.09**		**3.77**			**2.2**	**2.7**	**70.7**	**0.8**	**17.7**	**0.2**	**7.9**	**0.1**	**246.4**	**250.4**	**248.4**	**192.8**	**196.8**	**194.8**	**182.8**	**186.8**	**184.8**
12566	28.0	15.84	15.84		3.96			2.4	2.9	77.9	0.8	19.5	0.2	8.7	0.1	254.1	258.1	256.1	195.1	199.1	197.1	184.1	188.1	186.1
13464	30.0	16.97	16.97		4.24			2.8	3.3	89.5	0.9	22.4	0.3	9.9	0.1	266.5	270.5	268.5	198.7	202.7	200.7	186.2	190.2	188.2
14362	32.0	18.11	18.11		4.53			3.2	3.7	101.8	1.1	25.5	0.3	11.3	0.1	279.8	283.8	281.8	202.7	206.7	204.7	188.4	192.4	190.4
15259	34.0	19.24	19.24		4.81			3.6	4.2	114.9	1.2	28.7	0.3	12.8	0.2	293.9	297.9	295.9	206.8	210.8	208.8	190.7	194.7	192.7
16157	36.0	20.37	20.37		5.09			4.0	4.6	128.9	1.3	32.2	0.4	14.3	0.2	308.8	312.8	310.8	211.2	215.2	213.2	193.2	197.2	195.2
17054	38.0	21.50	21.50		5.38			4.5	5.1	143.6	1.5	35.9	0.4	16.0	0.2	324.6	328.6	326.6	215.9	219.9	217.9	195.8	199.8	197.8
17952	**40.0**	**22.63**	**22.63**		**5.66**			**5.0**	**5.6**	**159.1**	**1.6**	**39.8**	**0.4**	**17.7**	**0.2**	**341.3**	**345.3**	**343.3**	**220.8**	**224.8**	**222.8**	**198.5**	**202.5**	**200.5**
18850	42.0	23.76	23.76		5.94			5.5	6.2	175.4	1.7	43.8	0.5	19.5	0.2	358.8	362.8	360.8	226.0	230.0	228.0	201.4	205.4	203.4
19747	44.0	24.90	24.90		6.22			6.0	6.7	192.5	1.9	48.1	0.5	21.4	0.2	377.1	381.1	379.1	231.4	235.4	233.4	204.4	208.4	206.4
20645	46.0	26.03	26.03		6.51			6.6	7.3	210.4	2.1	52.6	0.6	23.4	0.3	396.3	400.3	398.3	237.0	241.0	239.0	207.5	211.5	209.5
21542	48.0	27.16	27.16		6.79			7.2	7.9	229.1	2.2	57.3	0.6	25.5	0.3	416.4	420.4	418.4	242.9	246.9	244.9	210.8	214.8	212.8
22440	50.0	28.29	28.29		7.07			7.8	8.5	248.6	2.4	62.1	0.7	27.6	0.3	437.3	441.3	439.3	249.1	253.1	251.1	214.2	218.2	216.2
23338	52.0	29.42	29.42		7.36			8.4	9.2	268.8	2.6	67.2	0.7	29.9	0.3	459.0	463.0	461.0	255.5	259.5	257.5	217.8	221.8	219.8
24235	54.0	30.55	30.55		7.64			9.1	9.8	289.9	2.8	72.5	0.8	32.2	0.4	481.6	485.6	483.6	262.1	266.1	264.1	221.5	225.5	223.5
25133	56.0	31.69	31.69		7.92			9.7	10.5	311.8	3.0	77.9	0.8	34.6	0.4	505.0	509.0	507.0	269.0	273.0	271.0	225.3	229.3	227.3
26030	58.0	32.82	32.82		8.20			10.5	11.2	334.5	3.2	83.6	0.9	37.2	0.4	529.3	533.3	531.3	276.2	280.2	278.2	229.2	233.2	231.2
26928	60.0	33.95	33.95		8.49			11.2	11.9	357.9	3.4	89.5	0.9	39.8	0.4	554.4	558.4	556.4	283.5	287.5	285.5	233.3	237.3	235.3


PID Pump Exchange - Appraisal Study - Alternative Alignment 1 - 40 CFS Design Flow
Booster Pump for Extending Delivery to Icicle Irrigation District
MAX TDH - 1 PUMP OPERATING
MIN TDH - 1 PUMP OPERATING
DESIGN POINT - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MIN TDH - 2 PUMPS OPERATING
DESIGN POINT - 2 PUMPS OPERATING
MAX TDH - 3 PUMPS OPERATING
MIN TDH - 3 PUMPS OPERATING
DESIGN POINT - 3 PUMPS OPERATING
TDH (feet)
260
240
220
200
180
160
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
Flow (cfs)

SYSTEM CURVE CALCULATION

PROJECT: PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY

ALTERNATIVE: ALTERNATIVE ALIGNMENT 5 - 10 CFS DESIGN FLOW - BOOSTER PUMP FOR EXTENDING DELIVERY TO ICICLE IRRIGATION DISTRICT

BY: David Rice, P.E.

DATE: 14-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	1158.0 feet	PID Canal Bottom
HWL	1160.5 feet	PID Canal (High Flow)
LWL	1158.5 feet	PID Canal (Low Flow)

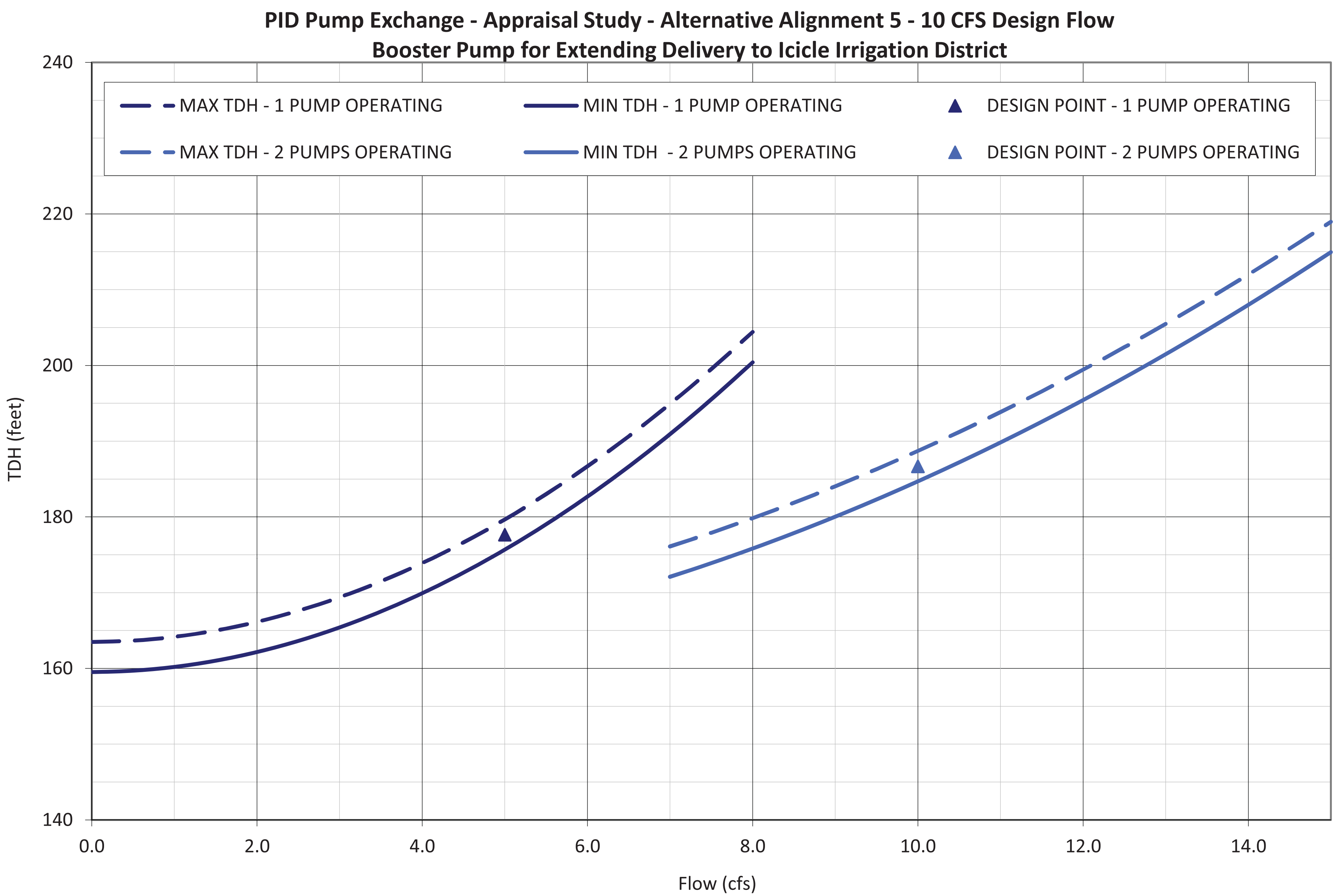
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1319.5 feet	IID Canal Bottom
HIGH	1322.0 feet	IID Canal (High Flow)
LWL	1320.0 feet	IID Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					12	12		20
O.D. (in)					12	12		20
I.D. (in)					12	12		20
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	8		2,700
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	2244	5.0	178	144.0
2	4488	10.0	187	302.6
*Assumes	70%	Efficiency		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		12-inch	12-inch	-inch	20-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0			159.5	163.5	161.5	159.5	163.5	161.5			
224	0.5	0.64	0.64		0.23			0.0	0.0	0.1	0.0	0.0	0.0			159.7	163.7	161.7	159.6	163.6	161.6			
449	1.0	1.27	1.27		0.46			0.0	0.1	0.5	0.0	0.1	0.0			160.2	164.2	162.2	159.8	163.8	161.8			
673	1.5	1.91	1.91		0.69			0.1	0.3	1.1	0.0	0.3	0.0			161.0	165.0	163.0	160.1	164.1	162.1			
898	2.0	2.55	2.55		0.92			0.1	0.5	2.0	0.0	0.5	0.0			162.2	166.2	164.2	160.6	164.6	162.6			
1122	2.5	3.18	3.18		1.15			0.2	0.7	3.1	0.1	0.8	0.0			163.6	167.6	165.6	161.2	165.2	163.2			
1346	3.0	3.82	3.82		1.37			0.3	1.0	4.5	0.1	1.1	0.0			165.4	169.4	167.4	161.9	165.9	163.9			
1571	3.5	4.46	4.46		1.60			0.4	1.3	6.2	0.1	1.5	0.0			167.5	171.5	169.5	162.8	166.8	164.8			
1795	4.0	5.09	5.09		1.83			0.5	1.7	8.1	0.2	2.0	0.0			169.9	173.9	171.9	163.8	167.8	165.8			
2020	4.5	5.73	5.73		2.06			0.7	2.1	10.2	0.2	2.5	0.1			172.6	176.6	174.6	164.8	168.8	166.8			
2244	**5.0**	**6.37**	**6.37**		**2.29**			**0.8**	**2.5**	**12.6**	**0.2**	**3.1**	**0.1**			**175.7**	**179.7**	**177.7**	**166.1**	**170.1**	**168.1**			
2468	5.5	7.00	7.00		2.52			1.0	3.0	15.2	0.3	3.8	0.1			179.0	183.0	181.0	167.4	171.4	169.4			
2693	6.0	7.64	7.64		2.75			1.2	3.5	18.1	0.3	4.5	0.1			182.7	186.7	184.7	168.8	172.8	170.8			
2917	6.5	8.27	8.27		2.98			1.4	4.1	21.3	0.4	5.3	0.1			186.6	190.6	188.6	170.4	174.4	172.4			
3142	7.0	8.91	8.91		3.21			1.6	4.7	24.7	0.5	6.2	0.1			190.9	194.9	192.9	172.1	176.1	174.1			
3366	7.5	9.55	9.55		3.44			1.8	5.4	28.3	0.5	7.1	0.1			195.5	199.5	197.5	173.9	177.9	175.9			
3590	8.0	10.18	10.18		3.67			2.1	6.0	32.2	0.6	8.1	0.2			200.4	204.4	202.4	175.8	179.8	177.8			
3815	8.5	10.82	10.82		3.90			2.4	6.7	36.4	0.7	9.1	0.2			205.6	209.6	207.6	177.9	181.9	179.9			
4039	9.0	11.46	11.46		4.12			2.6	7.5	40.8	0.7	10.2	0.2			211.1	215.1	213.1	180.0	184.0	182.0			
4264	9.5	12.09	12.09		4.35			2.9	8.3	45.4	0.8	11.4	0.2			217.0	221.0	219.0	182.3	186.3	184.3			
4488	**10.0**	**12.73**	**12.73**		**4.58**			**3.3**	**9.1**	**50.3**	**0.9**	**12.6**	**0.2**			**223.1**	**227.1**	**225.1**	**184.7**	**188.7**	**186.7**			
4712	10.5	13.37	13.37		4.81			3.6	10.0	55.5	1.0	13.9	0.3			229.5	233.5	231.5	187.2	191.2	189.2			
4937	11.0	14.00	14.00		5.04			3.9	10.9	60.9	1.1	15.2	0.3			236.3	240.3	238.3	189.8	193.8	191.8			
5161	11.5	14.64	14.64		5.27			4.3	11.8	66.6	1.1	16.6	0.3			243.3	247.3	245.3	192.6	196.6	194.6			
5386	12.0	15.28	15.28		5.50			4.7	12.8	72.5	1.2	18.1	0.3			250.7	254.7	252.7	195.4	199.4	197.4			
5610	12.5	15.91	15.91		5.73			5.1	13.8	78.6	1.3	19.7	0.4			258.3	262.3	260.3	198.4	202.4	200.4			
5834	13.0	16.55	16.55		5.96			5.5	14.8	85.1	1.4	21.3	0.4			266.3	270.3	268.3	201.5	205.5	203.5			
6059	13.5	17.19	17.19		6.19			5.9	15.9	91.7	1.5	22.9	0.4			274.6	278.6	276.6	204.7	208.7	206.7			
6283	14.0	17.82	17.82		6.42			6.4	17.0	98.7	1.6	24.7	0.5			283.2	287.2	285.2	208.0	212.0	210.0			
6508	14.5	18.46	18.46		6.65			6.9	18.1	105.8	1.8	26.5	0.5			292.1	296.1	294.1	211.4	215.4	213.4			
6732	15.0	19.10	19.10		6.87			7.3	19.3	113.2	1.9	28.3	0.5			301.2	305.2	303.2	215.0	219.0	217.0			



PID Pump Exchange - Appraisal Study - Alternative Alignment 5 - 10 CFS Design Flow
Booster Pump for Extending Delivery to Icicle Irrigation District
MAX TDH - 1 PUMP OPERATING
MIN TDH - 1 PUMP OPERATING
DESIGN POINT - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MIN TDH - 2 PUMPS OPERATING
DESIGN POINT - 2 PUMPS OPERATING
TDH (feet)
240
220
200
180
160
140
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
Flow (cfs)

SYSTEM CURVE CALCULATION

PROJECT: PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY

ALTERNATIVE: ALTERNATIVE ALIGNMENT 5 - 20 CFS DESIGN FLOW - BOOSTER PUMP FOR EXTENDING DELIVERY TO ICICLE IRRIGATION DISTRICT

BY: David Rice, P.E.

DATE: 14-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	1158.0 feet	PID Canal Bottom
HWL	1160.5 feet	PID Canal (High Flow)
LWL	1158.5 feet	PID Canal (Low Flow)

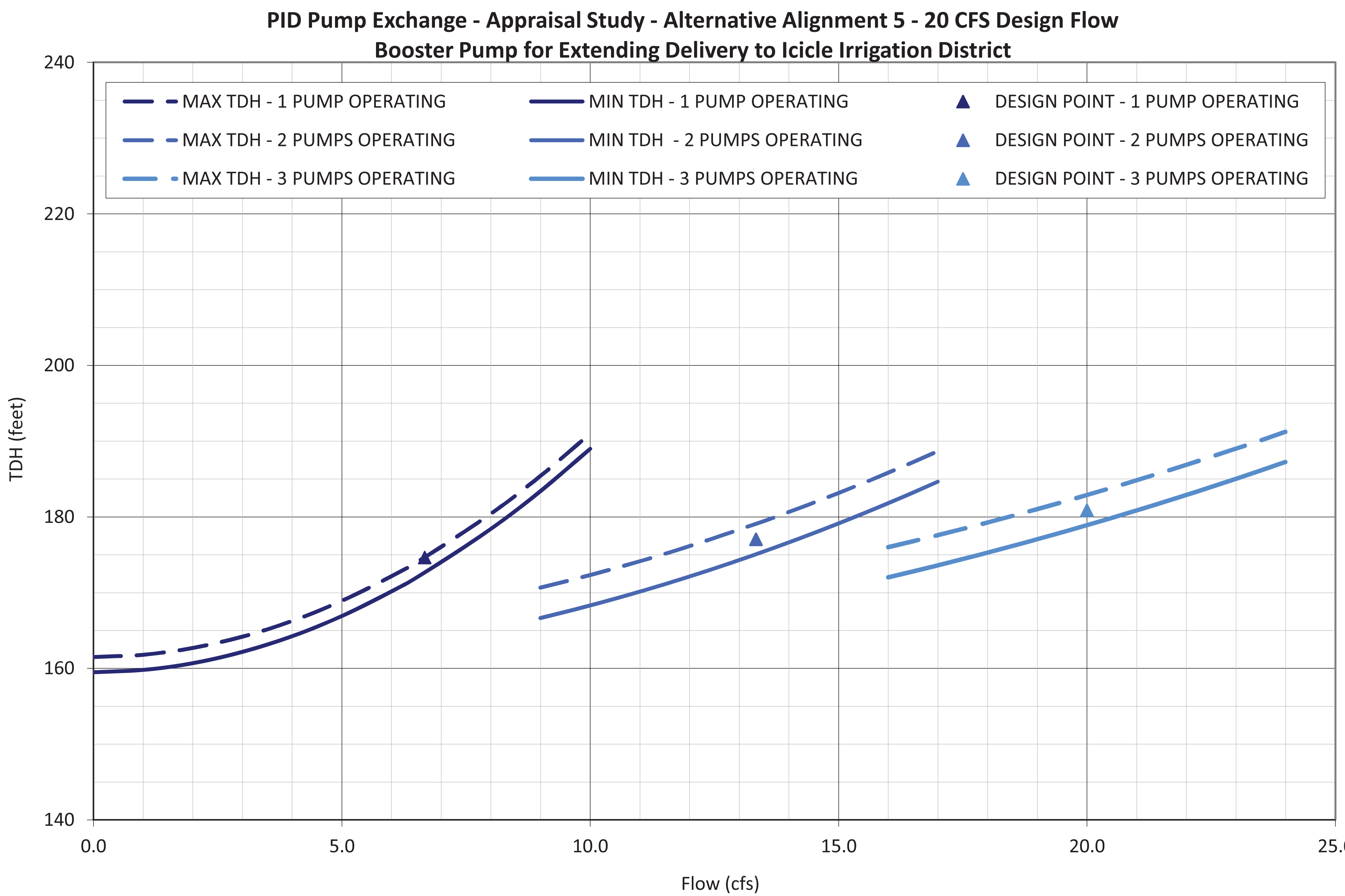
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1319.5 feet	IID Canal Bottom
HIGH	1322.0 feet	IID Canal (High Flow)
LWL	1320.0 feet	IID Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					14	14		30
O.D. (in)					14	14		30
I.D. (in)					14	14		30
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	8		2,690
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	2992	6.7	175	188.7
2	5985	13.3	177	382.7
3	8976	20.0	181	586.3
*Assumes	70%	Efficiency		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		14-inch	14-inch	-inch	30-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	159.5	163.5	161.5	159.5	163.5	161.5	159.5	163.5	161.5
449	1.0	0.94	0.94		0.20			0.0	0.0	0.3	0.0	0.1	0.0	0.0	0.0	159.8	163.8	161.8	159.6	163.6	161.6	159.6	163.6	161.6
898	2.0	1.87	1.87		0.41			0.0	0.1	1.1	0.0	0.3	0.0	0.1	0.0	160.7	164.7	162.7	159.9	163.9	161.9	159.7	163.7	161.7
1346	3.0	2.81	2.81		0.61			0.1	0.1	2.4	0.0	0.6	0.0	0.3	0.0	162.2	166.2	164.2	160.3	164.3	162.3	160.0	164.0	162.0
1795	4.0	3.74	3.74		0.81			0.1	0.2	4.3	0.1	1.1	0.0	0.5	0.0	164.3	168.3	166.3	160.9	164.9	162.9	160.3	164.3	162.3
2244	5.0	4.68	4.68		1.02			0.2	0.3	6.8	0.1	1.7	0.0	0.8	0.0	166.9	170.9	168.9	161.7	165.7	163.7	160.8	164.8	162.8
2693	6.0	5.61	5.61		1.22			0.2	0.5	9.8	0.2	2.4	0.0	1.1	0.0	170.2	174.2	172.2	162.7	166.7	164.7	161.3	165.3	163.3
2992	**6.7**	**6.24**	**6.24**		**1.36**			**0.3**	**0.6**	**12.1**	**0.2**	**3.0**	**0.1**	**1.3**	**0.0**	**172.7**	**176.7**	**174.7**	**163.5**	**167.5**	**165.5**	**161.7**	**165.7**	**163.7**
3590	8.0	7.48	7.48		1.63			0.4	0.8	17.4	0.3	4.3	0.1	1.9	0.0	178.4	182.4	180.4	165.2	169.2	167.2	162.7	166.7	164.7
4039	9.0	8.42	8.42		1.83			0.5	1.0	22.0	0.3	5.5	0.1	2.4	0.0	183.4	187.4	185.4	166.7	170.7	168.7	163.5	167.5	165.5
4488	10.0	9.35	9.35		2.04			0.6	1.3	27.2	0.4	6.8	0.1	3.0	0.1	189.0	193.0	191.0	168.3	172.3	170.3	164.5	168.5	166.5
4937	11.0	10.29	10.29		2.24			0.8	1.5	32.9	0.5	8.2	0.1	3.7	0.1	195.2	199.2	197.2	170.1	174.1	172.1	165.5	169.5	167.5
5386	12.0	11.22	11.22		2.44			0.9	1.8	39.1	0.6	9.8	0.2	4.3	0.1	201.9	205.9	203.9	172.1	176.1	174.1	166.6	170.6	168.6
5985	**13.3**	**12.47**	**12.47**		**2.72**			**1.1**	**2.1**	**48.3**	**0.7**	**12.1**	**0.2**	**5.4**	**0.1**	**211.8**	**215.8**	**213.8**	**175.1**	**179.1**	**177.1**	**168.3**	**172.3**	**170.3**
6283	14.0	13.09	13.09		2.85			1.3	2.3	53.2	0.8	13.3	0.2	5.9	0.1	217.1	221.1	219.1	176.6	180.6	178.6	169.1	173.1	171.1
6732	15.0	14.03	14.03		3.06			1.4	2.7	61.1	0.9	15.3	0.2	6.8	0.1	225.6	229.6	227.6	179.1	183.1	181.1	170.5	174.5	172.5
7181	16.0	14.97	14.97		3.26			1.6	3.0	69.6	1.0	17.4	0.3	7.7	0.1	234.7	238.7	236.7	181.8	185.8	183.8	172.0	176.0	174.0
7630	17.0	15.90	15.90		3.46			1.9	3.4	78.5	1.1	19.6	0.3	8.7	0.1	244.4	248.4	246.4	184.7	188.7	186.7	173.6	177.6	175.6
8078	18.0	16.84	16.84		3.67			2.1	3.7	88.0	1.2	22.0	0.3	9.8	0.2	254.6	258.6	256.6	187.7	191.7	189.7	175.3	179.3	177.3
8527	19.0	17.77	17.77		3.87			2.3	4.1	98.1	1.4	24.5	0.4	10.9	0.2	265.4	269.4	267.4	190.9	194.9	192.9	177.0	181.0	179.0
8976	**20.0**	**18.71**	**18.71**		**4.07**			**2.6**	**4.5**	**108.7**	**1.5**	**27.2**	**0.4**	**12.1**	**0.2**	**276.8**	**280.8**	**278.8**	**194.2**	**198.2**	**196.2**	**178.9**	**182.9**	**180.9**
9425	21.0	19.64	19.64		4.28			2.8	5.0	119.8	1.6	30.0	0.5	13.3	0.2	288.8	292.8	290.8	197.7	201.7	199.7	180.8	184.8	182.8
9874	22.0	20.58	20.58		4.48			3.1	5.4	131.5	1.8	32.9	0.5	14.6	0.2	301.3	305.3	303.3	201.4	205.4	203.4	182.9	186.9	184.9
10322	23.0	21.51	21.51		4.68			3.4	5.9	143.7	2.0	35.9	0.5	16.0	0.3	314.5	318.5	316.5	205.3	209.3	207.3	185.0	189.0	187.0
10771	24.0	22.45	22.45		4.89			3.7	6.4	156.5	2.1	39.1	0.6	17.4	0.3	328.2	332.2	330.2	209.3	213.3	211.3	187.2	191.2	189.2
11220	25.0	23.38	23.38		5.09			4.0	6.9	169.8	2.3	42.5	0.6	18.9	0.3	342.5	346.5	344.5	213.5	217.5	215.5	189.6	193.6	191.6
11669	26.0	24.32	24.32		5.30			4.4	7.4	183.7	2.4	45.9	0.7	20.4	0.3	357.3	361.3	359.3	217.8	221.8	219.8	192.0	196.0	194.0
12118	27.0	25.25	25.25		5.50			4.7	7.9	198.1	2.6	49.5	0.7	22.0	0.3	372.8	376.8	374.8	222.4	226.4	224.4	194.5	198.5	196.5
12566	28.0	26.19	26.19		5.70			5.1	8.5	213.0	2.8	53.2	0.8	23.7	0.4	388.8	392.8	390.8	227.0	231.0	229.0	197.0	201.0	199.0
13015	29.0	27.12	27.12		5.91			5.4	9.0	228.5	3.0	57.1	0.8	25.4	0.4	405.4	409.4	407.4	231.9	235.9	233.9	199.7	203.7	201.7
13464	30.0	28.06	28.06		6.11			5.8	9.6	244.5	3.2	61.1	0.9	27.2	0.4	422.6	426.6	424.6	236.9	240.9	238.9	202.5	206.5	204.5



PID Pump Exchange - Appraisal Study - Alternative Alignment 5 - 20 CFS Design Flow
Booster Pump for Extending Delivery to Icicle Irrigation District
MAX TDH - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MAX TDH - 3 PUMPS OPERATING
MIN TDH - 1 PUMP OPERATING
MIN TDH - 2 PUMPS OPERATING
MIN TDH - 3 PUMPS OPERATING
DESIGN POINT - 1 PUMP OPERATING
DESIGN POINT - 2 PUMPS OPERATING
DESIGN POINT - 3 PUMPS OPERATING
TDH (feet)
240
220
200
180
160
140
0.0
5.0
10.0
15.0
20.0
25.0
Flow (cfs)

SYSTEM CURVE CALCULATION
PROJECT: **PESHASTIN IRRIGATION DISTRICT PUMP EXCHANGE - APPRAISAL STUDY**
ALTERNATIVE: **ALTERNATIVE ALIGNMENT 5 - 40 CFS DESIGN FLOW - BOOSTER PUMP FOR EXTENDING DELIVERY TO ICICLE IRRIGATION DISTRICT**

BY: David Rice, P.E.
DATE: 14-Sep-12

SUCTION WATER SURFACE ELEVATIONS:		
ELEV	1158.0 feet	PID Canal Bottom
HWL	1160.5 feet	PID Canal (High Flow)
LWL	1158.5 feet	PID Canal (Low Flow)

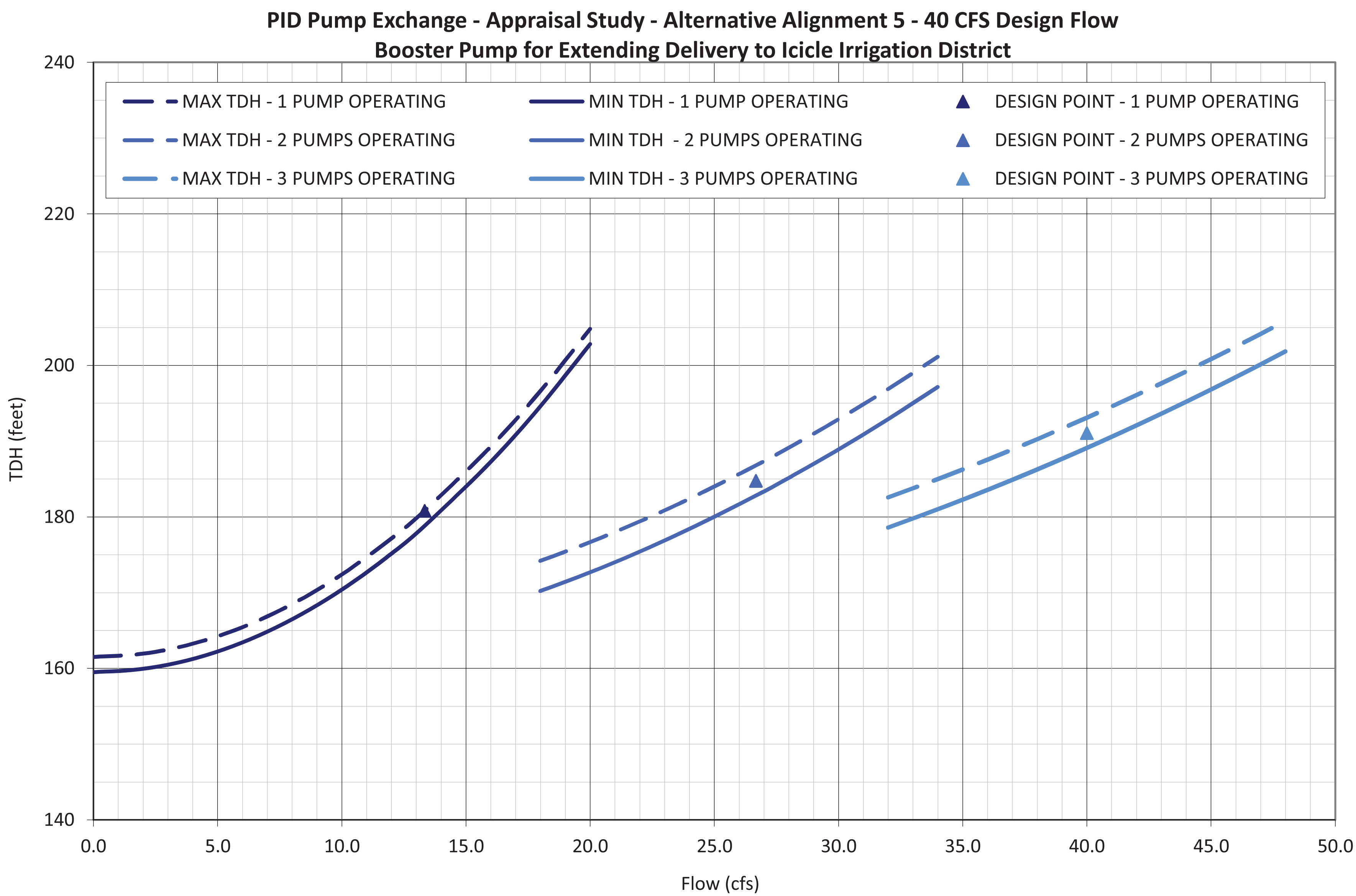
DISCHARGE WATER SURFACE ELEVATIONS:		
ELEV	1319.5 feet	IID Canal Bottom
HIGH	1322.0 feet	IID Canal (High Flow)
LWL	1320.0 feet	IID Canal (Low Flow)

PIPE	SUCTION PIPING		PS PIPING				DISCHARGE PIPING	
PROPERTIES	TRANS.	TRANS.	HEADER	TO PUMP	FR. PUMP	HEADER	TRANS.	TRANS.
NOM. DIAM. (in)					18	18		36
O.D. (in)					18	18		36
I.D. (in)					18	18		36
MATERIAL					STEEL	STEEL		HDPE
C					110	110		130
LENGTH (feet)					8	8		2,690
K					10	10		10

PROPOSED DESIGN POINTS:

PUMPS ON	FLOW (GPM)	FLOW (CFS)	TDH (FT)	POWER (HP)*
1	5985	13.3	181	390.8
2	11970	26.7	185	798.7
3	17952	40.0	191	1238.7
Assumes	*70%*	*Efficiency*		

TOTAL FLOW		VELOCITIES				SUCTION LOSSES		DISCHARGE LOSSES		PS LOSSES - 1 PUMP		PS LOSSES - 2 PUMPS		PS LOSSES - 3 PUMPS		TOTAL DYNAMIC HEAD - 1 PUMP			TOTAL DYNAMIC HEAD - 2 PUMPS			TOTAL DYNAMIC HEAD - 3 PUMPS		
		18-inch	18-inch	-inch	36-inch	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	Minor	Friction	MIN	MAX	DESIGN	MIN	MAX	DESIGN	MIN	MAX	DESIGN
(gpm)	(cfs)	(fps)	(fps)	(fps)	(fps)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
0	0.0	0.00	0.00		0.00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	159.5	163.5	161.5	159.5	163.5	161.5	159.5	163.5	161.5
898	2.0	1.13	1.13		0.28			0.0	0.0	0.4	0.0	0.1	0.0	0.0	0.0	159.9	163.9	161.9	159.6	163.6	161.6	159.6	163.6	161.6
1795	4.0	2.26	2.26		0.57			0.0	0.1	1.6	0.0	0.4	0.0	0.2	0.0	161.3	165.3	163.3	160.0	164.0	162.0	159.8	163.8	161.8
2693	6.0	3.39	3.39		0.85			0.1	0.2	3.6	0.0	0.9	0.0	0.4	0.0	163.4	167.4	165.4	160.7	164.7	162.7	160.2	164.2	162.2
3590	8.0	4.53	4.53		1.13			0.2	0.3	6.4	0.1	1.6	0.0	0.7	0.0	166.5	170.5	168.5	161.7	165.7	163.7	160.8	164.8	162.8
4488	10.0	5.66	5.66		1.41			0.3	0.5	9.9	0.1	2.5	0.0	1.1	0.0	170.4	174.4	172.4	162.8	166.8	164.8	161.4	165.4	163.4
5386	12.0	6.79	6.79		1.70			0.4	0.7	14.3	0.2	3.6	0.0	1.6	0.0	175.2	179.2	177.2	164.3	168.3	166.3	162.3	166.3	164.3
5985	**13.3**	**7.55**	**7.55**		**1.89**			**0.6**	**0.9**	**17.7**	**0.2**	**4.4**	**0.1**	**2.0**	**0.0**	**178.8**	**182.8**	**180.8**	**165.4**	**169.4**	**167.4**	**162.9**	**166.9**	**164.9**
7181	16.0	9.05	9.05		2.26			0.8	1.2	25.5	0.3	6.4	0.1	2.8	0.0	187.3	191.3	189.3	168.0	172.0	170.0	164.4	168.4	166.4
8078	18.0	10.18	10.18		2.55			1.0	1.5	32.2	0.4	8.1	0.1	3.6	0.0	194.6	198.6	196.6	170.2	174.2	172.2	165.7	169.7	167.7
8976	20.0	11.32	11.32		2.83			1.2	1.9	39.8	0.4	9.9	0.1	4.4	0.1	202.8	206.8	204.8	172.7	176.7	174.7	167.1	171.1	169.1
9874	22.0	12.45	12.45		3.11			1.5	2.2	48.1	0.5	12.0	0.1	5.3	0.1	211.9	215.9	213.9	175.4	179.4	177.4	168.6	172.6	170.6
10771	24.0	13.58	13.58		3.39			1.8	2.6	57.3	0.6	14.3	0.2	6.4	0.1	221.8	225.8	223.8	178.4	182.4	180.4	170.4	174.4	172.4
11970	**26.7**	**15.09**	**15.09**		**3.77**			**2.2**	**3.2**	**70.7**	**0.8**	**17.7**	**0.2**	**7.9**	**0.1**	**236.4**	**240.4**	**238.4**	**182.8**	**186.8**	**184.8**	**172.9**	**176.9**	**174.9**
12566	28.0	15.84	15.84		3.96			2.4	3.5	77.9	0.8	19.5	0.2	8.7	0.1	244.2	248.2	246.2	185.1	189.1	187.1	174.2	178.2	176.2
13464	30.0	16.97	16.97		4.24			2.8	4.0	89.5	0.9	22.4	0.3	9.9	0.1	256.7	260.7	258.7	188.9	192.9	190.9	176.3	180.3	178.3
14362	32.0	18.11	18.11		4.53			3.2	4.5	101.8	1.1	25.5	0.3	11.3	0.1	270.0	274.0	272.0	192.9	196.9	194.9	178.6	182.6	180.6
15259	34.0	19.24	19.24		4.81			3.6	5.0	114.9	1.2	28.7	0.3	12.8	0.2	284.2	288.2	286.2	197.1	201.1	199.1	181.0	185.0	183.0
16157	36.0	20.37	20.37		5.09			4.0	5.5	128.9	1.3	32.2	0.4	14.3	0.2	299.2	303.2	301.2	201.6	205.6	203.6	183.6	187.6	185.6
17054	38.0	21.50	21.50		5.38			4.5	6.1	143.6	1.5	35.9	0.4	16.0	0.2	315.1	319.1	317.1	206.4	210.4	208.4	186.3	190.3	188.3
17952	**40.0**	**22.63**	**22.63**		**5.66**			**5.0**	**6.7**	**159.1**	**1.6**	**39.8**	**0.4**	**17.7**	**0.2**	**331.9**	**335.9**	**333.9**	**211.4**	**215.4**	**213.4**	**189.1**	**193.1**	**191.1**
18850	42.0	23.76	23.76		5.94			5.5	7.4	175.4	1.7	43.8	0.5	19.5	0.2	349.5	353.5	351.5	216.7	220.7	218.7	192.1	196.1	194.1
19747	44.0	24.90	24.90		6.22			6.0	8.0	192.5	1.9	48.1	0.5	21.4	0.2	367.9	371.9	369.9	222.2	226.2	224.2	195.2	199.2	197.2
20645	46.0	26.03	26.03		6.51			6.6	8.7	210.4	2.1	52.6	0.6	23.4	0.3	387.2	391.2	389.2	228.0	232.0	230.0	198.4	202.4	200.4
21542	48.0	27.16	27.16		6.79			7.2	9.4	229.1	2.2	57.3	0.6	25.5	0.3	407.4	411.4	409.4	234.0	238.0	236.0	201.8	205.8	203.8
22440	50.0	28.29	28.29		7.07			7.8	10.2	248.6	2.4	62.1	0.7	27.6	0.3	428.4	432.4	430.4	240.3	244.3	242.3	205.4	209.4	207.4
23338	52.0	29.42	29.42		7.36			8.4	10.9	268.8	2.6	67.2	0.7	29.9	0.3	450.3	454.3	452.3	246.8	250.8	248.8	209.1	213.1	211.1
24235	54.0	30.55	30.55		7.64			9.1	11.7	289.9	2.8	72.5	0.8	32.2	0.4	473.0	477.0	475.0	253.6	257.6	255.6	212.9	216.9	214.9
25133	56.0	31.69	31.69		7.92			9.7	12.6	311.8	3.0	77.9	0.8	34.6	0.4	496.6	500.6	498.6	260.6	264.6	262.6	216.8	220.8	218.8
26030	58.0	32.82	32.82		8.20			10.5	13.4	334.5	3.2	83.6	0.9	37.2	0.4	521.0	525.0	523.0	267.8	271.8	269.8	220.9	224.9	222.9
26928	60.0	33.95	33.95		8.49			11.2	14.3	357.9	3.4	89.5	0.9	39.8	0.4	546.3	550.3	548.3	275.4	279.4	277.4	225.2	229.2	227.2



PID Pump Exchange - Appraisal Study - Alternative Alignment 5 - 40 CFS Design Flow
Booster Pump for Extending Delivery to Icicle Irrigation District
MAX TDH - 1 PUMP OPERATING
MIN TDH - 1 PUMP OPERATING
DESIGN POINT - 1 PUMP OPERATING
MAX TDH - 2 PUMPS OPERATING
MIN TDH - 2 PUMPS OPERATING
DESIGN POINT - 2 PUMPS OPERATING
MAX TDH - 3 PUMPS OPERATING
MIN TDH - 3 PUMPS OPERATING
DESIGN POINT - 3 PUMPS OPERATING
TDH (feet)
240
220
200
180
160
140
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
Flow (cfs)

Peshastin Irrigation District Pump Exchange Appraisal Study D. Rice
Opinion of Probable Costs - Pumping From PID Canal to IID Division 3A Canal 20-Sep-12
Design Flow Rate = 10 CFS

			ALTERNATIVE 1		ALTERNATIVE 5	
ITEM	**UNIT**	**UNIT COST**	**QTY**	**COST**	**QTY**	**COST**
Micellaneous Site Work						
Diversion and care of water	LS	VARIES	1	$5,000	1	$5,000
Temporary & permanent access	LS	VARIES	1	$10,000	1	$8,000
Erosion and sediment control	LS	VARIES	1	$10,000	1	$11,000
Clearing and grubbing	AC	$3,500	0.3	$1,085	0.2	$651
Subtotal - Miscellaneous Site Work				**$26,085**		**$24,651**
Earthwork						
Excavation and stockpile, soil	CY	$6.00	1,051	$6,309	1,253	$7,517
Excavation and stockpile, rock	CY	$15.00	701	$10,514	835	$12,528
Backfill (imported material)	CY	$30.00	682	$20,447	816	$24,494
Backfill (native material)	CY	$8.00	810	$6,481	969	$7,748
Waste/Disposal of excess material	CY	$5.00	942	$4,711	1,120	$5,598
Subtotal - Earthwork				**$48,462**		**$57,886**
Pump Station and Intake Facility						
Reinforced Concrete Structure	LS	$40,000	1	$40,000	1	$40,000
Vertical Turbine or Centrifugal Pumps - 150-160 HP, VFD	EA	$120,000	2	$240,000	2	$240,000
3-Phase Power Extension	LS	VARIES	1	$100,000	1	$100,000
Electrical and Controls	LS	$80,000	1	$80,000	1	$80,000
Piping, Valves, Meter and Appurtenances	LS	$40,000	1	$40,000	1	$40,000
Subtotal - Pump Station and Intake Facility				**$500,000**		**$500,000**
Delivery Pipeline						
20" CL 52 D.I. Pipe	LF	$115.00	2,250	$258,750	2,700	$310,500
Fittings and Appurtenances	LF	$15.00	2,250	$33,750	2,700	$40,500
Deadman Road Pavement Repair	LS	VARIES	1	$25,000	1	$30,000
Subtotal - Delivery Pipeline				**$317,500**		**$381,000**
Outlet Structure						
Reinforced Concrete Outlet Structure	LS	$5,000.00	1	$5,000	1	$5,000
Subtotal - Outlet Structure				**$5,000**		**$5,000**
Construction Subtotal				**$897,000**		**$969,000**
Mobilization / Demobilization	10.0%			$89,700		$96,900
Contingency	30.0%			$296,010		$319,770
Engineering, Permitting and Administration	20.0%			$197,340		$213,180
Sales Tax	8.0%			$118,404		$127,908
Allowance for Land Acquisition	LS	$50,000.00	1	$50,000	1	$50,000
Total Project Cost				**$1,648,000**		**$1,777,000**

Peshastin Irrigation District Pump Exchange Appraisal Study D. Rice
Opinion of Probable Operating Costs - Pumping From PID Canal to IID Division 3A Canal 20-Sep-12
Design Flow Rate = 10 CFS

			ALIGNMENT 1		ALIGNMENT 5	
ITEM	UNIT	UNIT COST	QTY	COST	QTY	COST
Annual Operations and Maintenance Cost[1]				**$11,920**		**$16,120**
Pumping Power Costs[2]						
Monthly Basic Charge (3-Phase Power)	/EA/MO	$14.50	1	$14.50	1	$14.50
Monthly Demand Charge	/HP/MO	$3.52	320	$1,126.40	305	$1,073.60
Energy Charge						
2-Week Annual Pumping Duration	kWH	$0.0165	80,210	$1,323.46	76,450	$1,261.43
4-Week Annual Pumping Duration	kWH	$0.0165	160,420	$2,646.93	152,900	$2,522.85
6-Week Annual Pumping Duration	kWH	$0.0165	240,630	$3,970.39	229,350	$3,784.28
8-Week Annual Pumping Duration	kWH	$0.0165	320,840	$5,293.85	305,800	$5,045.71
Total Annual Pumping Costs						
2-Week Annual Pumping Duration				$7,028		$6,702
4-Week Annual Pumping Duration				$8,351		$7,963
6-Week Annual Pumping Duration				$9,675		$9,225
8-Week Annual Pumping Duration				$10,998		$10,486
Total Annual Operating Costs[3]						
2-Week Annual Pumping Duration				**$18,900**		**$22,800**
4-Week Annual Pumping Duration				**$20,300**		**$24,100**
6-Week Annual Pumping Duration				**$21,600**		**$25,300**
8-Week Annual Pumping Duration				**$22,900**		**$26,600**

Notes:
1) Annual Operations and Maintenance Costs include estimated salaries, benefits, transportation, maintenance, repairs, administration, insurance,
2) Pumping power costs are based on Chelan PUD Electrical Rate Schedule 5 (Irrigation Service), and are applied May through June, in 2012 dollars.
3) Rounded to nearest $100.

Peshastin Irrigation District Pump Exchange Appraisal Study D. Rice
Opinion of Probable Costs - Pumping From PID Canal to IID Division 3A Canal 20-Sep-12
Design Flow Rate = 20 CFS

ITEM	UNIT	UNIT COST	ALIGNMENT 1 QTY	ALIGNMENT 1 COST	ALIGNMENT 5 QTY	ALIGNMENT 5 COST
Micellaneous Site Work						
Diversion and care of water	LS	VARIES	1	$5,000	1	$5,000
Temporary & permanent access	LS	VARIES	1	$10,000	1	$8,000
Erosion and sediment control	LS	VARIES	1	$10,000	1	$11,000
Clearing and grubbing	AC	$3,500	0.3	$1,085	0.2	$651
Subtotal - Miscellaneous Site Work				**$26,085**		**$24,651**
Earthwork						
Excavation and stockpile, soil	CY	$6.00	1,501	$9,007	1,789	$10,733
Excavation and stockpile, rock	CY	$15.00	1,001	$15,011	1,193	$17,889
Backfill (imported material)	CY	$30.00	970	$29,107	1,162	$34,870
Backfill (native material)	CY	$8.00	998	$7,985	1,193	$9,541
Waste/Disposal of excess material	CY	$5.00	1,504	$7,519	1,789	$8,944
Subtotal - Earthwork				**$68,628**		**$81,977**
Pump Station and Intake Facility						
Reinforced Concrete Structure	LS	$60,000	1	$60,000	1	$60,000
Vertical Turbine or Centrifugal Pumps - 200-210 HP, VFD	EA	$160,000	3	$480,000	3	$480,000
3-Phase Power Extension	LS	VARIES	1	$100,000	1	$100,000
Electrical and Controls	LS	$130,000	1	$130,000	1	$130,000
Piping, Valves, Meter and Appurtenances	LS	$60,000	1	$60,000	1	$60,000
Subtotal - Pump Station and Intake Facility				**$830,000**		**$830,000**
Delivery Pipeline						
30" CL 52 D.I. Pipe	LF	$160.00	2,250	$360,000	2,700	$432,000
Fittings and Appurtenances	LF	$17.00	2,250	$38,250	2,700	$45,900
Deadman Road Pavement Repair	LS	VARIES	1	$25,000	1	$30,000
Subtotal - Delivery Pipeline				**$423,250**		**$507,900**
Outlet Structure						
Reinforced Concrete Outlet Structure	LS	$6,000.00	1	$6,000	1	$6,000
Subtotal - Outlet Structure				**$6,000**		**$6,000**
Construction Subtotal				**$1,354,000**		**$1,451,000**
Mobilization / Demobilization	10.0%			$135,400		$145,100
Contingency	30.0%			$446,820		$478,830
Engineering, Permitting and Administration	20.0%			$297,880		$319,220
Sales Tax	8.0%			$178,728		$191,532
Allowance for Land Acquisition	LS	$50,000.00	1	$50,000	1	$50,000
Total Project Cost				**$2,463,000**		**$2,636,000**

Peshastin Irrigation District Pump Exchange Appraisal Study
Opinion of Probable Operating Costs - Pumping From PID Canal to IID Division 3A Canal
Design Flow Rate = 20 CFS

D. Rice
20-Sep-12

ITEM	UNIT	UNIT COST	ALIGNMENT 1 QTY	ALIGNMENT 1 COST	ALIGNMENT 5 QTY	ALIGNMENT 5 COST
Annual Operations and Maintenance Cost[1]				**$14,220**		**$19,320**
Pumping Power Costs[2]						
Basic Charge (3-Phase Power)	/EA/MO	$14.50	1	$14.50	1	$14.50
Monthly Demand Charge	/HP/MO	$3.52	620	$2,182.40	590	$2,076.80
Energy Charge						
2-Week Annual Pumping Duration	kWH	$0.0165	155,407	$2,564.21	147,887	$2,440.14
4-Week Annual Pumping Duration	kWH	$0.0165	310,813	$5,128.42	295,774	$4,880.27
6-Week Annual Pumping Duration	kWH	$0.0165	466,220	$7,692.63	443,661	$7,320.41
8-Week Annual Pumping Duration	kWH	$0.0165	621,627	$10,256.84	591,548	$9,760.54
Total Annual Pumping Costs						
2-Week Annual Pumping Duration				$13,549		$12,897
4-Week Annual Pumping Duration				$16,113		$15,337
6-Week Annual Pumping Duration				$18,677		$17,777
8-Week Annual Pumping Duration				$21,241		$20,217
Total Annual Operating Costs[3]						
2-Week Annual Pumping Duration				**$27,800**		**$32,200**
4-Week Annual Pumping Duration				**$30,300**		**$34,700**
6-Week Annual Pumping Duration				**$32,900**		**$37,100**
8-Week Annual Pumping Duration				**$35,500**		**$39,500**

Notes:
1) Annual Operations and Maintenance Costs include estimated salaries, benefits, transportation, maintenance, repairs, administration, insurance,
2) Pumping power costs are based on Chelan PUD Electrical Rate Schedule 5 (Irrigation Service), and are applied May through June, in 2012 dollars.
3) Rounded to nearest $100.

Peshastin Irrigation District Pump Exchange Appraisal Study D. Rice
Opinion of Probable Costs - Pumping From PID Canal to IID Division 3A Canal 20-Sep-12
Design Flow Rate = 40 CFS

			ALIGNMENT 1		ALIGNMENT 5	
ITEM	**UNIT**	**UNIT COST**	**QTY**	**COST**	**QTY**	**COST**
Micellaneous Site Work						
Diversion and care of water	LS	VARIES	1	$5,000	1	$5,000
Temporary & permanent access	LS	VARIES	1	$10,000	1	$8,000
Erosion and sediment control	LS	VARIES	1	$10,000	1	$11,000
Clearing and grubbing	AC	$3,500	0.3	$1,085	0.2	$651
Subtotal - Miscellaneous Site Work				**$26,085**		**$24,651**
Earthwork						
Excavation and stockpile, soil	CY	$6.00	1,817	$10,902	2,164	$12,987
Excavation and stockpile, rock	CY	$15.00	1,211	$18,170	1,443	$21,645
Backfill (imported material)	CY	$30.00	1,158	$34,736	1,387	$41,617
Backfill (native material)	CY	$8.00	1,115	$8,919	1,331	$10,650
Waste/Disposal of excess material	CY	$5.00	1,913	$9,567	2,276	$11,381
Subtotal - Earthwork				**$82,296**		**$98,279**
Pump Station and Intake Facility						
Reinforced Concrete Structure	LS	$80,000	1	$80,000	1	$80,000
Vertical Turbine or Centrifugal Pumps - 420-440 HP, VFD	EA	$240,000	3	$720,000	3	$720,000
3-Phase Power Extension	LS	VARIES	1	$100,000	1	$100,000
Electrical and Controls	LS	$190,000	1	$190,000	1	$190,000
Piping, Valves, Meter and Appurtenances	LS	$110,000	1	$110,000	1	$110,000
Subtotal - Pump Station and Intake Facility				**$1,200,000**		**$1,200,000**
Delivery Pipeline						
36" CL 52 D.I. Pipe	LF	$210.00	2,250	$472,500	2,700	$567,000
Fittings and Appurtenances	LF	$23.00	2,250	$51,750	2,700	$62,100
U.S. Highway 2 Crossing	LS	VARIES	0	$0	1	$420,000
Subtotal - Delivery Pipeline				**$524,250**		**$1,049,100**
Outlet Structure						
Reinforced Concrete Outlet Structure	LS	$10,000.00	1	$10,000	1	$10,000
Subtotal - Outlet Structure				**$10,000**		**$10,000**
Construction Subtotal				**$1,843,000**		**$2,382,000**
Mobilization / Demobilization	10.0%			$184,300		$238,200
Contingency	30.0%			$608,190		$786,060
Engineering, Permitting and Administration	20.0%			$405,460		$524,040
Sales Tax	8.0%			$243,276		$314,424
Allowance for Land Acquisition	LS	$50,000.00	1	$50,000	1	$50,000
Total Project Cost				**$3,334,000**		**$4,295,000**

Peshastin Irrigation District Pump Exchange Appraisal Study D. Rice
Opinion of Probable Operating Costs - Pumping From PID Canal to IID Division 3A Canal 20-Sep-12
Design Flow Rate = 40 CFS

			ALIGNMENT 1		ALIGNMENT 5	
ITEM	**UNIT**	**UNIT COST**	**QTY**	**COST**	**QTY**	**COST**
Annual Operations and Maintenance Cost[1]				**$17,820**		**$24,620**
Pumping Power Costs[2]						
Basic Charge (3-Phase Power)	/EA/MO	$14.50	1	$14.50	1	$14.50
Monthly Demand Charge	/HP/MO	$3.52	1,300	$4,576.00	1,240	$4,364.80
Energy Charge						
2-Week Annual Pumping Duration	kWH	$0.0165	325,853	$5,376.57	310,813	$5,128.42
4-Week Annual Pumping Duration	kWH	$0.0165	651,706	$10,753.14	621,627	$10,256.84
6-Week Annual Pumping Duration	kWH	$0.0165	977,558	$16,129.71	932,440	$15,385.27
8-Week Annual Pumping Duration	kWH	$0.0165	1,303,411	$21,506.28	1,243,254	$20,513.69
Total Annual Pumping Costs						
2-Week Annual Pumping Duration				$28,329		$27,025
4-Week Annual Pumping Duration				$33,706		$32,153
6-Week Annual Pumping Duration				$39,082		$37,282
8-Week Annual Pumping Duration				$44,459		$42,410
Total Annual Operating Costs[3]						
2-Week Annual Pumping Duration				**$46,100**		**$51,600**
4-Week Annual Pumping Duration				**$51,500**		**$56,800**
6-Week Annual Pumping Duration				**$56,900**		**$61,900**
8-Week Annual Pumping Duration				**$62,300**		**$67,000**

Notes:
1) Annual Operations and Maintenance Costs include estimated salaries, benefits, transportation, maintenance, repairs, administration, insurance
2) Pumping power costs are based on Chelan PUD Electrical Rate Schedule 5 (Irrigation Service), and are applied May through June, in 2012 dollars
3) Rounded to nearest $100.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis - Pumping From PID Canal to IID Division 3A Canal
Alternative 1, Design Flow Rate = 10 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 50th Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$1,648,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$1,806,169
To Replace 50% After Life of Project		$3,612,339
To Replace 100% After Life of Project	$1,648,000	$7,224,677
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$52,607
To Replace 50% After Life of Project		$105,214
To Replace 100% After Life of Project	$48,000	$210,427
Total Replacement Cost:		
To Replace 25% After Life of Project		**$1,858,776**
To Replace 50% After Life of Project		**$3,717,552**
To Replace 100% After Life of Project	**$1,696,000**	**$7,435,105**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$16,479
To Replace 50% After Life of Project	$32,958
To Replace 100% After Life of Project	$65,916
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$8,734
To Replace 50% After Life of Project	$17,469
To Replace 100% After Life of Project	$34,938
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$17,755
To Replace 50% After Life of Project	$35,510
To Replace 100% After Life of Project	$71,021
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$37,176
To Replace 50% After Life of Project	$74,351
To Replace 100% After Life of Project	$148,702

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$424,000	$596,000	$351,398	**$1,371,398**
50% Replacement	$848,000	$596,000	$351,398	**$1,795,398**
100% Replacement	$1,696,000	$596,000	$351,398	**$2,643,398**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$424,000	$596,000	$417,571	**$1,437,571**
50% Replacement	$848,000	$596,000	$417,571	**$1,861,571**
100% Replacement	$1,696,000	$596,000	$417,571	**$2,709,571**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$424,000	$596,000	$483,745	**$1,503,745**
50% Replacement	$848,000	$596,000	$483,745	**$1,927,745**
100% Replacement	$1,696,000	$596,000	$483,745	**$2,775,745**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$424,000	$596,000	$549,918	**$1,569,918**
50% Replacement	$848,000	$596,000	$549,918	**$1,993,918**
100% Replacement	$1,696,000	$596,000	$549,918	**$2,841,918**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Capital Expenses:	$1,648,000											
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits		$8,734	$8,996	$9,266	$9,544	$9,831	$10,126	$10,429	$10,742	$11,064	$11,396	$11,738
Interest		$0	$262	$540	$834	$1,145	$1,475	$1,823	$2,190	$2,578	$2,987	$3,419
End of Year Balance		**$8,734**	**$17,993**	**$27,799**	**$38,177**	**$49,153**	**$60,753**	**$73,005**	**$85,938**	**$99,580**	**$113,964**	**$129,121**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits		$17,469	$17,993	$18,533	$19,089	$19,661	$20,251	$20,859	$21,484	$22,129	$22,793	$23,477
Interest		$0	$524	$1,080	$1,668	$2,291	$2,949	$3,645	$4,380	$5,156	$5,975	$6,838
End of Year Balance		**$17,469**	**$35,986**	**$55,598**	**$76,355**	**$98,306**	**$121,507**	**$146,011**	**$171,875**	**$199,161**	**$227,928**	**$258,243**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits		$34,938	$35,986	$37,065	$38,177	$39,323	$40,502	$41,717	$42,969	$44,258	$45,586	$46,953
Interest		$0	$1,048	$2,159	$3,336	$4,581	$5,898	$7,290	$8,761	$10,313	$11,950	$13,676
End of Year Balance		**$34,938**	**$71,971**	**$111,196**	**$152,709**	**$196,613**	**$243,014**	**$292,021**	**$343,751**	**$398,321**	**$455,856**	**$516,485**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672
Maintenance and Small Repairs[7]		$5,800	$5,974	$6,153	$6,338	$6,528	$6,724	$6,926	$7,133	$7,347	$7,568	$7,795
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$11,920**	**$12,278**	**$12,646**	**$13,025**	**$13,416**	**$13,819**	**$14,233**	**$14,660**	**$15,100**	**$15,553**	**$16,019**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]		**$7,028**	**$7,239**	**$7,456**	**$7,680**	**$7,910**	**$8,147**	**$8,392**	**$8,644**	**$8,903**	**$9,170**	**$9,445**
4-Week Annual Pumping Duration[8]		**$8,351**	**$8,602**	**$8,860**	**$9,126**	**$9,400**	**$9,682**	**$9,972**	**$10,271**	**$10,579**	**$10,897**	**$11,224**
6-Week Annual Pumping Duration[8]		**$9,675**	**$9,965**	**$10,264**	**$10,572**	**$10,889**	**$11,216**	**$11,552**	**$11,899**	**$12,256**	**$12,624**	**$13,002**
8-Week Annual Pumping Duration[8]		**$10,998**	**$11,328**	**$11,668**	**$12,018**	**$12,379**	**$12,750**	**$13,133**	**$13,527**	**$13,932**	**$14,350**	**$14,781**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**

Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:												
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits	$12,090	$12,453	$12,827	$13,212	$13,608	$14,016	$14,437	$14,870	$15,316	$15,775	$16,249	$16,736
Interest	$3,874	$4,353	$4,857	$5,387	$5,945	$6,532	$7,148	$7,796	$8,476	$9,189	$9,938	$10,724
End of Year Balance	**$145,085**	**$161,891**	**$179,575**	**$198,173**	**$217,727**	**$238,275**	**$259,859**	**$282,525**	**$306,316**	**$331,281**	**$357,468**	**$384,928**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits	$24,181	$24,906	$25,654	$26,423	$27,216	$28,032	$28,873	$29,739	$30,632	$31,551	$32,497	$33,472
Interest	$7,747	$8,705	$9,713	$10,774	$11,890	$13,064	$14,296	$15,592	$16,951	$18,379	$19,877	$21,448
End of Year Balance	**$290,171**	**$323,782**	**$359,149**	**$396,347**	**$435,453**	**$476,549**	**$519,719**	**$565,050**	**$612,633**	**$662,563**	**$714,937**	**$769,857**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits	$48,362	$49,813	$51,307	$52,846	$54,432	$56,065	$57,747	$59,479	$61,263	$63,101	$64,994	$66,944
Interest	$15,495	$17,410	$19,427	$21,549	$23,781	$26,127	$28,593	$31,183	$33,903	$36,758	$39,754	$42,896
End of Year Balance	**$580,342**	**$647,565**	**$718,299**	**$792,694**	**$870,906**	**$953,098**	**$1,039,438**	**$1,130,100**	**$1,225,266**	**$1,325,125**	**$1,429,873**	**$1,539,713**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]	$8,029	$8,269	$8,517	$8,773	$9,036	$9,307	$9,587	$9,874	$10,170	$10,475	$10,790	$11,113
Administration, Insurance, Accounting	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses	**$16,500**	**$16,995**	**$17,505**	**$18,030**	**$18,571**	**$19,128**	**$19,702**	**$20,293**	**$20,902**	**$21,529**	**$22,175**	**$22,840**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]	**$9,728**	**$10,020**	**$10,321**	**$10,630**	**$10,949**	**$11,278**	**$11,616**	**$11,965**	**$12,324**	**$12,693**	**$13,074**	**$13,466**
4-Week Annual Pumping Duration[8]	**$11,560**	**$11,907**	**$12,264**	**$12,632**	**$13,011**	**$13,402**	**$13,804**	**$14,218**	**$14,644**	**$15,084**	**$15,536**	**$16,002**
6-Week Annual Pumping Duration[8]	**$13,392**	**$13,794**	**$14,208**	**$14,634**	**$15,073**	**$15,525**	**$15,991**	**$16,471**	**$16,965**	**$17,474**	**$17,998**	**$18,538**
8-Week Annual Pumping Duration[8]	**$15,224**	**$15,681**	**$16,151**	**$16,636**	**$17,135**	**$17,649**	**$18,179**	**$18,724**	**$19,286**	**$19,864**	**$20,460**	**$21,074**
Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$17,238	$17,755	$18,288	$18,837	$19,402	$19,984	$20,583	$21,201	$21,837	$22,492	$23,167	$23,862	$24,577	$25,315	$26,074	$26,856	$27,662	$28,492	$29,347	$30,227	$31,134	$32,068	$33,030	$34,021	$35,041	$36,093	$37,176
$11,548	$12,411	$13,316	$14,265	$15,258	$16,297	$17,386	$18,525	$19,717	$20,963	$22,267	$23,630	$25,055	$26,544	$28,099	$29,725	$31,422	$33,194	$35,045	$36,977	$38,993	$41,097	$43,292	$45,581	$47,969	$50,460	$53,056
$413,714	$443,881	$475,485	$508,586	$543,246	$579,527	$617,496	$657,221	$698,774	$742,229	$787,663	$835,154	$884,786	$936,645	$990,818	$1,047,399	$1,106,483	$1,168,170	$1,232,561	$1,299,765	$1,369,892	$1,443,057	$1,519,379	$1,598,981	$1,681,992	$1,768,544	$1,858,776
$34,476	$35,510	$36,576	$37,673	$38,803	$39,967	$41,166	$42,401	$43,673	$44,984	$46,333	$47,723	$49,155	$50,629	$52,148	$53,713	$55,324	$56,984	$58,693	$60,454	$62,268	$64,136	$66,060	$68,042	$70,083	$72,185	$74,351
$23,096	$24,823	$26,633	$28,529	$30,515	$32,595	$34,772	$37,050	$39,433	$41,926	$44,534	$47,260	$50,109	$53,087	$56,199	$59,449	$62,844	$66,389	$70,090	$73,954	$77,986	$82,194	$86,583	$91,163	$95,939	$100,920	$106,113
$827,429	$887,762	$950,970	$1,017,173	$1,086,491	$1,159,053	$1,234,991	$1,314,442	$1,397,549	$1,484,459	$1,575,326	$1,670,309	$1,769,573	$1,873,289	$1,981,636	$2,094,798	$2,212,966	$2,336,339	$2,465,123	$2,599,531	$2,739,785	$2,886,114	$3,038,757	$3,197,962	$3,363,984	$3,537,089	$3,717,552
$68,952	$71,021	$73,152	$75,346	$77,607	$79,935	$82,333	$84,803	$87,347	$89,967	$92,666	$95,446	$98,310	$101,259	$104,297	$107,426	$110,648	$113,968	$117,387	$120,908	$124,536	$128,272	$132,120	$136,083	$140,166	$144,371	$148,702
$46,191	$49,646	$53,266	$57,058	$61,030	$65,189	$69,543	$74,099	$78,867	$83,853	$89,068	$94,520	$100,219	$106,174	$112,397	$118,898	$125,688	$132,778	$140,180	$147,907	$155,972	$164,387	$173,167	$182,325	$191,878	$201,839	$212,225
$1,654,857	$1,775,524	$1,901,941	$2,034,345	$2,172,982	$2,318,106	$2,469,982	$2,628,884	$2,795,098	$2,968,918	$3,150,652	$3,340,618	$3,539,146	$3,746,579	$3,963,273	$4,189,597	$4,425,933	$4,672,679	$4,930,246	$5,199,062	$5,479,569	$5,772,228	$6,077,515	$6,395,924	$6,727,967	$7,074,177	$7,435,105
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$11,447	$11,790	$12,144	$12,508	$12,883	$13,270	$13,668	$14,078	$14,500	$14,935	$15,384	$15,845	$16,320	$16,810	$17,314	$17,834	$18,369	$18,920	$19,487	$20,072	$20,674	$21,294	$21,933	$22,591	$23,269	$23,967	$24,686
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$23,525	$24,231	$24,958	$25,707	$26,478	$27,272	$28,090	$28,933	$29,801	$30,695	$31,616	$32,564	$33,541	$34,547	$35,584	$36,651	$37,751	$38,883	$40,050	$41,251	$42,489	$43,764	$45,077	$46,429	$47,822	$49,256	$50,734
$13,870	$14,286	$14,715	$15,156	$15,611	$16,079	$16,562	$17,059	$17,570	$18,098	$18,641	$19,200	$19,776	$20,369	$20,980	$21,609	$22,258	$22,925	$23,613	$24,322	$25,051	$25,803	$26,577	$27,374	$28,195	$29,041	$29,913
$16,482	$16,977	$17,486	$18,011	$18,551	$19,107	$19,681	$20,271	$20,879	$21,506	$22,151	$22,815	$23,500	$24,205	$24,931	$25,679	$26,449	$27,243	$28,060	$28,902	$29,769	$30,662	$31,582	$32,529	$33,505	$34,510	$35,546
$19,094	$19,667	$20,257	$20,865	$21,491	$22,135	$22,800	$23,483	$24,188	$24,914	$25,661	$26,431	$27,224	$28,041	$28,882	$29,748	$30,641	$31,560	$32,507	$33,482	$34,486	$35,521	$36,587	$37,684	$38,815	$39,979	$41,178
$21,706	$22,357	$23,028	$23,719	$24,431	$25,163	$25,918	$26,696	$27,497	$28,322	$29,171	$30,046	$30,948	$31,876	$32,833	$33,818	$34,832	$35,877	$36,953	$38,062	$39,204	$40,380	$41,591	$42,839	$44,124	$45,448	$46,811
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis - Pumping From PID Canal to IID Division 3A Canal
Alternative 5, Design Flow Rate = 10 CFS

(yellow)	Input Cells - Assumed or Given Values
(blue)	Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 50th Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$1,777,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$1,947,550
To Replace 50% After Life of Project		$3,895,100
To Replace 100% After Life of Project	$1,777,000	$7,790,201
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$90,966
To Replace 50% After Life of Project		$181,932
To Replace 100% After Life of Project	$83,000	$363,864
Total Replacement Cost:		
To Replace 25% After Life of Project		**$2,038,516**
To Replace 50% After Life of Project		**$4,077,033**
To Replace 100% After Life of Project	**$1,860,000**	**$8,154,065**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$18,072
To Replace 50% After Life of Project	$36,145
To Replace 100% After Life of Project	$72,290
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$9,579
To Replace 50% After Life of Project	$19,158
To Replace 100% After Life of Project	$38,316
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$19,472
To Replace 50% After Life of Project	$38,944
To Replace 100% After Life of Project	$77,889
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$40,770
To Replace 50% After Life of Project	$81,541
To Replace 100% After Life of Project	$163,081

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$465,000	$806,000	$335,096	**$1,606,096**
50% Replacement	$930,000	$806,000	$335,096	**$2,071,096**
100% Replacement	$1,860,000	$806,000	$335,096	**$3,001,096**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$465,000	$806,000	$398,168	**$1,669,168**
50% Replacement	$930,000	$806,000	$398,168	**$2,134,168**
100% Replacement	$1,860,000	$806,000	$398,168	**$3,064,168**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$465,000	$806,000	$461,239	**$1,732,239**
50% Replacement	$930,000	$806,000	$461,239	**$2,197,239**
100% Replacement	$1,860,000	$806,000	$461,239	**$3,127,239**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$465,000	$806,000	$524,310	**$1,795,310**
50% Replacement	$930,000	$806,000	$524,310	**$2,260,310**
100% Replacement	$1,860,000	$806,000	$524,310	**$3,190,310**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:	$1,777,000																							
Replacement Fund (For Funding Replacement of 25% of System):																								
Deposits		$9,579	$9,866	$10,162	$10,467	$10,781	$11,105	$11,438	$11,781	$12,134	$12,498	$12,873	$13,260	$13,657	$14,067	$14,489	$14,924	$15,371	$15,833	$16,308	$16,797	$17,301	$17,820	$18,354
Interest		$0	$287	$592	$915	$1,256	$1,617	$1,999	$2,402	$2,827	$3,276	$3,750	$4,248	$4,773	$5,326	$5,908	$6,520	$7,163	$7,839	$8,550	$9,295	$10,078	$10,899	$11,761
End of Year Balance		**$9,579**	**$19,733**	**$30,487**	**$41,869**	**$53,906**	**$66,628**	**$80,065**	**$94,248**	**$109,210**	**$124,984**	**$141,607**	**$159,115**	**$177,546**	**$196,939**	**$217,336**	**$238,780**	**$261,315**	**$284,987**	**$309,845**	**$335,937**	**$363,316**	**$392,035**	**$422,150**
Replacement Fund (For Funding Replacement of 50% of System):																								
Deposits		$19,158	$19,733	$20,325	$20,934	$21,562	$22,209	$22,876	$23,562	$24,269	$24,997	$25,747	$26,519	$27,315	$28,134	$28,978	$29,848	$30,743	$31,665	$32,615	$33,594	$34,601	$35,640	$36,709
Interest		$0	$575	$1,184	$1,829	$2,512	$3,234	$3,998	$4,804	$5,655	$6,553	$7,499	$8,496	$9,547	$10,653	$11,816	$13,040	$14,327	$15,679	$17,099	$18,591	$20,156	$21,799	$23,522
End of Year Balance		**$19,158**	**$39,465**	**$60,974**	**$83,738**	**$107,812**	**$133,256**	**$160,130**	**$188,495**	**$218,419**	**$249,968**	**$283,214**	**$318,230**	**$355,091**	**$393,878**	**$434,673**	**$477,561**	**$522,630**	**$569,975**	**$619,689**	**$671,873**	**$726,631**	**$784,070**	**$844,300**
Replacement Fund (For Funding Replacement of 100% of System):																								
Deposits		$38,316	$39,465	$40,649	$41,869	$43,125	$44,419	$45,751	$47,124	$48,538	$49,994	$51,493	$53,038	$54,629	$56,268	$57,956	$59,695	$61,486	$63,331	$65,230	$67,187	$69,203	$71,279	$73,417
Interest		$0	$1,149	$2,368	$3,658	$5,024	$6,469	$7,995	$9,608	$11,310	$13,105	$14,998	$16,993	$19,094	$21,305	$23,633	$26,080	$28,654	$31,358	$34,198	$37,181	$40,312	$43,598	$47,044
End of Year Balance		**$38,316**	**$78,931**	**$121,948**	**$167,476**	**$215,625**	**$266,512**	**$320,259**	**$376,991**	**$436,838**	**$499,937**	**$566,428**	**$636,460**	**$710,183**	**$787,757**	**$869,346**	**$955,121**	**$1,045,261**	**$1,139,949**	**$1,239,378**	**$1,343,747**	**$1,453,262**	**$1,568,139**	**$1,688,601**
Operations and Maintenance Expenses:																								
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]		$10,000	$10,300	$10,609	$10,927	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$13,439	$13,842	$14,258	$14,685	$15,126	$15,580	$16,047	$16,528	$17,024	$17,535	$18,061	$18,603	$19,161
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$16,120**	**$16,604**	**$17,102**	**$17,615**	**$18,143**	**$18,687**	**$19,248**	**$19,826**	**$20,420**	**$21,033**	**$21,664**	**$22,314**	**$22,983**	**$23,673**	**$24,383**	**$25,114**	**$25,868**	**$26,644**	**$27,443**	**$28,267**	**$29,115**	**$29,988**	**$30,888**
Pumping Power Costs:																								
2-Week Annual Pumping Duration[8]		**$6,702**	**$6,903**	**$7,110**	**$7,323**	**$7,543**	**$7,769**	**$8,002**	**$8,243**	**$8,490**	**$8,744**	**$9,007**	**$9,277**	**$9,555**	**$9,842**	**$10,137**	**$10,441**	**$10,755**	**$11,077**	**$11,410**	**$11,752**	**$12,104**	**$12,468**	**$12,842**
4-Week Annual Pumping Duration[8]		**$7,963**	**$8,202**	**$8,448**	**$8,702**	**$8,963**	**$9,232**	**$9,509**	**$9,794**	**$10,088**	**$10,390**	**$10,702**	**$11,023**	**$11,354**	**$11,694**	**$12,045**	**$12,407**	**$12,779**	**$13,162**	**$13,557**	**$13,964**	**$14,383**	**$14,814**	**$15,259**
6-Week Annual Pumping Duration[8]		**$9,225**	**$9,502**	**$9,787**	**$10,080**	**$10,383**	**$10,694**	**$11,015**	**$11,345**	**$11,686**	**$12,036**	**$12,397**	**$12,769**	**$13,152**	**$13,547**	**$13,953**	**$14,372**	**$14,803**	**$15,247**	**$15,705**	**$16,176**	**$16,661**	**$17,161**	**$17,676**
8-Week Annual Pumping Duration[8]		**$10,486**	**$10,801**	**$11,125**	**$11,459**	**$11,802**	**$12,156**	**$12,521**	**$12,897**	**$13,284**	**$13,682**	**$14,093**	**$14,515**	**$14,951**	**$15,399**	**$15,861**	**$16,337**	**$16,827**	**$17,332**	**$17,852**	**$18,388**	**$18,939**	**$19,507**	**$20,093**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis - Pumping From PID Canal to IID Division 3A Canal (Cont.)

24	25	26	27	28	29	30	31	32	33	34	35	36	37
$18,905	$19,472	$20,056	$20,658	$21,278	$21,916	$22,574	$23,251	$23,948	$24,667	$25,407	$26,169	$26,954	$27,763
$12,665	$13,612	$14,604	$15,644	$16,733	$17,873	$19,067	$20,316	$21,623	$22,990	$24,420	$25,915	$27,477	$29,110
$453,720	**$486,803**	**$521,464**	**$557,766**	**$595,776**	**$635,566**	**$677,206**	**$720,773**	**$766,345**	**$814,002**	**$863,828**	**$915,912**	**$970,344**	**$1,027,216**
$37,810	$38,944	$40,113	$41,316	$42,555	$43,832	$45,147	$46,501	$47,897	$49,333	$50,813	$52,338	$53,908	$55,525
$25,329	$27,223	$29,208	$31,288	$33,466	$35,747	$38,134	$40,632	$43,246	$45,981	$48,840	$51,830	$54,955	$58,221
$907,439	**$973,607**	**$1,042,928**	**$1,115,531**	**$1,191,553**	**$1,271,131**	**$1,354,412**	**$1,441,546**	**$1,532,689**	**$1,628,003**	**$1,727,657**	**$1,831,824**	**$1,940,687**	**$2,054,433**
$75,620	$77,889	$80,225	$82,632	$85,111	$87,664	$90,294	$93,003	$95,793	$98,667	$101,627	$104,676	$107,816	$111,050
$50,658	$54,446	$58,416	$62,576	$66,932	$71,493	$76,268	$81,265	$86,493	$91,961	$97,680	$103,659	$109,909	$116,441
$1,814,879	**$1,947,213**	**$2,085,855**	**$2,231,063**	**$2,383,105**	**$2,542,263**	**$2,708,825**	**$2,883,093**	**$3,065,379**	**$3,256,007**	**$3,455,314**	**$3,663,649**	**$3,881,374**	**$4,108,866**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449
$19,736	$20,328	$20,938	$21,566	$22,213	$22,879	$23,566	$24,273	$25,001	$25,751	$26,523	$27,319	$28,139	$28,983
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$31,814	**$32,769**	**$33,752**	**$34,764**	**$35,807**	**$36,881**	**$37,988**	**$39,127**	**$40,301**	**$41,510**	**$42,756**	**$44,038**	**$45,359**	**$46,720**
$13,227	**$13,624**	**$14,032**	**$14,453**	**$14,887**	**$15,334**	**$15,794**	**$16,267**	**$16,755**	**$17,258**	**$17,776**	**$18,309**	**$18,858**	**$19,424**
$15,716	**$16,188**	**$16,673**	**$17,174**	**$17,689**	**$18,220**	**$18,766**	**$19,329**	**$19,909**	**$20,506**	**$21,121**	**$21,755**	**$22,408**	**$23,080**
$18,206	**$18,752**	**$19,315**	**$19,894**	**$20,491**	**$21,106**	**$21,739**	**$22,391**	**$23,063**	**$23,755**	**$24,467**	**$25,201**	**$25,957**	**$26,736**
$20,695	**$21,316**	**$21,956**	**$22,614**	**$23,293**	**$23,992**	**$24,711**	**$25,453**	**$26,216**	**$27,003**	**$27,813**	**$28,647**	**$29,507**	**$30,392**
24	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**

38	39	40	41	42	43	44	45	46	47	48	49	50
$28,595	$29,453	$30,337	$31,247	$32,184	$33,150	$34,145	$35,169	$36,224	$37,311	$38,430	$39,583	$40,770
$30,816	$32,599	$34,460	$36,404	$38,434	$40,552	$42,764	$45,071	$47,478	$49,989	$52,608	$55,339	$58,187
$1,086,628	**$1,148,681**	**$1,213,478**	**$1,281,129**	**$1,351,748**	**$1,425,450**	**$1,502,358**	**$1,582,598**	**$1,666,300**	**$1,753,599**	**$1,844,637**	**$1,939,559**	**$2,038,516**
$57,191	$58,907	$60,674	$62,494	$64,369	$66,300	$68,289	$70,338	$72,448	$74,621	$76,860	$79,166	$81,541
$61,633	$65,198	$68,921	$72,809	$76,868	$81,105	$85,527	$90,141	$94,956	$99,978	$105,216	$110,678	$116,374
$2,173,257	**$2,297,361**	**$2,426,956**	**$2,562,259**	**$2,703,496**	**$2,850,901**	**$3,004,717**	**$3,165,196**	**$3,332,599**	**$3,507,199**	**$3,689,274**	**$3,879,118**	**$4,077,033**
$114,382	$117,813	$121,348	$124,988	$128,738	$132,600	$136,578	$140,675	$144,896	$149,242	$153,720	$158,331	$163,081
$123,266	$130,395	$137,842	$145,617	$153,736	$162,210	$171,054	$180,283	$189,912	$199,956	$210,432	$221,356	$232,747
$4,346,514	**$4,594,723**	**$4,853,912**	**$5,124,518**	**$5,406,991**	**$5,701,801**	**$6,009,433**	**$6,330,391**	**$6,665,199**	**$7,014,397**	**$7,378,549**	**$7,758,237**	**$8,154,065**
$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$29,852	$30,748	$31,670	$32,620	$33,599	$34,607	$35,645	$36,715	$37,816	$38,950	$40,119	$41,323	$42,562
$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$48,122	**$49,566**	**$51,052**	**$52,584**	**$54,162**	**$55,786**	**$57,460**	**$59,184**	**$60,959**	**$62,788**	**$64,672**	**$66,612**	**$68,610**
$20,007	**$20,607**	**$21,225**	**$21,862**	**$22,518**	**$23,193**	**$23,889**	**$24,606**	**$25,344**	**$26,104**	**$26,887**	**$27,694**	**$28,525**
$23,772	**$24,486**	**$25,220**	**$25,977**	**$26,756**	**$27,559**	**$28,386**	**$29,237**	**$30,114**	**$31,018**	**$31,948**	**$32,907**	**$33,894**
$27,538	**$28,364**	**$29,215**	**$30,092**	**$30,994**	**$31,924**	**$32,882**	**$33,868**	**$34,884**	**$35,931**	**$37,009**	**$38,119**	**$39,263**
$31,304	**$32,243**	**$33,210**	**$34,206**	**$35,233**	**$36,290**	**$37,378**	**$38,500**	**$39,655**	**$40,844**	**$42,070**	**$43,332**	**$44,632**
38	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis - Pumping From PID Canal to IID Division 3A Canal
Alternative 1, Design Flow Rate = 20 CFS

Input Cells - Assumed or Given Values (yellow)
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 5oth Year Equal to Future Value of Replacement Cost (blue)

ASSUMPTIONS:		
Estimated Capital Cost:	$2,463,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$2,699,390
To Replace 50% After Life of Project		$5,398,780
To Replace 100% After Life of Project	$2,463,000	$10,797,561
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$73,430
To Replace 50% After Life of Project		$146,861
To Replace 100% After Life of Project	$67,000	$293,722
Total Replacement Cost:		
To Replace 25% After Life of Project		**$2,772,821**
To Replace 50% After Life of Project		**$5,545,641**
To Replace 100% After Life of Project	**$2,530,000**	**$11,091,282**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$24,582
To Replace 50% After Life of Project	$49,165
To Replace 100% After Life of Project	$98,330
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$13,030
To Replace 50% After Life of Project	$26,059
To Replace 100% After Life of Project	$52,118
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$26,486
To Replace 50% After Life of Project	$52,973
To Replace 100% After Life of Project	$105,945
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$55,456
To Replace 50% After Life of Project	$110,913
To Replace 100% After Life of Project	$221,826

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$632,500	$711,000	$677,436	**$2,020,936**
50% Replacement	$1,265,000	$711,000	$677,436	**$2,653,436**
100% Replacement	$2,530,000	$711,000	$677,436	**$3,918,436**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$632,500	$711,000	$805,646	**$2,149,146**
50% Replacement	$1,265,000	$711,000	$805,646	**$2,781,646**
100% Replacement	$2,530,000	$711,000	$805,646	**$4,046,646**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$632,500	$711,000	$933,857	**$2,277,357**
50% Replacement	$1,265,000	$711,000	$933,857	**$2,909,857**
100% Replacement	$2,530,000	$711,000	$933,857	**$4,174,857**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$632,500	$711,000	$1,062,067	**$2,405,567**
50% Replacement	$1,265,000	$711,000	$1,062,067	**$3,038,067**
100% Replacement	$2,530,000	$711,000	$1,062,067	**$4,303,067**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Capital Expenses:	$2,463,000											
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits		$13,030	$13,420	$13,823	$14,238	$14,665	$15,105	$15,558	$16,025	$16,505	$17,001	$17,511
Interest		$0	$391	$805	$1,244	$1,709	$2,200	$2,719	$3,267	$3,846	$4,456	$5,100
End of Year Balance		**$13,030**	**$26,841**	**$41,469**	**$56,951**	**$73,324**	**$90,629**	**$108,905**	**$128,197**	**$148,548**	**$170,005**	**$192,616**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits		$26,059	$26,841	$27,646	$28,475	$29,330	$30,210	$31,116	$32,049	$33,011	$34,001	$35,021
Interest		$0	$782	$1,610	$2,488	$3,417	$4,399	$5,438	$6,534	$7,692	$8,913	$10,200
End of Year Balance		**$26,059**	**$53,682**	**$82,938**	**$113,901**	**$146,648**	**$181,257**	**$217,811**	**$256,394**	**$297,097**	**$340,011**	**$385,232**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits		$52,118	$53,682	$55,292	$56,951	$58,659	$60,419	$62,232	$64,099	$66,022	$68,002	$70,042
Interest		$0	$1,564	$3,221	$4,976	$6,834	$8,799	$10,875	$13,069	$15,384	$17,826	$20,401
End of Year Balance		**$52,118**	**$107,363**	**$165,876**	**$227,803**	**$293,296**	**$362,514**	**$435,621**	**$512,789**	**$594,194**	**$680,022**	**$770,465**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672
Maintenance and Small Repairs[7]		$8,100	$8,343	$8,593	$8,851	$9,117	$9,390	$9,672	$9,962	$10,261	$10,569	$10,886
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$14,220**	**$14,647**	**$15,086**	**$15,539**	**$16,005**	**$16,485**	**$16,979**	**$17,489**	**$18,013**	**$18,554**	**$19,110**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]		**$13,549**	**$13,955**	**$14,374**	**$14,805**	**$15,249**	**$15,707**	**$16,178**	**$16,663**	**$17,163**	**$17,678**	**$18,208**
4-Week Annual Pumping Duration[8]		**$16,113**	**$16,596**	**$17,094**	**$17,607**	**$18,135**	**$18,679**	**$19,240**	**$19,817**	**$20,411**	**$21,024**	**$21,654**
6-Week Annual Pumping Duration[8]		**$18,677**	**$19,237**	**$19,815**	**$20,409**	**$21,021**	**$21,652**	**$22,301**	**$22,971**	**$23,660**	**$24,369**	**$25,101**
8-Week Annual Pumping Duration[8]		**$21,241**	**$21,879**	**$22,535**	**$23,211**	**$23,907**	**$24,625**	**$25,363**	**$26,124**	**$26,908**	**$27,715**	**$28,547**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**

Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:												
Replacement Fund (For Funding Replacement of 25% of System):												
Deposits	$18,036	$18,577	$19,134	$19,708	$20,300	$20,909	$21,536	$22,182	$22,847	$23,533	$24,239	$24,966
Interest	$5,778	$6,493	$7,245	$8,036	$8,869	$9,744	$10,663	$11,629	$12,644	$13,708	$14,826	$15,998
End of Year Balance	**$216,431**	**$241,500**	**$267,880**	**$295,624**	**$324,793**	**$355,445**	**$387,644**	**$421,455**	**$456,946**	**$494,187**	**$533,252**	**$574,215**
Replacement Fund (For Funding Replacement of 50% of System):												
Deposits	$36,072	$37,154	$38,269	$39,417	$40,599	$41,817	$43,072	$44,364	$45,695	$47,065	$48,477	$49,932
Interest	$11,557	$12,986	$14,490	$16,073	$17,737	$19,488	$21,327	$23,259	$25,287	$27,417	$29,651	$31,995
End of Year Balance	**$432,861**	**$483,001**	**$535,759**	**$591,249**	**$649,585**	**$710,890**	**$775,288**	**$842,910**	**$913,892**	**$988,375**	**$1,066,503**	**$1,148,430**
Replacement Fund (For Funding Replacement of 100% of System):												
Deposits	$72,144	$74,308	$76,537	$78,833	$81,198	$83,634	$86,143	$88,727	$91,389	$94,131	$96,955	$99,863
Interest	$23,114	$25,972	$28,980	$32,146	$35,475	$38,975	$42,653	$46,517	$50,575	$54,834	$59,302	$63,990
End of Year Balance	**$865,722**	**$966,001**	**$1,071,519**	**$1,182,497**	**$1,299,170**	**$1,421,780**	**$1,550,576**	**$1,685,821**	**$1,827,785**	**$1,976,749**	**$2,133,006**	**$2,296,860**
Operations and Maintenance Expenses:												
Salaries (1/12 FTE)[4]	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]	$11,212	$11,549	$11,895	$12,252	$12,620	$12,998	$13,388	$13,790	$14,203	$14,630	$15,068	$15,520
Administration, Insurance, Accounting	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses	**$19,684**	**$20,274**	**$20,883**	**$21,509**	**$22,154**	**$22,819**	**$23,503**	**$24,209**	**$24,935**	**$25,683**	**$26,453**	**$27,247**
Pumping Power Costs:												
2-Week Annual Pumping Duration[8]	**$18,755**	**$19,317**	**$19,897**	**$20,494**	**$21,108**	**$21,742**	**$22,394**	**$23,066**	**$23,758**	**$24,470**	**$25,205**	**$25,961**
4-Week Annual Pumping Duration[8]	**$22,304**	**$22,973**	**$23,662**	**$24,372**	**$25,103**	**$25,857**	**$26,632**	**$27,431**	**$28,254**	**$29,102**	**$29,975**	**$30,874**
6-Week Annual Pumping Duration[8]	**$25,854**	**$26,629**	**$27,428**	**$28,251**	**$29,098**	**$29,971**	**$30,870**	**$31,797**	**$32,750**	**$33,733**	**$34,745**	**$35,787**
8-Week Annual Pumping Duration[8]	**$29,403**	**$30,285**	**$31,194**	**$32,129**	**$33,093**	**$34,086**	**$35,109**	**$36,162**	**$37,247**	**$38,364**	**$39,515**	**$40,701**
Year	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis - Pumping From PID Canal to IID Division 3A Canal (Cont.)

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$25,715	$26,486	$27,281	$28,099	$28,942	$29,811	$30,705	$31,626	$32,575	$33,552	$34,559	$35,595	$36,663	$37,763	$38,896	$40,063	$41,265	$42,503	$43,778	$45,091	$46,444	$47,837	$49,272	$50,750	$52,273	$53,841	$55,456
$17,226	$18,515	$19,865	$21,279	$22,760	$24,312	$25,935	$27,634	$29,412	$31,272	$33,217	$35,250	$37,375	$39,596	$41,917	$44,341	$46,874	$49,518	$52,278	$55,160	$58,168	$61,306	$64,580	$67,996	$71,558	$75,273	$79,147
$617,156	$662,157	$709,303	$758,681	$810,384	$864,506	$921,146	$980,407	$1,042,393	$1,107,217	$1,174,992	$1,245,838	$1,319,876	$1,397,235	$1,478,048	$1,562,453	$1,650,591	$1,742,612	$1,838,668	$1,938,919	$2,043,530	$2,152,673	$2,266,526	$2,385,272	$2,509,103	$2,638,218	$2,772,821
$51,430	$52,973	$54,562	$56,199	$57,885	$59,621	$61,410	$63,252	$65,150	$67,104	$69,117	$71,191	$73,326	$75,526	$77,792	$80,126	$82,530	$85,005	$87,556	$90,182	$92,888	$95,674	$98,545	$101,501	$104,546	$107,682	$110,913
$34,453	$37,029	$39,729	$42,558	$45,521	$48,623	$51,870	$55,269	$58,824	$62,544	$66,433	$70,500	$74,750	$79,193	$83,834	$88,683	$93,747	$99,035	$104,557	$110,320	$116,335	$122,612	$129,160	$135,992	$143,116	$150,546	$158,293
$1,234,313	$1,324,315	$1,418,606	$1,517,363	$1,620,768	$1,729,012	$1,842,292	$1,960,813	$2,084,787	$2,214,435	$2,349,985	$2,491,675	$2,639,752	$2,794,471	$2,956,097	$3,124,906	$3,301,182	$3,485,223	$3,677,335	$3,877,838	$4,087,061	$4,305,347	$4,533,052	$4,770,544	$5,018,207	$5,276,435	$5,545,641
$102,859	$105,945	$109,124	$112,397	$115,769	$119,242	$122,819	$126,504	$130,299	$134,208	$138,234	$142,381	$146,653	$151,052	$155,584	$160,252	$165,059	$170,011	$175,111	$180,365	$185,775	$191,349	$197,089	$203,002	$209,092	$215,365	$221,826
$68,906	$74,059	$79,459	$85,116	$91,042	$97,246	$103,741	$110,538	$117,649	$125,087	$132,866	$140,999	$149,501	$158,385	$167,668	$177,366	$187,494	$198,071	$209,113	$220,640	$232,670	$245,224	$258,321	$271,983	$286,233	$301,092	$316,586
$2,468,625	$2,648,629	$2,837,211	$3,034,725	$3,241,536	$3,458,024	$3,684,584	$3,921,626	$4,169,574	$4,428,869	$4,699,970	$4,983,350	$5,279,504	$5,588,941	$5,912,194	$6,249,811	$6,602,364	$6,970,446	$7,354,671	$7,755,676	$8,174,121	$8,610,694	$9,066,104	$9,541,089	$10,036,413	$10,552,870	$11,091,282
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$15,986	$16,466	$16,960	$17,468	$17,992	$18,532	$19,088	$19,661	$20,251	$20,858	$21,484	$22,128	$22,792	$23,476	$24,180	$24,906	$25,653	$26,423	$27,215	$28,032	$28,873	$29,739	$30,631	$31,550	$32,496	$33,471	$34,475
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$28,064	$28,906	$29,774	$30,667	$31,587	$32,534	$33,510	$34,516	$35,551	$36,618	$37,716	$38,848	$40,013	$41,214	$42,450	$43,723	$45,035	$46,386	$47,778	$49,211	$50,687	$52,208	$53,774	$55,388	$57,049	$58,761	$60,523
$26,740	$27,542	$28,368	$29,219	$30,096	$30,998	$31,928	$32,886	$33,873	$34,889	$35,936	$37,014	$38,124	$39,268	$40,446	$41,659	$42,909	$44,196	$45,522	$46,888	$48,295	$49,743	$51,236	$52,773	$54,356	$55,987	$57,666
$31,800	$32,754	$33,737	$34,749	$35,791	$36,865	$37,971	$39,110	$40,284	$41,492	$42,737	$44,019	$45,340	$46,700	$48,101	$49,544	$51,030	$52,561	$54,138	$55,762	$57,435	$59,158	$60,933	$62,761	$64,643	$66,583	$68,580
$36,861	$37,967	$39,106	$40,279	$41,487	$42,732	$44,014	$45,334	$46,694	$48,095	$49,538	$51,024	$52,555	$54,132	$55,755	$57,428	$59,151	$60,926	$62,753	$64,636	$66,575	$68,572	$70,629	$72,748	$74,931	$77,179	$79,494
$41,922	$43,179	$44,475	$45,809	$47,183	$48,599	$50,057	$51,558	$53,105	$54,698	$56,339	$58,029	$59,770	$61,563	$63,410	$65,313	$67,272	$69,290	$71,369	$73,510	$75,715	$77,987	$80,326	$82,736	$85,218	$87,775	$90,408

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis - Pumping From PID Canal to IID Division 3A Canal
Alternative 5, Design Flow Rate = 20 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 50th Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$2,636,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$2,888,994
To Replace 50% After Life of Project		$5,777,988
To Replace 100% After Life of Project	$2,636,000	$11,555,976
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$120,557
To Replace 50% After Life of Project		$241,115
To Replace 100% After Life of Project	$110,000	$482,230
Total Replacement Cost:		
To Replace 25% After Life of Project		**$3,009,551**
To Replace 50% After Life of Project		**$6,019,103**
To Replace 100% After Life of Project	**$2,746,000**	**$12,038,206**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$26,681
To Replace 50% After Life of Project	$53,362
To Replace 100% After Life of Project	$106,725
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$14,142
To Replace 50% After Life of Project	$28,284
To Replace 100% After Life of Project	$56,568
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$28,748
To Replace 50% After Life of Project	$57,495
To Replace 100% After Life of Project	$114,990
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$60,191
To Replace 50% After Life of Project	$120,382
To Replace 100% After Life of Project	$240,764

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$686,500	$966,000	$644,832	**$2,297,332**
50% Replacement	$1,373,000	$966,000	$644,832	**$2,983,832**
100% Replacement	$2,746,000	$966,000	$644,832	**$4,356,832**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$686,500	$966,000	$766,839	**$2,419,339**
50% Replacement	$1,373,000	$966,000	$766,839	**$3,105,839**
100% Replacement	$2,746,000	$966,000	$766,839	**$4,478,839**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$686,500	$966,000	$888,845	**$2,541,345**
50% Replacement	$1,373,000	$966,000	$888,845	**$3,227,845**
100% Replacement	$2,746,000	$966,000	$888,845	**$4,600,845**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$686,500	$966,000	$1,010,852	**$2,663,352**
50% Replacement	$1,373,000	$966,000	$1,010,852	**$3,349,852**
100% Replacement	$2,746,000	$966,000	$1,010,852	**$4,722,852**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:	$2,636,000																							
Replacement Fund (For Funding Replacement of 25% of System):																								
Deposits		$14,142	$14,566	$15,003	$15,453	$15,917	$16,394	$16,886	$17,393	$17,915	$18,452	$19,006	$19,576	$20,163	$20,768	$21,391	$22,033	$22,694	$23,374	$24,076	$24,798	$25,542	$26,308	$27,097
Interest		$0	$424	$874	$1,350	$1,854	$2,388	$2,951	$3,546	$4,174	$4,837	$5,536	$6,272	$7,047	$7,864	$8,722	$9,626	$10,576	$11,574	$12,622	$13,723	$14,879	$16,091	$17,363
End of Year Balance		**$14,142**	**$29,132**	**$45,009**	**$61,813**	**$79,584**	**$98,366**	**$118,203**	**$139,142**	**$161,231**	**$184,520**	**$209,061**	**$234,908**	**$262,119**	**$290,750**	**$320,863**	**$352,522**	**$385,791**	**$420,739**	**$457,437**	**$495,958**	**$536,379**	**$578,778**	**$623,239**
Replacement Fund (For Funding Replacement of 50% of System):																								
Deposits		$28,284	$29,132	$30,006	$30,906	$31,834	$32,789	$33,772	$34,786	$35,829	$36,904	$38,011	$39,151	$40,326	$41,536	$42,782	$44,065	$45,387	$46,749	$48,151	$49,596	$51,084	$52,616	$54,195
Interest		$0	$849	$1,748	$2,701	$3,709	$4,775	$5,902	$7,092	$8,349	$9,674	$11,071	$12,544	$14,095	$15,727	$17,445	$19,252	$21,151	$23,147	$25,244	$27,446	$29,757	$32,183	$34,727
End of Year Balance		**$28,284**	**$58,265**	**$90,019**	**$123,626**	**$159,168**	**$196,732**	**$236,406**	**$278,284**	**$322,462**	**$369,039**	**$418,122**	**$469,817**	**$524,237**	**$581,500**	**$641,727**	**$705,044**	**$771,582**	**$841,479**	**$914,874**	**$991,916**	**$1,072,757**	**$1,157,556**	**$1,246,478**
Replacement Fund (For Funding Replacement of 100% of System):																								
Deposits		$56,568	$58,265	$60,013	$61,813	$63,667	$65,577	$67,545	$69,571	$71,658	$73,808	$76,022	$78,303	$80,652	$83,071	$85,564	$88,130	$90,774	$93,498	$96,303	$99,192	$102,167	$105,232	$108,389
Interest		$0	$1,697	$3,496	$5,401	$7,418	$9,550	$11,804	$14,184	$16,697	$19,348	$22,142	$25,087	$28,189	$31,454	$34,890	$38,504	$42,303	$46,295	$50,489	$54,892	$59,515	$64,365	$69,453
End of Year Balance		**$56,568**	**$116,529**	**$180,038**	**$247,252**	**$318,337**	**$393,464**	**$472,813**	**$556,568**	**$644,923**	**$738,079**	**$836,243**	**$939,633**	**$1,048,474**	**$1,163,000**	**$1,283,454**	**$1,410,088**	**$1,543,165**	**$1,682,957**	**$1,829,748**	**$1,983,833**	**$2,145,515**	**$2,315,113**	**$2,492,956**
Operations and Maintenance Expenses:																								
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]		$13,200	$13,596	$14,004	$14,424	$14,857	$15,302	$15,761	$16,234	$16,721	$17,223	$17,740	$18,272	$18,820	$19,385	$19,966	$20,565	$21,182	$21,818	$22,472	$23,146	$23,841	$24,556	$25,293
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$19,320**	**$19,900**	**$20,497**	**$21,111**	**$21,745**	**$22,397**	**$23,069**	**$23,761**	**$24,474**	**$25,208**	**$25,964**	**$26,743**	**$27,546**	**$28,372**	**$29,223**	**$30,100**	**$31,003**	**$31,933**	**$32,891**	**$33,878**	**$34,894**	**$35,941**	**$37,019**
Pumping Power Costs:																								
2-Week Annual Pumping Duration[8]		**$12,897**	**$13,284**	**$13,682**	**$14,093**	**$14,515**	**$14,951**	**$15,399**	**$15,861**	**$16,337**	**$16,827**	**$17,332**	**$17,852**	**$18,388**	**$18,939**	**$19,507**	**$20,093**	**$20,695**	**$21,316**	**$21,956**	**$22,614**	**$23,293**	**$23,992**	**$24,711**
4-Week Annual Pumping Duration[8]		**$15,337**	**$15,797**	**$16,271**	**$16,759**	**$17,262**	**$17,780**	**$18,313**	**$18,862**	**$19,428**	**$20,011**	**$20,611**	**$21,230**	**$21,867**	**$22,523**	**$23,198**	**$23,894**	**$24,611**	**$25,349**	**$26,110**	**$26,893**	**$27,700**	**$28,531**	**$29,387**
6-Week Annual Pumping Duration[8]		**$17,777**	**$18,310**	**$18,860**	**$19,425**	**$20,008**	**$20,608**	**$21,227**	**$21,863**	**$22,519**	**$23,195**	**$23,891**	**$24,607**	**$25,346**	**$26,106**	**$26,889**	**$27,696**	**$28,527**	**$29,383**	**$30,264**	**$31,172**	**$32,107**	**$33,070**	**$34,062**
8-Week Annual Pumping Duration[8]		**$20,217**	**$20,824**	**$21,448**	**$22,092**	**$22,754**	**$23,437**	**$24,140**	**$24,864**	**$25,610**	**$26,379**	**$27,170**	**$27,985**	**$28,825**	**$29,689**	**$30,580**	**$31,497**	**$32,442**	**$33,416**	**$34,418**	**$35,451**	**$36,514**	**$37,610**	**$38,738**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis - Pumping From PID Canal to IID Division 3A Canal (Cont.)

24	25	26	27	28	29	30	31	32	33	34	35	36	37
$27,910	$28,748	$29,610	$30,498	$31,413	$32,356	$33,326	$34,326	$35,356	$36,417	$37,509	$38,634	$39,793	$40,987
$18,697	$20,095	$21,561	$23,096	$24,704	$26,387	$28,149	$29,994	$31,923	$33,942	$36,052	$38,259	$40,566	$42,977
$669,846	**$718,689**	**$769,860**	**$823,454**	**$879,571**	**$938,314**	**$999,789**	**$1,064,109**	**$1,131,388**	**$1,201,747**	**$1,275,308**	**$1,352,202**	**$1,432,561**	**$1,516,525**
$55,821	$57,495	$59,220	$60,997	$62,826	$64,711	$66,653	$68,652	$70,712	$72,833	$75,018	$77,269	$79,587	$81,974
$37,394	$40,191	$43,121	$46,192	$49,407	$52,774	$56,299	$59,987	$63,847	$67,883	$72,105	$76,518	$81,132	$85,954
$1,339,693	**$1,437,379**	**$1,539,720**	**$1,646,908**	**$1,759,142**	**$1,876,627**	**$1,999,579**	**$2,128,218**	**$2,262,777**	**$2,403,493**	**$2,550,616**	**$2,704,403**	**$2,865,122**	**$3,033,050**
$111,641	$114,990	$118,440	$121,993	$125,653	$129,423	$133,305	$137,304	$141,424	$145,666	$150,036	$154,537	$159,173	$163,949
$74,789	$80,382	$86,243	$92,383	$98,814	$105,549	$112,598	$119,975	$127,693	$135,767	$144,210	$153,037	$162,264	$171,907
$2,679,385	**$2,874,757**	**$3,079,440**	**$3,293,816**	**$3,518,284**	**$3,753,255**	**$3,999,158**	**$4,256,437**	**$4,525,553**	**$4,806,986**	**$5,101,232**	**$5,408,806**	**$5,730,244**	**$6,066,100**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449
$26,051	$26,833	$27,638	$28,467	$29,321	$30,201	$31,107	$32,040	$33,001	$33,991	$35,011	$36,061	$37,143	$38,257
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$38,130	**$39,274**	**$40,452**	**$41,665**	**$42,915**	**$44,203**	**$45,529**	**$46,895**	**$48,302**	**$49,751**	**$51,243**	**$52,780**	**$54,364**	**$55,995**
$25,453	**$26,216**	**$27,003**	**$27,813**	**$28,647**	**$29,507**	**$30,392**	**$31,304**	**$32,243**	**$33,210**	**$34,206**	**$35,232**	**$36,289**	**$37,378**
$30,268	**$31,177**	**$32,112**	**$33,075**	**$34,067**	**$35,089**	**$36,142**	**$37,226**	**$38,343**	**$39,493**	**$40,678**	**$41,899**	**$43,156**	**$44,450**
$35,084	**$36,137**	**$37,221**	**$38,338**	**$39,488**	**$40,672**	**$41,892**	**$43,149**	**$44,444**	**$45,777**	**$47,150**	**$48,565**	**$50,022**	**$51,522**
$39,900	**$41,097**	**$42,330**	**$43,600**	**$44,908**	**$46,255**	**$47,643**	**$49,072**	**$50,544**	**$52,061**	**$53,622**	**$55,231**	**$56,888**	**$58,595**
24	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**

38	39	40	41	42	43	44	45	46	47	48	49	50
$42,217	$43,483	$44,788	$46,131	$47,515	$48,941	$50,409	$51,921	$53,479	$55,083	$56,736	$58,438	$60,191
$45,496	$48,127	$50,875	$53,745	$56,742	$59,869	$63,134	$66,540	$70,094	$73,801	$77,667	$81,700	$85,904
$1,604,238	**$1,695,848**	**$1,791,511**	**$1,891,388**	**$1,995,645**	**$2,104,455**	**$2,217,998**	**$2,336,459**	**$2,460,032**	**$2,588,916**	**$2,723,319**	**$2,863,457**	**$3,009,551**
$84,434	$86,967	$89,576	$92,263	$95,031	$97,882	$100,818	$103,843	$106,958	$110,167	$113,472	$116,876	$120,382
$90,992	$96,254	$101,751	$107,491	$113,483	$119,739	$126,267	$133,080	$140,188	$147,602	$155,335	$163,399	$171,807
$3,208,475	**$3,391,696**	**$3,583,022**	**$3,782,776**	**$3,991,290**	**$4,208,910**	**$4,435,995**	**$4,672,918**	**$4,920,063**	**$5,177,832**	**$5,446,639**	**$5,726,913**	**$6,019,103**
$168,867	$173,933	$179,151	$184,526	$190,061	$195,763	$201,636	$207,685	$213,916	$220,333	$226,943	$233,752	$240,764
$181,983	$192,509	$203,502	$214,981	$226,967	$239,477	$252,535	$266,160	$280,375	$295,204	$310,670	$326,798	$343,615
$6,416,950	**$6,783,392**	**$7,166,045**	**$7,565,552**	**$7,982,580**	**$8,417,820**	**$8,871,991**	**$9,345,836**	**$9,840,127**	**$10,355,664**	**$10,893,277**	**$11,453,827**	**$12,038,206**
$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$39,405	$40,587	$41,805	$43,059	$44,351	$45,681	$47,052	$48,463	$49,917	$51,415	$52,957	$54,546	$56,182
$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$57,675	**$59,405**	**$61,187**	**$63,023**	**$64,913**	**$66,861**	**$68,866**	**$70,932**	**$73,060**	**$75,252**	**$77,510**	**$79,835**	**$82,230**
$38,499	**$39,654**	**$40,844**	**$42,069**	**$43,331**	**$44,631**	**$45,970**	**$47,349**	**$48,770**	**$50,233**	**$51,740**	**$53,292**	**$54,891**
$45,784	**$47,157**	**$48,572**	**$50,029**	**$51,530**	**$53,076**	**$54,668**	**$56,308**	**$57,997**	**$59,737**	**$61,530**	**$63,375**	**$65,277**
$53,068	**$54,660**	**$56,300**	**$57,989**	**$59,729**	**$61,520**	**$63,366**	**$65,267**	**$67,225**	**$69,242**	**$71,319**	**$73,459**	**$75,662**
$60,352	**$62,163**	**$64,028**	**$65,949**	**$67,927**	**$69,965**	**$72,064**	**$74,226**	**$76,453**	**$78,746**	**$81,109**	**$83,542**	**$86,048**
38	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis - Pumping From PID Canal to IID Division 3A Canal
Alternative 1, Design Flow Rate = 40 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 50th Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$3,334,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$3,653,986
To Replace 50% After Life of Project		$7,307,971
To Replace 100% After Life of Project	$3,334,000	$14,615,943
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$107,406
To Replace 50% After Life of Project		$214,811
To Replace 100% After Life of Project	$98,000	$429,623
Total Replacement Cost:		
To Replace 25% After Life of Project		**$3,761,391**
To Replace 50% After Life of Project		**$7,522,783**
To Replace 100% After Life of Project	**$3,432,000**	**$15,045,565**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$33,347
To Replace 50% After Life of Project	$66,693
To Replace 100% After Life of Project	$133,386
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$17,675
To Replace 50% After Life of Project	$35,350
To Replace 100% After Life of Project	$70,699
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$35,929
To Replace 50% After Life of Project	$71,858
To Replace 100% After Life of Project	$143,717
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$75,228
To Replace 50% After Life of Project	$150,456
To Replace 100% After Life of Project	$300,911

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O &M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$858,000	$891,000	$1,416,454	**$3,165,454**
50% Replacement	$1,716,000	$891,000	$1,416,454	**$4,023,454**
100% Replacement	$3,432,000	$891,000	$1,416,454	**$5,739,454**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$858,000	$891,000	$1,685,282	**$3,434,282**
50% Replacement	$1,716,000	$891,000	$1,685,282	**$4,292,282**
100% Replacement	$3,432,000	$891,000	$1,685,282	**$6,008,282**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$858,000	$891,000	$1,954,111	**$3,703,111**
50% Replacement	$1,716,000	$891,000	$1,954,111	**$4,561,111**
100% Replacement	$3,432,000	$891,000	$1,954,111	**$6,277,111**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$858,000	$891,000	$2,222,939	**$3,971,939**
50% Replacement	$1,716,000	$891,000	$2,222,939	**$4,829,939**
100% Replacement	$3,432,000	$891,000	$2,222,939	**$6,545,939**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:	$3,334,000																							
Replacement Fund (For Funding Replacement of 25% of System):																								
Deposits		$17,675	$18,205	$18,751	$19,314	$19,893	$20,490	$21,105	$21,738	$22,390	$23,062	$23,753	$24,466	$25,200	$25,956	$26,735	$27,537	$28,363	$29,214	$30,090	$30,993	$31,923	$32,880	$33,867
Interest		$0	$530	$1,092	$1,688	$2,318	$2,984	$3,688	$4,432	$5,217	$6,045	$6,918	$7,839	$8,808	$9,828	$10,902	$12,031	$13,218	$14,465	$15,775	$17,151	$18,596	$20,111	$21,701
End of Year Balance		**$17,675**	**$36,410**	**$56,254**	**$77,255**	**$99,466**	**$122,940**	**$147,732**	**$173,902**	**$201,509**	**$230,616**	**$261,288**	**$293,593**	**$327,601**	**$363,385**	**$401,021**	**$440,588**	**$482,169**	**$525,848**	**$571,713**	**$619,857**	**$670,376**	**$723,367**	**$778,935**
Replacement Fund (For Funding Replacement of 50% of System):																								
Deposits		$35,350	$36,410	$37,502	$38,627	$39,786	$40,980	$42,209	$43,476	$44,780	$46,123	$47,507	$48,932	$50,400	$51,912	$53,469	$55,074	$56,726	$58,428	$60,180	$61,986	$63,845	$65,761	$67,733
Interest		$0	$1,060	$2,185	$3,375	$4,635	$5,968	$7,376	$8,864	$10,434	$12,091	$13,837	$15,677	$17,616	$19,656	$21,803	$24,061	$26,435	$28,930	$31,551	$34,303	$37,191	$40,223	$43,402
End of Year Balance		**$35,350**	**$72,820**	**$112,507**	**$154,510**	**$198,931**	**$245,879**	**$295,465**	**$347,804**	**$403,018**	**$461,232**	**$522,576**	**$587,185**	**$655,201**	**$726,769**	**$802,042**	**$881,176**	**$964,337**	**$1,051,695**	**$1,143,426**	**$1,239,715**	**$1,340,752**	**$1,446,735**	**$1,557,870**
Replacement Fund (For Funding Replacement of 100% of System):																								
Deposits		$70,699	$72,820	$75,005	$77,255	$79,573	$81,960	$84,419	$86,951	$89,560	$92,246	$95,014	$97,864	$100,800	$103,824	$106,939	$110,147	$113,451	$116,855	$120,361	$123,971	$127,691	$131,521	$135,467
Interest		$0	$2,121	$4,369	$6,750	$9,271	$11,936	$14,753	$17,728	$20,868	$24,181	$27,674	$31,355	$35,231	$39,312	$43,606	$48,122	$52,871	$57,860	$63,102	$68,606	$74,383	$80,445	$86,804
End of Year Balance		**$70,699**	**$145,640**	**$225,014**	**$309,020**	**$397,863**	**$491,758**	**$590,930**	**$695,609**	**$806,037**	**$922,464**	**$1,045,152**	**$1,174,371**	**$1,310,402**	**$1,453,538**	**$1,604,083**	**$1,762,353**	**$1,928,675**	**$2,103,390**	**$2,286,852**	**$2,479,430**	**$2,681,503**	**$2,893,469**	**$3,115,740**
Operations and Maintenance Expenses:																								
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]		$11,700	$12,051	$12,413	$12,785	$13,168	$13,564	$13,970	$14,390	$14,821	$15,266	$15,724	$16,196	$16,681	$17,182	$17,697	$18,228	$18,775	$19,338	$19,918	$20,516	$21,132	$21,765	$22,418
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$17,820**	**$18,355**	**$18,905**	**$19,472**	**$20,057**	**$20,658**	**$21,278**	**$21,916**	**$22,574**	**$23,251**	**$23,949**	**$24,667**	**$25,407**	**$26,169**	**$26,954**	**$27,763**	**$28,596**	**$29,454**	**$30,337**	**$31,247**	**$32,185**	**$33,150**	**$34,145**
Pumping Power Costs:																								
2-Week Annual Pumping Duration[8]		**$28,329**	**$29,179**	**$30,054**	**$30,956**	**$31,885**	**$32,841**	**$33,826**	**$34,841**	**$35,886**	**$36,963**	**$38,072**	**$39,214**	**$40,390**	**$41,602**	**$42,850**	**$44,136**	**$45,460**	**$46,824**	**$48,228**	**$49,675**	**$51,165**	**$52,700**	**$54,281**
4-Week Annual Pumping Duration[8]		**$33,706**	**$34,717**	**$35,758**	**$36,831**	**$37,936**	**$39,074**	**$40,246**	**$41,454**	**$42,697**	**$43,978**	**$45,298**	**$46,656**	**$48,056**	**$49,498**	**$50,983**	**$52,512**	**$54,088**	**$55,710**	**$57,382**	**$59,103**	**$60,876**	**$62,702**	**$64,583**
6-Week Annual Pumping Duration[8]		**$39,082**	**$40,255**	**$41,462**	**$42,706**	**$43,987**	**$45,307**	**$46,666**	**$48,066**	**$49,508**	**$50,993**	**$52,523**	**$54,099**	**$55,722**	**$57,394**	**$59,115**	**$60,889**	**$62,715**	**$64,597**	**$66,535**	**$68,531**	**$70,587**	**$72,704**	**$74,886**
8-Week Annual Pumping Duration[8]		**$44,459**	**$45,793**	**$47,166**	**$48,581**	**$50,039**	**$51,540**	**$53,086**	**$54,679**	**$56,319**	**$58,009**	**$59,749**	**$61,541**	**$63,388**	**$65,289**	**$67,248**	**$69,265**	**$71,343**	**$73,484**	**$75,688**	**$77,959**	**$80,298**	**$82,706**	**$85,188**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis - Pumping From PID Canal to IID Division 3A Canal (Cont.)

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$34,883	$35,929	$37,007	$38,117	$39,261	$40,439	$41,652	$42,901	$44,188	$45,514	$46,879	$48,286	$49,734	$51,226	$52,763	$54,346	$55,977	$57,656	$59,386	$61,167	$63,002	$64,892	$66,839	$68,844	$70,909	$73,037	$75,228
$23,368	$25,116	$26,947	$28,866	$30,875	$32,979	$35,182	$37,487	$39,898	$42,421	$45,059	$47,817	$50,700	$53,713	$56,861	$60,150	$63,585	$67,172	$70,917	$74,826	$78,906	$83,163	$87,604	$92,238	$97,070	$102,110	$107,364
$837,186	**$898,231**	**$962,185**	**$1,029,168**	**$1,099,303**	**$1,172,721**	**$1,249,555**	**$1,329,943**	**$1,414,029**	**$1,501,964**	**$1,593,903**	**$1,690,006**	**$1,790,440**	**$1,895,380**	**$2,005,005**	**$2,119,501**	**$2,239,063**	**$2,363,890**	**$2,494,193**	**$2,630,186**	**$2,772,093**	**$2,920,148**	**$3,074,592**	**$3,235,674**	**$3,403,653**	**$3,578,800**	**$3,761,391**
$69,765	$71,858	$74,014	$76,235	$78,522	$80,877	$83,304	$85,803	$88,377	$91,028	$93,759	$96,572	$99,469	$102,453	$105,527	$108,692	$111,953	$115,312	$118,771	$122,334	$126,004	$129,784	$133,678	$137,688	$141,819	$146,073	$150,456
$46,736	$50,231	$53,894	$57,731	$61,750	$65,958	$70,363	$74,973	$79,797	$84,842	$90,118	$95,634	$101,400	$107,426	$113,723	$120,300	$127,170	$134,344	$141,833	$149,652	$157,811	$166,326	$175,209	$184,476	$194,140	$204,219	$214,728
$1,674,372	**$1,796,461**	**$1,924,370**	**$2,058,335**	**$2,198,607**	**$2,345,443**	**$2,499,109**	**$2,659,885**	**$2,828,059**	**$3,003,929**	**$3,187,806**	**$3,380,012**	**$3,580,881**	**$3,790,760**	**$4,010,010**	**$4,239,002**	**$4,478,125**	**$4,727,781**	**$4,988,385**	**$5,260,371**	**$5,544,187**	**$5,840,297**	**$6,149,183**	**$6,471,347**	**$6,807,306**	**$7,157,599**	**$7,522,783**
$139,531	$143,717	$148,028	$152,469	$157,043	$161,755	$166,607	$171,606	$176,754	$182,056	$187,518	$193,144	$198,938	$204,906	$211,053	$217,385	$223,906	$230,623	$237,542	$244,668	$252,008	$259,569	$267,356	$275,376	$283,638	$292,147	$300,911
$93,472	$100,462	$107,788	$115,462	$123,500	$131,916	$140,727	$149,947	$159,593	$169,684	$180,236	$191,268	$202,801	$214,853	$227,446	$240,601	$254,340	$268,688	$283,667	$299,303	$315,622	$332,651	$350,418	$368,951	$388,281	$408,438	$429,456
$3,348,744	**$3,592,923**	**$3,848,739**	**$4,116,670**	**$4,397,214**	**$4,690,885**	**$4,998,219**	**$5,319,771**	**$5,656,118**	**$6,007,858**	**$6,375,611**	**$6,760,023**	**$7,161,762**	**$7,581,520**	**$8,020,019**	**$8,478,005**	**$8,956,251**	**$9,455,562**	**$9,976,771**	**$10,520,743**	**$11,088,373**	**$11,680,593**	**$12,298,367**	**$12,942,694**	**$13,614,613**	**$14,315,198**	**$15,045,565**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$23,091	$23,784	$24,497	$25,232	$25,989	$26,769	$27,572	$28,399	$29,251	$30,128	$31,032	$31,963	$32,922	$33,910	$34,927	$35,975	$37,054	$38,166	$39,311	$40,490	$41,705	$42,956	$44,245	$45,572	$46,939	$48,347	$49,798
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$35,169	**$36,224**	**$37,311**	**$38,430**	**$39,583**	**$40,771**	**$41,994**	**$43,254**	**$44,551**	**$45,888**	**$47,265**	**$48,683**	**$50,143**	**$51,647**	**$53,197**	**$54,793**	**$56,436**	**$58,130**	**$59,873**	**$61,670**	**$63,520**	**$65,425**	**$67,388**	**$69,410**	**$71,492**	**$73,637**	**$75,846**
$55,910	**$57,587**	**$59,315**	**$61,094**	**$62,927**	**$64,815**	**$66,759**	**$68,762**	**$70,825**	**$72,950**	**$75,138**	**$77,392**	**$79,714**	**$82,106**	**$84,569**	**$87,106**	**$89,719**	**$92,411**	**$95,183**	**$98,038**	**$100,979**	**$104,009**	**$107,129**	**$110,343**	**$113,653**	**$117,063**	**$120,575**
$66,521	**$68,517**	**$70,572**	**$72,689**	**$74,870**	**$77,116**	**$79,430**	**$81,812**	**$84,267**	**$86,795**	**$89,399**	**$92,081**	**$94,843**	**$97,688**	**$100,619**	**$103,638**	**$106,747**	**$109,949**	**$113,248**	**$116,645**	**$120,144**	**$123,749**	**$127,461**	**$131,285**	**$135,223**	**$139,280**	**$143,459**
$77,132	**$79,446**	**$81,829**	**$84,284**	**$86,813**	**$89,417**	**$92,100**	**$94,863**	**$97,709**	**$100,640**	**$103,659**	**$106,769**	**$109,972**	**$113,271**	**$116,669**	**$120,169**	**$123,774**	**$127,488**	**$131,312**	**$135,252**	**$139,309**	**$143,488**	**$147,793**	**$152,227**	**$156,794**	**$161,498**	**$166,342**
$87,743	**$90,376**	**$93,087**	**$95,879**	**$98,756**	**$101,718**	**$104,770**	**$107,913**	**$111,151**	**$114,485**	**$117,920**	**$121,457**	**$125,101**	**$128,854**	**$132,720**	**$136,701**	**$140,802**	**$145,026**	**$149,377**	**$153,858**	**$158,474**	**$163,228**	**$168,125**	**$173,169**	**$178,364**	**$183,715**	**$189,226**
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis - Pumping From PID Canal to IID Division 3A Canal
Alternative 5, Design Flow Rate = 40 CFS

Input Cells - Assumed or Given Values
Input Cells - Adjust Using Goal Seek Tool to Make Account Balance at end of 5oth Year Equal to Future Value of Replacement Cost

ASSUMPTIONS:		
Estimated Capital Cost:	$4,295,000	Total Capital Cost
Interest on Replacement Fund:	3.00%	
Rate of Inflation:	3.00%	
Project Design Life:	50	Years

SUMMARY REPLACEMENT COSTS:	CURRENT COST[2]	FUTURE COST[3]
Estimated Project Replacement Cost:		
To Replace 25% After Life of Project		$4,707,219
To Replace 50% After Life of Project		$9,414,438
To Replace 100% After Life of Project	$4,295,000	$18,828,876
Disposal and Removal Cost:		
To Replace 25% After Life of Project		$168,780
To Replace 50% After Life of Project		$337,561
To Replace 100% After Life of Project	$154,000	$675,122
Total Replacement Cost:		
To Replace 25% After Life of Project		**$4,875,999**
To Replace 50% After Life of Project		**$9,751,999**
To Replace 100% After Life of Project	**$4,449,000**	**$19,503,998**

REPLACEMENT FUND SUMMARY	
Annual Deposit Required (Assume Equal Deposit Made Each Year):	
To Replace 25% After Life of Project	$43,228
To Replace 50% After Life of Project	$86,456
To Replace 100% After Life of Project	$172,913
Deposit Required at Year 1 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$22,912
To Replace 50% After Life of Project	$45,825
To Replace 100% After Life of Project	$91,649
Deposit Required at Year 25 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$46,576
To Replace 50% After Life of Project	$93,152
To Replace 100% After Life of Project	$186,304
Deposit Required at Year 50 (Assume Deposits Increase at the Rate of Inflation):	
To Replace 25% After Life of Project	$97,520
To Replace 50% After Life of Project	$195,040
To Replace 100% After Life of Project	$390,080

TOTAL LONG-TERM COST SUMMARY: (PRESENT VALUE OF LONG-TERM COSTS THROUGH 50-YEAR LIFE CYCLE)	**Replacment Fund**	**O&M**	**Power**	**TOTAL**
Assuming the Pumping Power Costs for a 2-week Annual Operating Duration:				
25% Replacement	$1,112,250	$1,231,000	$1,351,246	**$3,694,496**
50% Replacement	$2,224,500	$1,231,000	$1,351,246	**$4,806,746**
100% Replacement	$4,449,000	$1,231,000	$1,351,246	**$7,031,246**
Assuming the Pumping Power Costs for a 4-week Annual Operating Duration:				
25% Replacement	$1,112,250	$1,231,000	$1,607,667	**$3,950,917**
50% Replacement	$2,224,500	$1,231,000	$1,607,667	**$5,063,167**
100% Replacement	$4,449,000	$1,231,000	$1,607,667	**$7,287,667**
Assuming the Pumping Power Costs for a 6-week Annual Operating Duration:				
25% Replacement	$1,112,250	$1,231,000	$1,864,088	**$4,207,338**
50% Replacement	$2,224,500	$1,231,000	$1,864,088	**$5,319,588**
100% Replacement	$4,449,000	$1,231,000	$1,864,088	**$7,544,088**
Assuming the Pumping Power Costs for an 8-week Annual Operating Duration:				
25% Replacement	$1,112,250	$1,231,000	$2,120,509	**$4,463,759**
50% Replacement	$2,224,500	$1,231,000	$2,120,509	**$5,576,009**
100% Replacement	$4,449,000	$1,231,000	$2,120,509	**$7,800,509**

LIFE CYCLE COSTS:

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Capital Expenses:	$4,295,000																							
Replacement Fund (For Funding Replacement of 25% of System):																								
Deposits		$22,912	$23,600	$24,308	$25,037	$25,788	$26,562	$27,359	$28,179	$29,025	$29,895	$30,792	$31,716	$32,668	$33,648	$34,657	$35,697	$36,768	$37,871	$39,007	$40,177	$41,382	$42,624	$43,902
Interest		$0	$687	$1,416	$2,188	$3,004	$3,868	$4,781	$5,745	$6,763	$7,837	$8,969	$10,161	$11,418	$12,740	$14,132	$15,596	$17,134	$18,751	$20,450	$22,234	$24,106	$26,071	$28,132
End of Year Balance		**$22,912**	**$47,199**	**$72,923**	**$100,148**	**$128,940**	**$159,370**	**$191,510**	**$225,434**	**$261,222**	**$298,954**	**$338,715**	**$380,593**	**$424,678**	**$471,066**	**$519,855**	**$571,147**	**$625,049**	**$681,671**	**$741,128**	**$803,539**	**$869,027**	**$937,722**	**$1,009,756**
Replacement Fund (For Funding Replacement of 50% of System):																								
Deposits		$45,825	$47,199	$48,615	$50,074	$51,576	$53,123	$54,717	$56,359	$58,049	$59,791	$61,585	$63,432	$65,335	$67,295	$69,314	$71,393	$73,535	$75,741	$78,013	$80,354	$82,765	$85,247	$87,805
Interest		$0	$1,375	$2,832	$4,375	$6,009	$7,736	$9,562	$11,491	$13,526	$15,673	$17,937	$20,323	$22,836	$25,481	$28,264	$31,191	$34,269	$37,503	$40,900	$44,468	$48,212	$52,142	$56,263
End of Year Balance		**$45,825**	**$94,399**	**$145,846**	**$200,296**	**$257,881**	**$318,740**	**$383,020**	**$450,869**	**$522,444**	**$597,908**	**$677,430**	**$761,185**	**$849,356**	**$942,132**	**$1,039,710**	**$1,142,294**	**$1,250,098**	**$1,363,342**	**$1,482,256**	**$1,607,078**	**$1,738,055**	**$1,875,444**	**$2,019,512**
Replacement Fund (For Funding Replacement of 100% of System):																								
Deposits		$91,649	$94,399	$97,231	$100,148	$103,152	$106,247	$109,434	$112,717	$116,099	$119,582	$123,169	$126,864	$130,670	$134,590	$138,628	$142,787	$147,070	$151,482	$156,027	$160,708	$165,529	$170,495	$175,610
Interest		$0	$2,749	$5,664	$8,751	$12,018	$15,473	$19,124	$22,981	$27,052	$31,347	$35,875	$40,646	$45,671	$50,961	$56,528	$62,383	$68,538	$75,006	$81,801	$88,935	$96,425	$104,283	$112,527
End of Year Balance		**$91,649**	**$188,798**	**$291,693**	**$400,591**	**$515,761**	**$637,481**	**$766,039**	**$901,738**	**$1,044,888**	**$1,195,817**	**$1,354,860**	**$1,522,370**	**$1,698,712**	**$1,884,263**	**$2,079,419**	**$2,284,588**	**$2,500,196**	**$2,726,685**	**$2,964,512**	**$3,214,156**	**$3,476,109**	**$3,750,887**	**$4,039,024**
Operations and Maintenance Expenses:																								
Salaries (1/12 FTE)[4]		$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,454	$5,618	$5,787	$5,960	$6,139	$6,323
Benefits[5]		$1,320	$1,360	$1,400	$1,442	$1,486	$1,530	$1,576	$1,623	$1,672	$1,722	$1,774	$1,827	$1,882	$1,938	$1,997	$2,057	$2,118	$2,182	$2,247	$2,315	$2,384	$2,456	$2,529
Transportation Costs[6]		$500	$515	$530	$546	$563	$580	$597	$615	$633	$652	$672	$692	$713	$734	$756	$779	$802	$826	$851	$877	$903	$930	$958
Maintenance and Small Repairs[7]		$18,500	$19,055	$19,627	$20,215	$20,822	$21,447	$22,090	$22,753	$23,435	$24,138	$24,862	$25,608	$26,377	$27,168	$27,983	$28,822	$29,687	$30,578	$31,495	$32,440	$33,413	$34,415	$35,448
Administration, Insurance, Accounting		$1,000	$1,030	$1,061	$1,093	$1,126	$1,159	$1,194	$1,230	$1,267	$1,305	$1,344	$1,384	$1,426	$1,469	$1,513	$1,558	$1,605	$1,653	$1,702	$1,754	$1,806	$1,860	$1,916
Other		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total O&M Expenses		**$24,620**	**$25,359**	**$26,119**	**$26,903**	**$27,710**	**$28,541**	**$29,398**	**$30,279**	**$31,188**	**$32,124**	**$33,087**	**$34,080**	**$35,102**	**$36,155**	**$37,240**	**$38,357**	**$39,508**	**$40,693**	**$41,914**	**$43,171**	**$44,466**	**$45,800**	**$47,174**
Pumping Power Costs:																								
2-Week Annual Pumping Duration[8]		**$27,025**	**$27,836**	**$28,671**	**$29,531**	**$30,417**	**$31,329**	**$32,269**	**$33,237**	**$34,234**	**$35,261**	**$36,319**	**$37,409**	**$38,531**	**$39,687**	**$40,878**	**$42,104**	**$43,367**	**$44,668**	**$46,008**	**$47,388**	**$48,810**	**$50,274**	**$51,783**
4-Week Annual Pumping Duration[8]		**$32,153**	**$33,118**	**$34,111**	**$35,135**	**$36,189**	**$37,275**	**$38,393**	**$39,545**	**$40,731**	**$41,953**	**$43,211**	**$44,508**	**$45,843**	**$47,218**	**$48,635**	**$50,094**	**$51,597**	**$53,145**	**$54,739**	**$56,381**	**$58,073**	**$59,815**	**$61,609**
6-Week Annual Pumping Duration[8]		**$37,282**	**$38,400**	**$39,552**	**$40,739**	**$41,961**	**$43,220**	**$44,516**	**$45,852**	**$47,227**	**$48,644**	**$50,104**	**$51,607**	**$53,155**	**$54,750**	**$56,392**	**$58,084**	**$59,826**	**$61,621**	**$63,470**	**$65,374**	**$67,335**	**$69,355**	**$71,436**
8-Week Annual Pumping Duration[8]		**$42,410**	**$43,682**	**$44,993**	**$46,343**	**$47,733**	**$49,165**	**$50,640**	**$52,159**	**$53,724**	**$55,336**	**$56,996**	**$58,706**	**$60,467**	**$62,281**	**$64,149**	**$66,074**	**$68,056**	**$70,098**	**$72,201**	**$74,367**	**$76,598**	**$78,895**	**$81,262**
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**

NOTES:
1) Total Field Cost is from Engineer's Opinion of Probable Costs, includes construction costs and contingency.
2) Current Cost is equal to the Engineer's opinion of the probable cost of the project at beginning of project life (2012 dollars) plus the current estimated cost of disposal and removal.
3) Future cost is value or the project cost at end of life cycle of the project, or the current cost inflated at the rate shown through the life cycle of the project.
4) Salaries assumes salary for 1/12 full-time equivalent (FTE) to help manage/operate the pump station, or one person for about 8 hours per week during irrigation season.
5) Benefits assumes benefits = salaries X 40%.
6) Allowance for trips to and from pump station.
7) Estimated in the first year as 0.3% of the capacital cost of the pump station, rounded to the nearest $100.
8) Assumes pumping power costs, or power rates, increase at the assumed rate of inflation.

Peshastin Irrigation District Pump Exchange Appraisal Study
Life Cycle Cost Analysis - Pumping From PID Canal to IID Division 3A Canal (Cont.)

24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
$45,220	$46,576	$47,973	$49,413	$50,895	$52,422	$53,994	$55,614	$57,283	$59,001	$60,771	$62,594	$64,472	$66,406	$68,399	$70,451	$72,564	$74,741	$76,983	$79,293	$81,671	$84,122	$86,645	$89,245	$91,922	$94,680	$97,520
$30,293	$32,558	$34,932	$37,419	$40,024	$42,752	$45,607	$48,595	$51,721	$54,991	$58,411	$61,987	$65,724	$69,630	$73,711	$77,974	$82,427	$87,077	$91,931	$96,999	$102,288	$107,806	$113,564	$119,570	$125,835	$132,368	$139,179
$1,085,268	**$1,164,402**	**$1,247,308**	**$1,334,139**	**$1,425,059**	**$1,520,232**	**$1,619,834**	**$1,724,043**	**$1,833,047**	**$1,947,040**	**$2,066,222**	**$2,190,803**	**$2,320,999**	**$2,457,036**	**$2,599,145**	**$2,747,570**	**$2,902,561**	**$3,064,379**	**$3,233,294**	**$3,409,585**	**$3,593,544**	**$3,785,472**	**$3,985,681**	**$4,194,496**	**$4,412,253**	**$4,639,300**	**$4,875,999**
$90,439	$93,152	$95,947	$98,825	$101,790	$104,844	$107,989	$111,229	$114,565	$118,002	$121,542	$125,189	$128,944	$132,813	$136,797	$140,901	$145,128	$149,482	$153,966	$158,585	$163,343	$168,243	$173,290	$178,489	$183,844	$189,359	$195,040
$60,585	$65,116	$69,864	$74,838	$80,048	$85,504	$91,214	$97,190	$103,443	$109,983	$116,822	$123,973	$131,448	$139,260	$147,422	$155,949	$164,854	$174,154	$183,863	$193,998	$204,575	$215,613	$227,128	$239,141	$251,670	$264,735	$278,358
$2,170,536	**$2,328,805**	**$2,494,615**	**$2,668,279**	**$2,850,117**	**$3,040,464**	**$3,239,667**	**$3,448,086**	**$3,666,094**	**$3,894,079**	**$4,132,444**	**$4,381,606**	**$4,641,999**	**$4,914,071**	**$5,198,290**	**$5,495,140**	**$5,805,122**	**$6,128,758**	**$6,466,587**	**$6,819,170**	**$7,187,088**	**$7,570,944**	**$7,971,363**	**$8,388,993**	**$8,824,507**	**$9,278,601**	**$9,751,999**
$180,878	$186,304	$191,893	$197,650	$203,580	$209,687	$215,978	$222,457	$229,131	$236,005	$243,085	$250,377	$257,889	$265,625	$273,594	$281,802	$290,256	$298,964	$307,933	$317,171	$326,686	$336,486	$346,581	$356,978	$367,688	$378,718	$390,080
$121,171	$130,232	$139,728	$149,677	$160,097	$171,007	$182,428	$194,380	$206,885	$219,966	$233,645	$247,947	$262,896	$278,520	$294,844	$311,897	$329,708	$348,307	$367,725	$387,995	$409,150	$431,225	$454,257	$478,282	$503,340	$529,470	$556,716
$4,341,072	**$4,657,609**	**$4,989,231**	**$5,336,558**	**$5,700,235**	**$6,080,929**	**$6,479,334**	**$6,896,172**	**$7,332,188**	**$7,788,158**	**$8,264,888**	**$8,763,212**	**$9,283,997**	**$9,828,142**	**$10,396,581**	**$10,990,280**	**$11,610,245**	**$12,257,516**	**$12,933,174**	**$13,638,340**	**$14,374,176**	**$15,141,888**	**$15,942,726**	**$16,777,986**	**$17,649,013**	**$18,557,202**	**$19,503,998**
$6,513	$6,708	$6,909	$7,117	$7,330	$7,550	$7,777	$8,010	$8,250	$8,498	$8,753	$9,015	$9,286	$9,564	$9,851	$10,147	$10,451	$10,765	$11,088	$11,420	$11,763	$12,116	$12,479	$12,854	$13,239	$13,636	$14,046
$2,605	$2,683	$2,764	$2,847	$2,932	$3,020	$3,111	$3,204	$3,300	$3,399	$3,501	$3,606	$3,714	$3,826	$3,940	$4,059	$4,180	$4,306	$4,435	$4,568	$4,705	$4,846	$4,992	$5,141	$5,296	$5,455	$5,618
$987	$1,016	$1,047	$1,078	$1,111	$1,144	$1,178	$1,214	$1,250	$1,288	$1,326	$1,366	$1,407	$1,449	$1,493	$1,537	$1,584	$1,631	$1,680	$1,730	$1,782	$1,836	$1,891	$1,948	$2,006	$2,066	$2,128
$36,511	$37,607	$38,735	$39,897	$41,094	$42,327	$43,596	$44,904	$46,251	$47,639	$49,068	$50,540	$52,056	$53,618	$55,227	$56,883	$58,590	$60,348	$62,158	$64,023	$65,944	$67,922	$69,960	$72,058	$74,220	$76,447	$78,740
$1,974	$2,033	$2,094	$2,157	$2,221	$2,288	$2,357	$2,427	$2,500	$2,575	$2,652	$2,732	$2,814	$2,898	$2,985	$3,075	$3,167	$3,262	$3,360	$3,461	$3,565	$3,671	$3,782	$3,895	$4,012	$4,132	$4,256
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$48,590	**$50,047**	**$51,549**	**$53,095**	**$54,688**	**$56,329**	**$58,019**	**$59,759**	**$61,552**	**$63,399**	**$65,300**	**$67,260**	**$69,277**	**$71,356**	**$73,496**	**$75,701**	**$77,972**	**$80,311**	**$82,721**	**$85,202**	**$87,758**	**$90,391**	**$93,103**	**$95,896**	**$98,773**	**$101,736**	**$104,788**
$53,336	**$54,936**	**$56,584**	**$58,282**	**$60,030**	**$61,831**	**$63,686**	**$65,597**	**$67,564**	**$69,591**	**$71,679**	**$73,830**	**$76,044**	**$78,326**	**$80,676**	**$83,096**	**$85,589**	**$88,156**	**$90,801**	**$93,525**	**$96,331**	**$99,221**	**$102,197**	**$105,263**	**$108,421**	**$111,674**	**$115,024**
$63,457	**$65,361**	**$67,322**	**$69,342**	**$71,422**	**$73,565**	**$75,771**	**$78,045**	**$80,386**	**$82,798**	**$85,281**	**$87,840**	**$90,475**	**$93,189**	**$95,985**	**$98,865**	**$101,831**	**$104,885**	**$108,032**	**$111,273**	**$114,611**	**$118,049**	**$121,591**	**$125,239**	**$128,996**	**$132,866**	**$136,852**
$73,579	**$75,786**	**$78,060**	**$80,402**	**$82,814**	**$85,298**	**$87,857**	**$90,493**	**$93,207**	**$96,004**	**$98,884**	**$101,850**	**$104,906**	**$108,053**	**$111,295**	**$114,633**	**$118,072**	**$121,615**	**$125,263**	**$129,021**	**$132,891**	**$136,878**	**$140,985**	**$145,214**	**$149,571**	**$154,058**	**$158,679**
$83,700	**$86,211**	**$88,798**	**$91,461**	**$94,205**	**$97,031**	**$99,942**	**$102,941**	**$106,029**	**$109,210**	**$112,486**	**$115,861**	**$119,336**	**$122,917**	**$126,604**	**$130,402**	**$134,314**	**$138,344**	**$142,494**	**$146,769**	**$151,172**	**$155,707**	**$160,378**	**$165,190**	**$170,145**	**$175,250**	**$180,507**
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50