Aspect consulting
earth + water

MEMORANDUM

Project No.: 040028-001-19

December 31, 2009

To: Mark Schuppe
Water Resources Section Manager - Central Regional Office
Washington State Department of Ecology

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REGISTERED
PROFESSIONAL ENGINEER
EXPIRES: 9/9/10

Mark E. Salmon, PE
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Re: **Evaluation of the Regulatory and Engineering Feasibility**
Twin Lakes Aquifer Coalition (TLAC)
Water Right Application G4-34915

1 Introduction

1.1 Purpose and Scope

This memorandum presents a summary of the regulatory and engineering feasibility for the Twin Lakes Aquifer Coalition (TLAC) groundwater right application G4-34915 under the cost reimbursement program. The application requests a water right appropriation within the Methow River Basin, Water Resources Inventory Area (WRIA) 48. Specifically, the TLAC application requests a maximum withdrawal rate of 4,500 gallons per minute (gpm) and a quantity of 2,000 acre-feet per year (afy) from wells located near the Methow River. The proposed purpose of use is restoration of water levels in Barnsley and Twin Lakes and the associated aquifer (herein referred to as the Twin Lakes Aquifer) by recharge of pumped groundwater.

The evaluation presented herein provides information on:

- regulatory and engineering feasibility of the project to assist Washington State Department of Ecology (Ecology) in evaluating whether the TLAC application meets

the criteria for expedited processing as defined under 173-152-050 Washington Administrative Code (WAC) (Hillis Rule); and,

- provide planning level engineering and planning level construction costs and operation costs. Engineering and construction costs were provided by subconsultant R.W. Beck, Inc.

The work was performed by Aspect Consulting, LLC under Ecology Water Resources Contract No. C0500006. The project location is shown on Figure 1.1.

1.2 Hydrogeologic Investigation Report Summary

A hydrogeologic investigation was recently performed by Aspect Consulting, LLC that included field data collection and development of a numerical groundwater model to assist in evaluating the TLAC proposal (Aspect, 2009). This report should be referred to for detailed information on the effects of the project on the hydrologic system. The Aspect Consulting investigation quantified the following project elements:

- pumping volumes and duration required to achieve TLAC target levels in Big Twin Lake;
- annual volumes required for lake-level maintenance (following initial fill);
- annual fluctuation in Big Twin Lake stage and seepage volume resulting from the project;
- reach locations and quantities of lake seepage (i.e., return flow) discharge back into the Methow River (including water that by-passes about a 3-mile reach of the Methow River);
- annual consumptive quantity lost to evapotranspiration as a result of increased lake levels;
- annual changes in aquifer storage; and,
- potential impacts to nearby wells and springs.

Each of these elements was quantified using in-stream flow constraints to comply with the Washington State Department of Fish and Wildlife target flows (WDFW Scenario), baseflow restrictions specified in 173-548 WAC (WAC Scenario), and a combination of these flows (WDFW/WAC Scenario). For each of these three diversion scenarios, the project elements were quantified at 500, 1,000, 1,500 and 2,000 gpm instantaneous groundwater withdrawal rates.

Findings from the hydrogeologic investigation are summarized in Table 1.1 below. At a 1,000 gpm withdrawal rate, the groundwater model predicts the lake will take approximately 3 years to fill (achieve the target lake elevation) under the WDFW Scenario and 2 years under the WDFW/WAC and WAC Scenarios. Withdrawal constraints are more restrictive under the WDFW Scenario resulting in a longer fill time. At withdrawal rates of 1,500 gpm or higher, the lake will be filled in the first year under all three withdrawal scenarios. Once filled, approximately 176 afy is required to maintain lake levels under the WDFW scenario and 214 afy are required under the WDFW/WAC and WAC Scenarios. The difference in lake maintenance flows results from the shorter allowed withdrawal period under WDFW

Scenario that results in slightly lower average lake levels (about 1 foot lower on average). There is inherent uncertainty in some of the input parameters in the predictive model (for example lake evaporation and mountain front recharge among others). Therefore, including a safety factor during design is recommended to account for this uncertainty as discussed in Section 3.

1.3 Summary of Findings

For the TLAC application to meet the criteria for expedited processing under WAC 173-152-050 (Hillis Rule), it must provide a net environmental benefit and be water budget neutral. WDFW has indicated that the proposed project with certain specified permit conditions will provide for substantial benefit to the natural environment through enhancement of the trophy trout fishery in Big Twin Lake. To meet the water budget neutral criterion, the project will require mitigation of 65 afy under the WDFW withdrawal scenario to offset consumptive evaporative losses and water that by-passes about 3 miles of the Methow River. Ecology has indicated that water that goes into storage must also be mitigated. Total quantity of lake seepage that goes to aquifer storage is 1,743 af and occurs during the first eleven years of the project (about 159 afy on average). After 11 years, the system approximates a steady state condition and changes in storage become insignificant. Withdrawals for the project would be constrained to periods when target flows for the Methow River developed by WDFW are met.

Project elements include construction of two wells capable of a combined withdrawal of 2,000 gpm, pumps, wellhead facilities, a 2.4-mile-long pipeline constructed with either a 12- or 15-inch-diameter pipe, and direct discharge into Twin Lake through a boulder cascade. Total 20-year life cycle cost for the project is $1.7 million for the 12-inch pipeline and $2.1 million for the 15-inch pipeline. The 15-inch pipe size offers a higher safety factor than the 12-inch pipe size, but both appear adequate to meet the flow rates and volumes indicated by the numerical model to meet the TLAC desired lake-level within a 1-year period.

A multipurpose storage project is currently being evaluated as an alternative to the TLAC proposal. The multipurpose storage project would be designed to optimize return flow to the Methow River as well as meet the TLAC lake level objectives and associated trout fishery benefit. The return flows could be used to mitigate for withdrawals by downstream water users. In the multipurpose storage evaluation, the natural kettle features of both Barnsley and Big Twin Lakes would be used to store water and provide a source of groundwater recharge via lake leakage. The feasibility of the multipurpose storage project is currently being evaluated. The potential for the multipurpose storage alternative to proceed under expedited processing will be assessed and will include consideration of proposed regulatory changes.

Additional field data were collected as part of the storage evaluation and the model updated based on these new data. The reader is directed to the results of the forthcoming storage evaluation which will present the results of the predictive simulations using the updated model. It should be noted that the results of the model scenarios presented herein would likely vary if the same scenarios were rerun on the updated model.

Table 1.1
Comparison of Model Annual Water Balance Components for ≥1,000 gpm Withdrawal Rate[1]

Annual Water Balance Component	Withdrawals under WDFW Target Window	Withdrawals under WDFW/WAC Scenario	Withdrawals under 173-548 WAC
Big Twin Lake Fill Duration	~15 years @ 500 gpm ~ 3 years @ 1,000 gpm 1 year @ >1,500 gpm	~ 5 years @ 500 gpm ~2 years @ 1,000 gpm 1 year @ >1,500 gpm	~4 years @ 500 gpm ~ 2 years@ 1,000 gpm 1 year @ >1,500 gpm
Volume Required to Maintain Big Twin Lake Level	176 afy	214 afy	214 afy
Average Big Twin Lake Elevation	1,798 ft	1,799 ft	1,799 ft
Big Twin Lake Level Fluctuations[2]	~ 1 ft	~ 0.5 ft	~ 0.5 ft
Twin Lakes Evaporative Losses	30 afy	36 afy	36 afy
Return Flow to Methow River – Northerly Component	90 afy	100 afy	100 afy
Return Flow to Methow River – Southeasterly Component ("by pass" quantity)	35 afy	39 afy	39 afy
Aquifer/Lake Storage	20 afy	38 afy	38 afy

1.) Values shown are relative to baseline (current) condition. Values shown are rounded off - the reader is referred to Aspect Consulting (2009) for more precise values. Values based on average of last five model years (model years 13 through 17).

2.) Lake level fluctuations reflect steady state condition after lake is filled.

2 Water Right Permitting Considerations

An initial evaluation of the TLAC water right indicated that approximately 58 competing water right applications have an earlier filing date and therefore are more senior than the TLAC water right (Aspect, 2005). A water right application may be priority processed under WAC 173-152-50 (Hillis Rule) if Ecology determines the application meets two criteria:

1. The use is water budget neutral[1]; and,
2. The use substantially enhances or protects the quality of the natural environment.

Ecology solicited the opinion of WDFW as to whether the proposed TLAC water right application constituted "substantial net benefit" to the natural environment. WFDW indicated that "the proposal does provide a substantial net benefit if appropriate conditions are placed on the permit" (WDFW, 2004a) and further indicated that the trophy trout fishery in Big Twin Lake was "the only substantial net benefit that WDFW is willing to consider" (WDFW, 2004b). Based on this input, Ecology has determined that the proposed project, as conditioned per comments received from WDFW, meets the criterion for enhancement of the natural environment.

In addition to benefiting the Big Twin Lake trout fishery, the project will also contribute 125 afy return flow to the Methow River. About 90 afy of the return flow will discharge to the Methow River upstream of Winthrop and about 35 afy will discharge in the "bypass" reach downstream of the High School. Return flows peak in April at 17 af (126 gpm) and are generally between 8 and 13 af for other months.

The project will require mitigation in order to meet Ecology's water budget neutral criterion. That criterion requires mitigation of consumptive uses including evaporative losses from the expanded lake surface, lake seepage that does return to the vicinity of the point of withdrawal, and lake seepage that fills aquifer storage. Augmenting Big Twin Lake levels increase the footprint of Big Twin Lake resulting in a corresponding increase in evaporative losses. Evaporative losses were estimated at 30 afy based on groundwater modeling results (Table 1.1) (Aspect, 2009).

A portion of the water conveyed to Big Twin Lake seeps from the lake building up the water level in the aquifer and ultimately discharging to the Methow River. The model predicts approximately 1,743 af of lake seepage fills aquifer storage during the first 11 years of the project (an average of 159 afy). After 11 years, the change in storage vacillates from positive to negative values indicating conditions are at or near a steady state condition. The buildup of aquifer levels (about 6 feet near Big Twin Lake) leads to an increase in the discharge to the Methow River (return flow). An approximate 3-year delay occurs between the initial filling of Big Twin Lake and increase in return flow. Between year 3 and year 10, the volume of return flow to the Methow River gradually increases until it reaches an approximate steady state. With termination of the project, the water in storage will diminish as it is discharged to the Methow River and aquifer levels return to pre-project levels. Ecology has indicated that

[1] Water budget neutral is defined in Ecology Water Resources Program Policy 1021 as a withdrawal of waters of state done in exchange for "at least an equivalent amount of water from other water rights, donation of water rights into trust, relinquishment of other water rights, or other mitigation projects that result in no diminishment of the source".

the volume of water that goes to storage is considered consumptive and would need to be mitigated.

Return flow to the Methow River occurs both north and south of Big Twin Lake. While the majority of lake seepage (90 acre-ft) flows northward, to the vicinity of the point of withdrawal, about 35 acre-ft flows south, bypassing about a 3-mile reach of the Methow River (Table 1.1). Consistent with Ecology's guidance, this bypass quantity must be mitigated.

Mitigation quantity for evaporative losses and by-pass estimated by the numerical model is, therefore, 65 acre-ft (30 afy for evaporative losses and 35 afy for by-pass) under the WDFW withdrawal scenario. Storage mitigation would be about 400 acre-ft during the first year and diminish to near zero at year 11, for a total storage mitigation quantity of 1,743 af. From year 12 onward, total annual mitigation would be 65 afy.

3 Engineering Feasibility and Cost Evaluation

3.1 Preliminary Evaluation of Cost and System Capacity

A preliminary evaluation of pumping rates, pipeline sizes, and costs was performed to evaluate the range of design parameters for developing a preliminary engineering design and more detailed cost estimates. In the analysis, preliminary life cycle costs were developed for 6-, 8-, 10-, 12-, 15-, and 18-inch pipeline sizes for pumping rates of 500 gpm to 4,000 gpm.

Figure 3.1 presents preliminary total system costs as a function of flow rate for various pipe sizes. The preliminary total system costs (vertical axis, Figure 3.1) include capital costs for the pump and piping as well as the power costs to operate the system for 20 years at present worth value. A family of curves for each pipe size is generated based on these costs over a range of flow rates.

In evaluating the various pump and pipe size choices, a safety factor of 2 was applied to the model flow rates to allow for model uncertainty. Tolerating longer lake fill durations to achieve the target lake level could be used to reduce the safety factor applied to the flow rates. For example, the model predicts a 1,000 gpm withdrawal rate is required to initially fill the lake in a 3-year period (Table 1.1). Applying a safety factor of 2 to this flow rate, the system would be designed to allow a contingency for flows up to 2,000 gpm. Alternatively, the system could be designed for a 1,000 gpm withdrawal rate and, if the actual fill time exceeds the model-predicted 3-year time period, the additional lake-fill time would be tolerated in lieu of the expense of designing for a larger system.

The 12-inch and 15-inch pipe sizes were found to offer the best flexibility relative to cost. The 6-inch and 8-inch pipe sizes were readily eliminated as undersized. At the maximum flow rate for the 6-inch pipe (500 gpm), the lake fill time would be on the order of 15 years under the WDFW withdrawal constraints and this was considered too long a duration.[2] The 8-inch pipe size has a maximum flow rate of 1,000 gpm and the model predictions indicate the lake could reach TLAC target levels within a three year period; however, the 8-inch pipe

[2] The term "maximum flow rate" as used in this memorandum refers to flows that will exceed the maximum recommended velocity for a given pipe size and create excess head loss.

size leaves no safety factor at the 1,000 gpm withdrawal rate. Similarly, the 10-inch pipe has the theoretical capacity to fill the lake in 3 years, but with a maximum flow rate of 1,500 gpm, does not offer the safety factor or operating flexibility of the 12- and 15-inch pipe sizes. For a 1 year fill scenario (i.e., flow rates of 1,500 gpm or more), the 10-inch pipe has no safety factor.

The 12-inch pipe size can readily accommodate flow rates required to achieve target lake levels in a 1 year (>1,500 gpm) and 3-year period (~1,000 gpm), while providing a safety factor of 1.8 for a 1,500 gpm flow rate and about 2.7 at the 1,000 gpm flow rate. Preliminary 20-year life-cycle costs for the 12-inch pipe size are about $200,000 greater than a 10-inch pipe, but accommodate nearly twice the range in flows. The 15-inch pipe size provides even greater flexibility and a higher factor of safety, but at a 1,000 gpm flow rate is about $400,000 more costly than the 12-inch pipe size. The 18-inch pipe size was eliminated based on a significant incremental cost over the 15-inch and is considered oversized for the target safety factor. Based on this analysis, planning level costs were derived for both the 12-inch and the 15-inch pipe diameters.

4 Project Elements and Estimated Cost

4.1 Source of Supply

The points of groundwater withdrawal proposed in the TLAC water right application are located within two ¼, ¼ sections of Haub Brothers Enterprises Trust property near the Methow River, between the Douglas County PUD Hatchery (State Hatchery) and the National Fish Hatchery (the NW¼ of the SW¼ of Section 3, T34N, R21E and the NE¼ of the SW¼ of Section 3, T34N, R21E). The TLAC application proposes up to two wells, one located in each of these two, 40-acre subsections.

Results of the hydrogeologic investigation indicate that two wells completed at depths of 100 to 150 feet in the deeper alluvial aquifer are expected to be capable of a combined instantaneous withdrawal rate of up to 2,000 gpm based on performance of nearby wells. The wells are located in the easterly most ¼, ¼ section (NE¼ of the SW¼ of Section 3, T34N, R21E) identified on TLAC's application to minimize interference with State Hatchery wells, Spring Branch Springs and between the proposed TLAC wells (Figure 4.1).

4.2 Diversion Constraints

The range of groundwater withdrawal scenarios for lake level augmentation were defined to reflect compliance with established regulatory baseflows (minimum in-stream flows) and/or more stringent target flows recommended by WDFW. Three augmentation scenarios were defined for evaluation based on stakeholder input, including: (1) pumping only during periods when base flows set under 173-548 WAC (Water Resources Program in the Methow River Basin, WRIA 48) are met (WAC Scenario), or (2) pumping during periods when WDFW recommended target flows (between 800 and 6,000 cubic feet per second [cfs] from April 1 to July 15) are met (WDFW Scenario), and (3) pumping under WDFW target flows through July 15 and under 173-548 WAC through September 30 (WDFW/WAC Scenario).

WDFW has conditioned approval of the project based on minimum and maximum flow criteria for the Methow River. As the endorsement of WDFW appears to be a critical factor for qualifying for expedited water right processing under the Hillis Rule (see Section 3), the WDFW diversion limits are used as the governing withdrawal constraint.

4.3 Point of Lake Recharge

The application identifies four places of use for lake recharge augmentation, including Barnsley Lake, Big Twin Lake, infiltration galleries positioned along the water conveyance pipeline, and the Twin Lakes Aquifer. WDFW has stipulated that water for the TLAC project be delivered "directly and entirely" to Big Twin Lake (WDFW, 2004a). As described in Section 5, a proposed point of lake recharge is offshore from the north end lake area (Figure 4.1). Other, more suitable, discharge points may be identified in the future based on optimizing fish habitat.

5 Engineering Facilities - Preliminary Design Recommendations

The proposed TLAC recharge program is based on two wells with an assumed pumping rate of 1,000 gpm each for a total anticipated withdrawal rate of up to 2,000 gpm. The facilities to pump the groundwater from the well field to Big Twin Lake would consist of the following:

Wells

A total of two production wells will be drilled for the Twin Lakes project. The wells will be completed in the water-bearing sand and gravel units located above the local bedrock (shale). Based on well logs for the nearby Methow Spring Chinook Hatchery, located in Winthrop,

Washington, the production wells are estimated to be completed to a maximum depth of 150 feet (ft) below ground surface (bgs). Each well will likely be drilled using cable-tool techniques and will consist of a 16-inch-diameter boring. Preliminary design and costs for the production wells includes completion with a 16-inch-diameter permanent steel casing and up to 30 feet of 12-inch-diameter, stainless-steel, telescoping screen. Estimated drilling costs (see Tables 5.1 and 5.2) include an alignment test, well development, and a 15% contingency for additional driller costs.

A 6-hour variable rate (step) test and 72-hour constant rate test is recommended in one of the production wells following the completion of well installation. The aquifer testing program will provide information on the aquifer's hydraulic parameters, the well's long-term sustainable yield and predicted drawdown, and any possible impairment of nearby wells. An extended 6-hour variable rate test is recommended in the second production well in order to confirm similar well and aquifer characteristics.

Submersible Well Pump

Depending on the final pipeline size, each pump would have the capacity of 1,000 gpm at 360 feet of total dynamic head (TDH) and a 100 horsepower motor for the 12-inch pipeline option, or 1,000 gpm at 270 TDH and a 100 horsepower motor for the 15-inch-diameter pipeline option. Figure 5.1 presents a typical pump section detail.

Wellhead Facilities

At each wellhead, there would be a pitless adaptor and a vault containing a Cla-Val or similar pump control valve, an isolation valve, and a tee and valve to allow pumping the well to waste. Three-phase power would be required and the pump starter is proposed to be housed in an outdoor NEMA rated enclosure with power being brought underground to the wellhead. These facilities are shown on Figure 5.2.

Pipeline

The pipeline from the well field to Big Twin Lake would be approximately 2.4 miles long. The proposed route follows road right-of-way for the majority of the route, with segments at the well field and at the lake crossing private property (Figure 4.1). The optimum size of the pipeline would be either 12-inch-diameter or 15-inch-diameter. Based on the groundwater and recharge model assumptions, the 12-inch would have an approximately $400,000 lower total life cycle cost than a 15-inch-diameter pipeline. However, a 12-inch pipe flowing at 2,000 gpm is near the maximum recommended velocity and if additional flows were needed, there would begin to be excess velocity and headloss through this pipeline size. A 15-inch-diameter pipeline will provide additional capacity if the recharge system has to be expanded in the future. In addition, there will be lower TDH and therefore lower pumping costs with this size pipeline.

Discharge Point

At the discharge point, a “boulder cascade” is recommended. This would be a short natural-looking streambed with large rocks anchored in place. The boulder cascade would provide energy dissipation, some oxygenation, and will limit erosion at the lake shore where the recharge water is discharged.

5.1 Project Costs

Tables 5.1 and 5.2 present an opinion of probable costs for a planning level estimate for the project using 12-inch and 15-inch pipe diameters, respectively. Total 20-year life cycle cost for a 12-inch pipeline is about $1.7 million and for a 15-inch pipeline about $2.1 million.

Capital costs for the 12-inch pipeline and well option are about $1.65 million, including tax and contingencies compared to capital costs for the 15-inch pipeline and well option of about $2.09 million (Tables 5.1 and 5.2). At a pumping rate of 2,000 gpm, the annual energy cost to pump the 176 acre-ft maintenance volume would be $6,000 for a 12-inch pipeline and $4,800 for a 15-inch pipeline. The 20-year power costs at present worth are estimated at $68,000 and $50,000 for the 12-inch and 15-inch pipe sizes, respectively.

6 References

Aspect Consulting, LLC, 2005, Report of Phase 1 Analysis, Twin Lakes Aquifer Coalition Water Right Application G4-34915 Cost Reimbursement Project. Bainbridge Island, Washington. Unpublished Work. March 2005.

Aspect Consulting, LLC, 2009, Hydrogeologic Evaluation Report Water Right Application G4-34915, Twin Lakes Aquifer Coalition, Cost Reimbursement Project. Bainbridge Island, Washington. Unpublished Work.

Washington State Department of Fish and Wildlife (WDFW), 2004a, Surface Water Application No. G4-34915 Letter, Department of Fish and Wildlife correspondence. March 16, 2004.

Washington State Department of Fish and Wildlife (WDFW), 2004b, TLAC Water Right Application Letter, Department of Fish and Wildlife correspondence. June 25, 2004.

Attachments

Table 5.1 – Planning Level Costs for Proposed 12-inch Pipeline and Two 1,000-gpm Wells
Table 5.2 – Planning Level Costs for Proposed 15-inch Pipeline and Two 1,000-gpm Wells
Figure 1.1 – Twin Lakes Project Area Map
Figure 3.1 – Comparison of Pumping Rates and Costs
Figure 4.1 – Proposed Pipeline Route
Figure 5.1 – Pump Section Detail
Figure 5.2 – Well Head Schematic

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TABLE 5.1

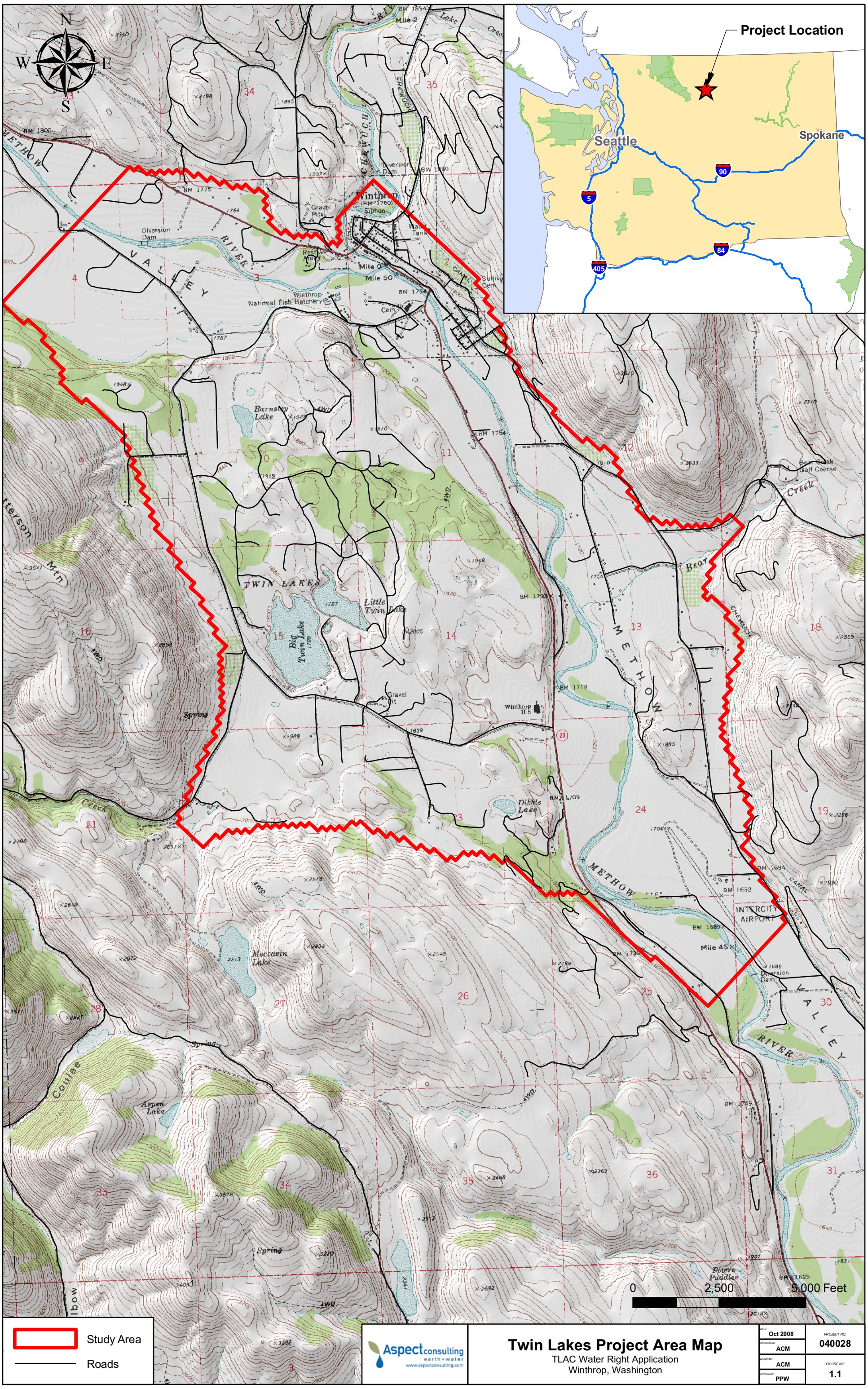
Twin Lakes Aquifer Recharge Project
Proposed 12-inch Pipeline and Two 1,000 gpm Wells
Winthrop Washington

ENGINEER'S OPINION OF PROBABLE COSTS								*31-Dec-09*
PLANNING LEVEL ESTIMATE								*RW Beck 11-1029-10000*
	QUANTITY		*MATERIAL*		*LABOR & EQUIPMENT*			*ENR: ____*
DIV NO.	*TASK DESCRIPTION*	*NUMBER UNITS*	*UNIT*	*UNIT COST*	*EXTEN.*	*UNIT COST*	*EXTEN.*	*Lump Sum or sub*	*TOTALS*
1	**GENERAL**								
	Contractor's Mark-ups								
	Bond & Insurance	1%			$ -		$ -	$8,760	$ 8,760
	Mobilization/Demob	2%			$ -		$ -	$17,519	$ 17,519
	Record Drawings	1	LS		$ -		$ -	$2,500	$ 2,500
2	**SITE WORK**								
	SPCC Plan/TESC	1	LS		$ -		$ -	$5,000	$ 5,000
	Construction Surveying	5	Days		$ -	1,360.00	$ 6,800.00		$ 6,800
	Temporary Fencing	250	LF	3.00	$ 750.00		$ -		$ 750
	Well Drilling and Construction	2	LS		$ -	95,395.60	$ 190,791.00		$ 190,791
	Well Yield and Aquifer Testing	1	LS		$ -	26,558.82	$ 26,559.00		$ 26,559
	Traffic Control	1	LS		$ -	500.00	$ 500.00		$ 500
	Trench Excavation Safety	1	LS		$ -		$ -	$1,000	$ 1,000
	Pavement - restoration	1,650	SY	21.00	$ 34,650.00		$ -		$ 34,650
	Pipeline, incl excav, bedding, backfill								
	12-inch diameter HDPE	12,500	LF	34.50	$ 431,250.00	16.34	$ 204,270.83		$ 635,521
	Discharge point - boulder cascade	1	LS	1,000.00	$ 1,000.00	3,000.00	$ 3,000.00		$ 4,000
3	**CONCRETE**								
	Cast-in-place concrete	4	CY	325.00	$ 1,155.56		$ -		$ 1,156
	Valve vault at well head	2	EA	3,250.00	$ 6,500.00	1,625.00	$ 3,250.00		$ 9,750
5	**METALS**								
	Misc Metals	1	LS	500.00	$ 500.00	500.00	$ 500.00		$ 1,000
11	**EQUIPMENT**								
	Submersible Well Pump & Discharge Head	2	EA	45,000.00	$ 90,000.00	11,250.00	$ 22,500.00		$ 112,500
13	**SPECIAL CONSTRUCTION**								
	Instrumentation System	1	EA		$ -		$ -	$10,000	$ 10,000
15	**MECHANICAL**								
	Piping								
	Ductile - well field pipe and fittings	150	LF	42.00	$ 6,300.00	36.00	$ 5,400.00		$ 11,700
	Valves								
	Cla-Val 8-inch Pump Control Valve	2	EA	11,800.00	$ 23,600.00	1,180.00	$ 2,360.00		$ 25,960
	Butterfly, 4-inch	2	EA	675.00	$ 1,350.00	337.50	$ 675.00		$ 2,025
	Butterfly, 8-inch	2	EA	1,525.00	$ 3,050.00	305.00	$ 610.00		$ 3,660
16	**ELECTRICAL**								
	Electrical	1	LS		$ -		$ -	$10,000	$ 10,000
	SUBTOTAL								**$ 1,122,200**
	CONTINGENCY							**15.0%**	**$168,400**
	Contractor Overhead, Profit & Field Admin.							**17.5%**	**$225,900**
	TAX							**8.90%**	**$135,000**
	ESTIMATED CONSTRUCTION BID								**$ 1,651,500**
	Present Worth Energy Costs (20 years)								**$68,000**
	TOTAL ESTIMATED COST								**$1,719,500**

TABLE 5.2

Twin Lakes Aquifer Recharge Project
Proposed 15-inch Pipeline and Two 1,000 gpm Wells
Winthrop Washington

ENGINEER'S OPINION OF PROBABLE COSTS								*31-Dec-09*
PLANNING LEVEL ESTIMATE								*RW Beck 11-1029-10000*
	QUANTITY		*MATERIAL*		*LABOR & EQUIPMENT*			*ENR: ____*
DIV NO. *TASK DESCRIPTION*	*NUMBER UNITS*	*UNIT*	*UNIT COST*	*EXTEN.*	*UNIT COST*	*EXTEN.*	*Lump Sum or sub*	*TOTALS*
1 GENERAL								
Contractor's Mark-ups								
Bond & Insurance	1%			$ -		$ -	$11,671	$ 11,671
Mobilization/Demob	2%			$ -		$ -	$23,342	$ 23,342
Record Drawings	1	LS		$ -		$ -	$2,500	$ 2,500
2 SITE WORK								
SPCC Plan/TESC	1	LS		$ -		$ -	$5,000	$ 5,000
Construction Surveying	5	Days		$ -	1,360.00	$ 6,800.00		$ 6,800
Temporary Fencing	250	LF	3.00	$ 750.00		$ -		$ 750
Well Drilling and Construction	2	LS		$ -	95,396	$ 190,791.00		$ 190,791
Well Yield and Aquifer Testing	1	LS		$ -	26,559	$ 26,559.00		$ 26,559
Traffic Control	1	LS		$ -	500.00	$ 500.00		$ 500
Trench Excavation Safety	1	LS		$ -		$ -	$1,000	$ 1,000
Pavement - restoration	1,650	SY	21.00	$ 34,650.00		$ -		$ 34,650
Pipeline, incl excav, bedding, backfill								
15-inch nominal ID - HDPE	12,500	LF	48.60	$ 607,500.00	25.53	$ 319,173.18		$ 926,673
Discharge point - boulder cascade	1	LS	1,000.00	$ 1,000.00	3,000.00	$ 3,000.00		$ 4,000
3 CONCRETE								
Cast-in-place concrete	4	CY	325.00	$ 1,155.56		$ -		$ 1,156
Valve vault at well head	2	EA	3,250.00	$ 6,500.00	1,625.00	$ 3,250.00		$ 9,750
5 METALS								
Misc Metals	1	LS	500.00	$ 500.00	500.00	$ 500.00		$ 1,000
11 EQUIPMENT								
Submersible Well Pump & Discharge Head	2	EA	45,000.00	$ 90,000.00	11,250.00	$ 22,500.00		$ 112,500
13 SPECIAL CONSTRUCTION								
Instrumentation System	1	EA		$ -		$ -	$10,000	$ 10,000
15 MECHANICAL								
Piping								
Ductile - well field pipe and fittings	150	LF	42.00	$ 6,300.00	36.00	$ 5,400.00		$ 11,700
Valves								
Cla-Val 8-inch Pump Control Valve	2	EA	11,800.00	$ 23,600.00	1,180.00	$ 2,360.00		$ 25,960
Butterfly, 4-inch	2	EA	675.00	$ 1,350.00	337.50	$ 675.00		$ 2,025
Butterfly, 8-inch	2	EA	1,525.00	$ 3,050.00	305.00	$ 610.00		$ 3,660
16 ELECTRICAL								
Electrical	1	LS		$ -		$ -	$10,000	$ 10,000
SUBTOTAL								**$ 1,422,000**
CONTINGENCY							**15.0%**	**$213,300**
Contractor Overhead, Profit & Field Admin.							**17.5%**	**$286,200**
TAX							**8.90%**	**$171,000**
ESTIMATED CONSTRUCTION BID								**$ 2,092,500**
Present Worth Energy Costs (20 years)								**$50,000**
TOTAL ESTIMATED COST								**$2,142,500**



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Twin Lakes Project Area Map
TLAC Water Right Application
Winthrop, Washington

DATE: Oct 2008	PROJECT NO. 040028
DESIGNED BY: ACM	
DRAWN BY: ACM	FIGURE NO. 1.1
REVIEWED BY: PPW	

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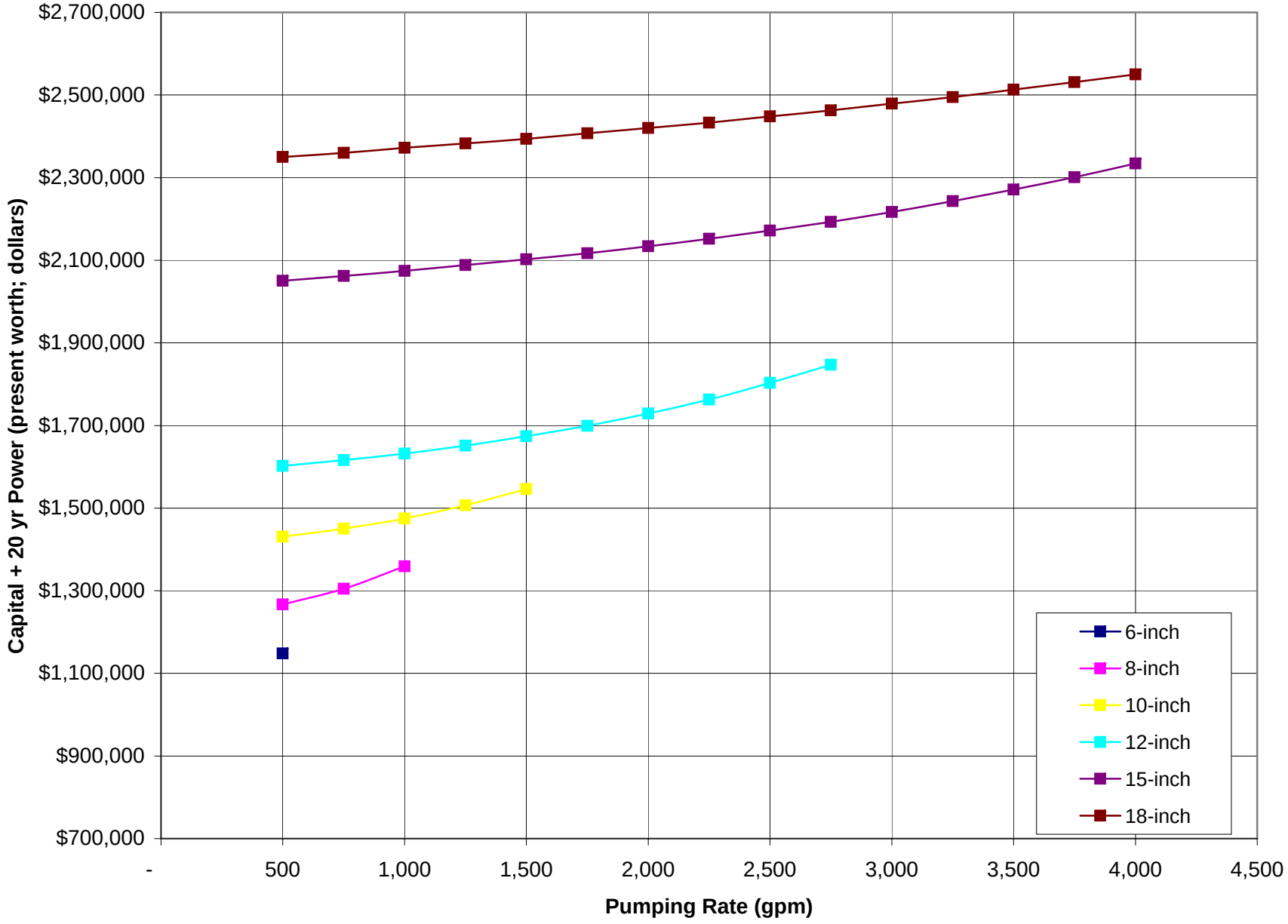
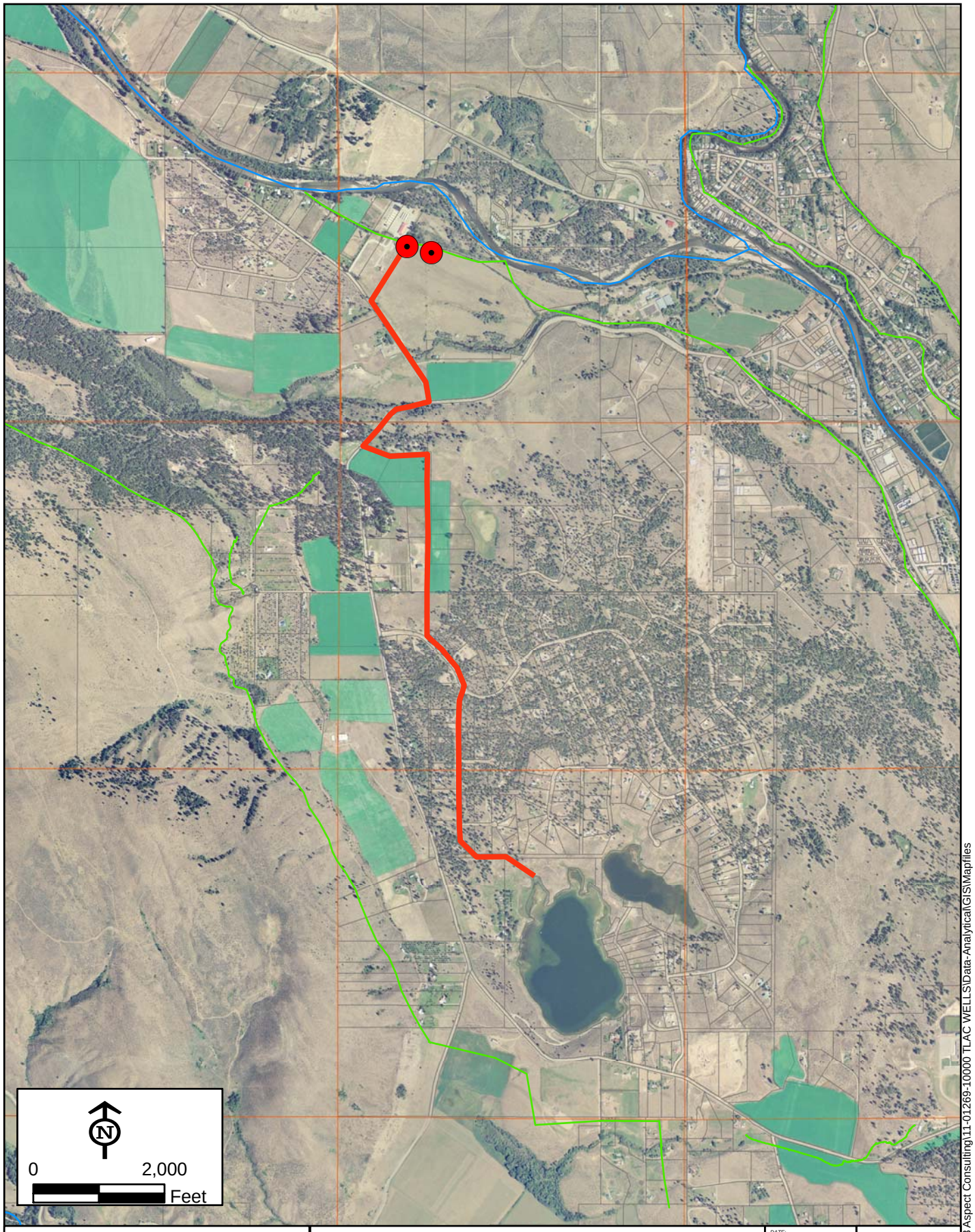


Figure 3.1
Comparison of Pumping Rate and Costs
TLAC Water Right Application
Winthrop, Washington

Aspect Consulting
12/31/2009
W:\040028 Water Resources Consultant Pool FY 04-05\Twin Lakes ASP 1\Deliverables\Planning Memo\Final\Figure 3.1 (May-09).xls



R·W·BECK

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Proposed Pipeline Route
TLAC Water Right Application
Winthrop, Washington

DATE: May 2009	PROJECT NO. 040028
DESIGNED BY: KSP	
DRAWN BY: KSP	FIGURE NO. 4.1
REVISED BY: KSP	

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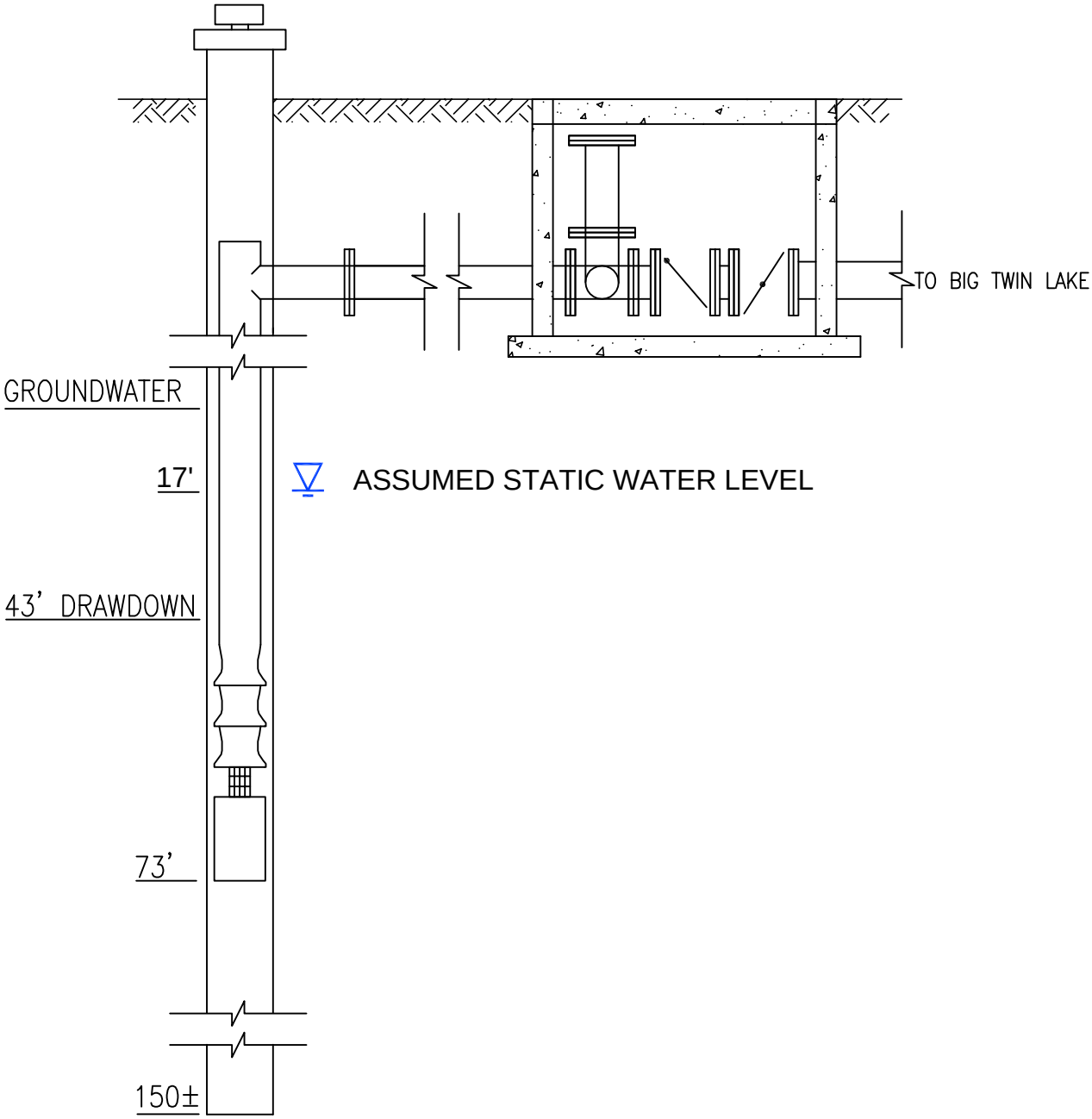

Figure 5.1
Pump Section Detail
TLAC Water Right Application
Winthrop, Washington

pbaker Oct 14, 2008 – 12:06pm – Q:\Water Resources Consultants\040028 TLAC Water Right Application\TLAC FIG 5.1 for Kieth.dwg

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Pump Section Detail

TLAC Water Right Application
Winthrop, Washington

DATE: Oct 2008	PROJECT NO. 040028-001
DESIGNED BY: EWM	
DRAWN BY: PMB	FIGURE NO. 5.1
REVISED BY: -	

Q:\Water Resources Consultants\040028 TLAC Water Right Application\TLAC FIG 5.1 for Kieth.dwg

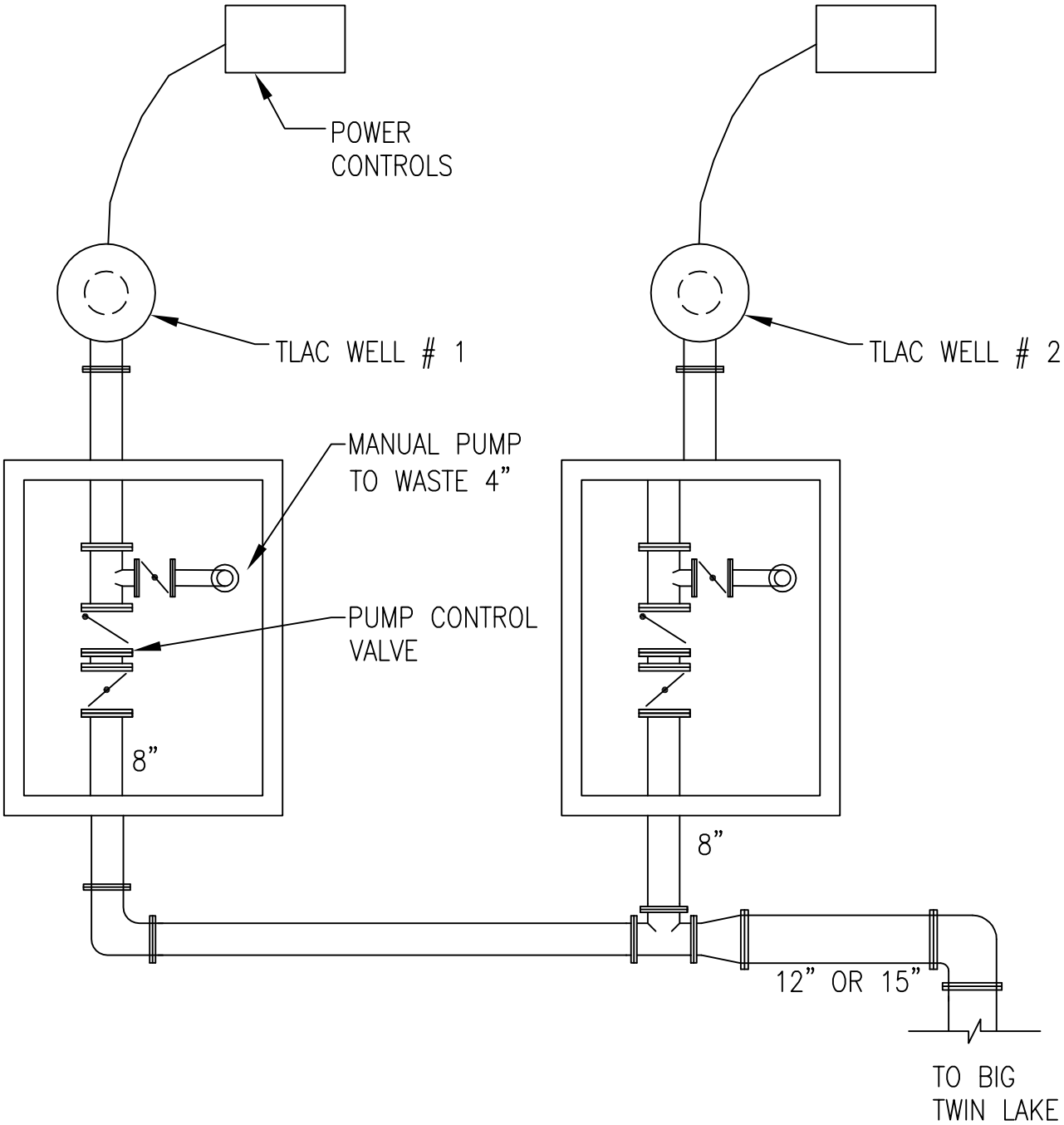

Figure 5.2
Well Head Schematic
TLAC Water Right Application
Winthrop, Washington

pbaker Oct 14, 2008 – 12:07pm – Q:\Water Resources Consultants\040028 TLAC Water Right Application\TLAC FIG 5.2 for Kieth.dwg

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Well Head Schematic

TLAC Water Right Application
Winthrop, Washington

DATE: Oct 2008	PROJECT NO. 040028-001
DESIGNED BY: EWM	
DRAWN BY: PMB	FIGURE NO. 5.2
REVISED BY: -	

Q:\Water Resources Consultants\040028 TLAC Water Right Application\TLAC FIG 5.2 for Kieth.dwg