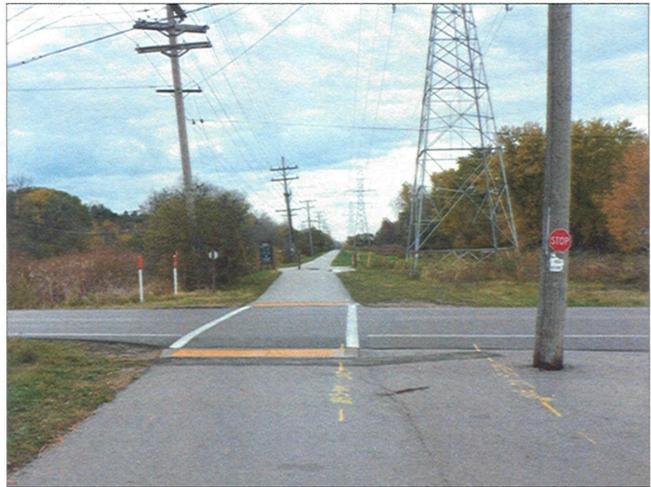


Estimate Review Report  
March 2012

# Wisconsin Department of Natural Resources

City of Waukesha Lake Michigan Water Supply Application  
Technical Review of the Cost Estimate



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## **1. Overview**

The City of Waukesha, Wisconsin submitted an Application for Lake Michigan Water Supply (Application) to the Wisconsin Department of Natural Resources (WDNR) in May 2010. As part of the Application review process, the WDNR has requested The Boldt Company's Technical Services Division (Boldt) to provide a review of the cost estimate included with the Application.

The Application contains four water supply alternatives to the City's current water supply as part of the evaluation to obtain long-term water supply for the City's water supply service area. The water supply alternatives include several cost estimates based on alternative water sources, pipeline routes for water supply and return flow routing for each alternative. The four water supply alternatives are as follows:

- No. 1 – Deep and Shallow Aquifers
- No. 2 – Shallow Aquifer and Fox River Alluvium
- No. 3 – Lake Michigan and Shallow Aquifers
- No. 4 – Lake Michigan

The WDNR has identified the following items related to the Application's water supply alternatives for which a review is required:

- Review the Application's cost estimates for access to easements, land purchase and pipeline installation relative to usual and customary costs.
  - Cost estimates are detailed in Appendix 'M' – Cost Estimate Update.
  - Pipeline routes are included in Appendix 'N' – Environmental Report.
  - Cost information regarding the Oak Creek and City of Racine Water Supply Alternatives is included in Addendum of same name dated September 1, 2010.
  - Updated cost estimates are included in the section entitled 'WS Cost' in the May 2011 Waukesha submittal, Response to WDNR Regarding Letter to Waukesha Water Utility.
- The Application applies a 25% contingency allowance to all four alternatives.
  - Is the contingency percentage appropriate?
  - Does the differentiation of alternative type and scope warrant a different contingency?
  - Provide analysis of usual and customary applications of contingency to different alternatives.
- A separate study was conducted by the University of Milwaukee / United States Geological Service (UWM/USGS) and Black & Veatch for a Riverbank Inducement water supply alternative (RBI) which included a Conceptual Level Design Cost Estimate. This is identified as RBI Alternative included in Appendix 'A'.
  - Provide analysis of the conceptual level design cost estimate in relation to any comparative usual and customary cost estimates.
  - Identify anomalous cost estimates or costing procedures.
- For purposes of the WDNR's review of Application, the applicable Wisconsin statutes define a reasonable water supply alternative as "a water supply alternative that is similar in cost to, and as environmentally sustainable and protective of public health as, the proposed new or increased diversion and that does not have greater adverse environmental impacts than the proposed new or increased diversion".
  - Discuss whether there is a construction industry standard for evaluating "similar in cost" related to construction alternatives.
  - The DNR has proposed using a range of +/- 50% for defining "similar" costs for water supply alternatives.

## **2. Background and Basis of Cost Estimate**

The City of Waukesha has had an ongoing investigation into the quantity and quality of its current water supply for over ten years. They have limited long-term water availability in the deep aquifer that is their current primary water supply. Additionally, this aquifer's water quality routinely exceeds the current radium regulations. Over the past several years, the Waukesha Water Utility has conducted water supply studies investigating alternative water supply strategies for the City of Waukesha. The cost estimates included in these studies were developed with preliminary, conceptual information. Detailed design and engineering has not been started or completed for the project. The cost estimates prepared were for long-range capital planning and were used for guidance in comparing water supply alternatives. The basic premise for these cost estimates was for comparison and should not be considered as final project costs. Final detailed project estimates are dependent on the final selected alternative, final detailed design, current and projected market conditions, site conditions, project scope, schedule and other variable factors.

CH2M HILL has prepared the conceptual cost estimates using their proprietary Parametric Cost Estimating System (CPES). Further description of this system is provided in Appendix 'M' of the Application.

### **a. Cost Estimate Review: Easement Access, Land Purchase, Pipeline Installation**

**Task:** Review the cost estimates for access to easements, land purchase and pipeline installation relative to usual and customary costs.

**Cost Estimates:** Boldt has performed an extensive review of all cost estimate information presented in Appendix 'M' of the Application for Alternatives: Numbers 1 through 4. This review included estimates for the water treatment plants, pump stations, pipeline installations, additional project cost allowances and construction estimate markups. Detailed commentary relative to the review is presented in Section Three – Cost Estimates Alternative Evaluations of this report.

An addendum dated September 1, 2010 from Reinhart Attorneys provided cost estimates for the Oak Creek water supply and the Racine water supply alternatives. Using the same estimate review process as was done for Alternative Nos. 1 through 4, Boldt's comparison for the Oak Creek water supply and the Racine water supply reflects an estimated cost 15% to 20% less than that included in the Reinhart letter. This variance is on the higher side of what might be expected with a conceptual estimate such as this. However, the subjective nature of quantity determination, unit pricing and unit pricing categorization of quantities is most likely causing this larger variance. For relative cost comparisons of alternatives, it is our opinion that the variance is within reason.

Attachment 'WS Cost' (May 2011) presented cost estimates for two (2) additional water supply alternatives. These included the Unconfined Deep Aquifer Alternative and the Multiple Source Alternative. Cost estimate information was presented at a summary level with limited detail. Comparisons were made to cost estimate information from Alternative Nos. 1 through 4. The cost estimates for the two additional water supply alternatives align with Alternatives Nos. 1 through 4.

It should be noted that the Application's cost estimates are in 2010 dollars with no escalation allowances included. For relative cost comparison purposes, this is appropriate. However, as the project moves forward and cost estimates are refined, escalation will need to be addressed, which will have an impact on the final, overall project cost.

Within the WTP estimates, a number of line items have quantities and unit pricing identified, but the cost estimate extension was not completed. This amounts to some significant estimate line item costs being

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unaccounted. However, the overall value of these un-extended items does not amount to a significant impact to the overall estimate.

**Conclusion:** In our opinion, the Application’s estimate development, format and methodology is representative of usual and customary costs based on the current conceptual status of the project and the intended use of the cost estimate information.

**Easements:** On October 25, 2011, Boldt and representatives from the DNR and PSC walked the utility corridors in which a portion of the water supply pipeline and return pipeline is currently being considered for routing. Access into the utility corridors appears to be fairly good. Aside from the main streets crossing the corridor, there are other access points along the corridor from other utilities and private land owners. The current assumption is that easements or access will be available through negotiations with the entities owning the property required for access. Congestion along the corridor, both overhead and underground, is evident to varying degrees.

**Conclusion:** Our opinion is that, based on preliminary information, the utility corridors provide a reasonable path for the pipeline routing.

**Land Purchase:** Land purchase pricing was investigated by Boldt in the locations identified for well fields and water treatment plants in Alternatives 1, 2 and 3.

**Conclusion:** Our opinion is the land purchase allowances used in the Application’s cost estimates are adequate and representative of current land pricing.

**b. Cost Estimate Contingency**

**Task:** Review the contingency factor for usual and customary application to the different alternatives, the appropriateness of contingency percentage and differentiation between contingency rate and alternative type and scope.

The application of contingency to a cost estimate is dependent on several factors including the project phase, the level of design and engineering completed, the estimating method used and the completeness of scope definition. Table 1 below provides generally accepted contingency factors for various levels of project definition.

**Table 1**

<b>Cost Estimate Accuracy &amp; Contingency</b>				
<b>Project Phase</b>	<b>Description of Estimating Method / Level of Detail</b>	<b>Design Completion %</b>	<b>Estimate Accuracy</b>	<b>Suggested Contingency</b>
Conceptual	Order of Magnitude	0 – 5%	+/- 30%	15% - 20%
Schematic Design	Preliminary / Factored / Feasibility	5% - 15%	+/- 20%	10%
Design Development	Control / Definite / Appropriation	15% - 30%	+/- 10%	8%
Construction Documents	Detailed / Definitive	40% - 85%	+/- 5%	5%
Bidding	Tabulated / Specific Detail	80% - 98%	+/- 3%	5%
Construction	True Cost	100%	+/- 0%	0%

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Table 2 provides additional definition regarding the type of information required and/or available at different stages of the project. Referencing Table 2, the documents required for a Class 40 estimate are identified. The Class 40 designation in Table 2 aligns with the Conceptual / Order of Magnitude designation in Table 1.

**Table 2**

Discipline / Item		Required Information	Class & Type of Estimate			
			40	30/20	10	5
Sitework	General Location	X				
	Specific Location		X	X	X	
	Site Layout & Topography			X	X	
	Soils Test			X	X	
	Detailed Drawings				X	
Process Flow	Sketched Flow Diagrams	X				
	Preliminary Flow Diagrams		X			
	Preliminary Flow Balances		X			
	P&ID Diagrams for Specific Equipment			X	X	
	Engineered P&ID Diagrams				X	
Equipment	Preliminary Sizing	X				
	Material Specifications	X				
	Equipment List	X	X	X	X	
	Budget Quotes from Vendors		X			
	Firm Quotes from Vendors			X	X	
	Purchasing Complete				X	
Buildings	Approximate Sizing	X				
	Preliminary Building General Arrangements		X			
	Preliminary Equipment General Arrangements		X	X		
	Material Specifications		X	X	X	
	Detailed Drawings				X	
Mechanical	Preliminary Flow Diagrams	X	X			
	Material Specifications		X			
	P&ID Diagrams for Specific Equipment			X	X	
	Engineered P&ID Diagrams			X	X	
	Detailed Drawings				X	
Instrumentation	Flow diagrams		X	X		
	Control Philosophy		X	X	X	
	Instrument List			X	X	
	Engineered P&ID Diagrams				X	
	Detailed Drawings				X	
Electrical	Preliminary Single Line Diagram		X			
	Motor List & Sizes			X		
	Engineered P&ID Diagrams			X	X	
	Detailed Drawings				X	
Levels of Accuracy:						
Class 40: <u>Order of Magnitude</u> . Long range planning, factored estimate from historical data or equipment multipliers.						
Class 20/30: <u>Feasibility Capital Cost</u> . Economic feasibility of project, preliminary documentation, budgetary quotes from equipment vendors.						
Class 10: <u>Capital Budget</u> . Appropriation funding for project, quantity takeoffs, firm quotes from equipment vendors, project schedule agreed upon.						
Class 5: <u>Capital Verification</u> . Confirm final probable cost of project, detailed design complete, bulk purchasing complete, equipment purchasing complete.						

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**Conclusion:** It is our opinion that the cost estimating information presented in the Application is at the Order of Magnitude / Conceptual / Class 40 stage of development. In reviewing both tables, some key points to note from our review of the cost estimating information:

- Design and engineering is mostly likely at a 0 – 5% level of completion.
- Table 2 identifies several items of information that are important in providing a Class 40 estimate including general site location, approximate size of buildings, preliminary equipment sizing and list of equipment, and preliminary flow diagrams or sketches. Process flow diagrams define and describe process system functions including equipment, mechanical and electrical requirements. The process flow of the various alternatives are somewhat defined by preliminary layouts, pipeline routing and descriptions of the pipelines, which can be considered preliminary flow diagrams. The water and wastewater treatment facilities, however, are not defined by any type of process flow diagrams. Estimates prepared for these facilities used a parametric form of estimating which relies on historical cost data which is then factored up or down based on comparison of the proposed facility to the historical data base. For this type of strategic planning and alternative comparison, the significance of not having preliminary flow diagrams is minimal.
- Other required information for a Class 40 estimate has been somewhat identified including
  - General location of the facilities
  - Pipeline routings
  - Preliminary sizing of equipment
  - Preliminary identification / listing of equipment
  - Preliminary sizing of buildings
- It is our opinion that the accuracy of the Application's cost estimates is +/- 30% based on the information in Tables 1 & 2.

The estimate accuracy and contingency information presented in Tables 1 & 2 has been developed from historical cost data and experience with large industrial projects such as this. It has also been compiled from various construction and engineering sources and resources throughout the years.

The parametric estimating method used by the City to determine the cost estimates for this project is also a historical and experience based program that develops project parameters using preliminary, conceptual information.

In our opinion, there is not significant differentiation in the types or scopes of the various alternatives. All alternatives address similar project scope, i.e., pipelines, water treatment facilities, wells, etc. The actual make-up of each alternative may be slightly different, but the type and scope are basically the same.

In our opinion, an anticipated contingency for a cost estimate at this level would be 15% to 20%. However, the basis for these cost estimates is to compare alternatives. Also, the project scope is fluid and could change significantly as the project moves forward. The 25% contingency used across all alternatives is consistent and reasonable for this level of estimate. When a specific alternative is selected, preliminary engineering will better define the scope for more accurate estimating. Reductions in Contingency would be expected as the project is refined.

### **c. Riverbank Inducement Water Supply Alternative**

**Task:** A separate study was conducted by UWM/USGS and Black & Veatch for a riverbank inducement water supply alternative (RBI). Review the cost estimate relative to usual and customary costs.

Conceptual cost estimates were developed for the RBI water supply alternative using much of the same cost methodology, assumptions and unit costs that were used by CH2M HILL for Alternate Nos. 1 through 4. Detailed design and engineering has not been started or completed for the RBI alternative. The cost

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estimates prepared were for long-range capital planning and were used for guidance in comparing water supply alternatives. The basic premise for these costs estimates was for comparison and should not be considered as final project costs.

**Conclusion:** Boldt performed a review of the cost estimate information included in Black & Veatch's report dated April 2011. Comparing the RBI total project capital cost estimate with Boldt's cost estimate review and opinions, the resultant estimates are within 6% of each other. Based on the conceptual nature of the cost estimate, our opinion is that information used to prepare the RBI's cost estimate is usual and customary.

**d. Evaluating "Similar in Cost" Related to Construction Alternatives**

For the review of the Application by the WDNR, the applicable statutes define a reasonable water supply alternative as . . . "a water supply alternative that is similar in cost to, and as environmentally sustainable and protective of public health as, the proposed new or increased diversion and that does not have greater adverse environmental impacts than the proposed new or increased diversion".

**Task:** Discuss whether there is a construction industry standard for evaluating "similar in cost" related to the alternatives. The DNR has proposed using a range of 50% for defining "similar in cost" for water supply alternatives.

Boldt is not aware of a construction industry standard for evaluating project alternatives in regards to a "similar in cost" parameter. We have extensive experience evaluating project costs in relation to bids, proposals, options, alternates and other similar comparisons. Cost is an important component of any evaluation; however, project scope is a more critical component. In order to make a meaningful comparison on cost, the project scope must be the same or very similar between alternatives. The project scope drives the cost. Project scope also drives similarity of projects or alternatives.

For this Application, all of the alternatives are satisfying the same basic requirement to provide potable water to the City of Waukesha. Each alternative is different, yet each uses similar components (pipelines, water treatment, wells, etc.) to satisfy the requirements. Each alternative uses the same estimating format and method to determine cost. Each alternative addresses initial capital costs plus annual operating and maintenance costs, which tends to level similarities for comparisons.

Our interpretation of establishing a cost range to define similarity in water supply alternatives is that it gives the DNR an initial evaluation tool to decide if the alternative in question should be studied further. In other words, if a water supply alternative is 50% higher than the base, it most likely includes more project scope, is too costly and falls outside the definition of a "reasonable water supply alternative" to meet the needs of the Application.

Using the Water Supply Alternative capital cost estimates as an example. The Lake Michigan with Return Flow to Underwood Creek alternative is \$164 million. The Lake Michigan and Shallow Aquifer alternative is \$238 million. The Lake Michigan and Shallow Aquifer alternative is almost 50% higher than the Lake Michigan with Return Flow to Underwood Creek alternative. Using the 50% similar cost range, the Lake Michigan and Shallow Aquifer alternative is not similar in cost to the Lake Michigan with Return Flow to Underwood Creek alternative, so it would therefore not be considered a reasonable alternative, if all other factors were considered equal.

**Conclusion:** Is the proposed range of 50% the proper one? Based on our experience in cost estimate evaluations, if there is a 25% to 30% variance in cost between alternatives, bids, proposals, etc., we feel this is enough variance to indicate vast differences in scope, interpretation, pricing, etc., which in turn indicates the alternatives are not similar in cost. In our opinion, the range could probably be reduced to 25% to 30%.

### **3. Alternatives Evaluations**

#### **a. Water Supply Alternative 1: Continue Use of Deep and Shallow Aquifers**

##### **General Overview**

Alternative 1 consists of continued use of the deep aquifer (St. Peter sandstone) and shallow aquifer south of Waukesha (Troy Bedrock Valley). Implementation of Alternative 1 will require the following:

- Additional deep well water treatment facilities at deep well numbers 6, 8 & 10.
- New shallow aquifer water treatment facility located south of Waukesha near the new shallow aquifer wells.
- Installation of fourteen (14) new shallow aquifer wells south of Waukesha near Vernon Marsh.
- New pumping stations for shallow aquifer wells.
- Transmission pipelines to convey the water.
  - From shallow wells to new treatment facility. (~ 22,000 lin. ft.)
  - From new treatment facility to Hillcrest pumping station. (~ 48,000 lin. ft.)
- Sludge pipeline between new water treatment facility and existing Waukesha WWTP. (~ 27,500 lin. ft.)

##### **Deep Well Treatment Facilities**

Capacity of the deep wells is expected to decrease because the groundwater elevation continues to drop. The declining water level causes water quality problems. It is anticipated that water treatment would be required at the three largest deep wells (Nos. 6, 8 & 10). These deep wells are located on small parcels of property, adjacent to residential property. The estimate assumes that these three wells will have their own treatment facility; hence adjacent residential property would need to be acquired. Water from the remaining deep wells will be blended at the Hillcrest reservoir.

The cost estimate summary for the Deep Well Treatment Facilities is as follows:

Deep Well			Deep Well Capital Cost Estimate	
No.	Capacity mgd/2009	Capacity mgd/planning	Land Cost	WTP Cost
2	1.15	0.81	-	-
3	1.4	0.98	-	-
5	1.44	1.01	-	-
6	2.59	1.63	\$500,000	\$6,579,000
7	1.08	0.76	-	-
8	2.16	1.36	\$500,000	\$5,329,000
9	1.94	1.36	-	-
10	3.74	2.36	\$500,000	\$9,868,000
Sub-Totals			\$1,500,000	\$21,776,000
Total, 2010				\$23,276,000
Total, 2020 F/P (3% Inflation, 1.344)				\$31,280,998
Total, 2010 P/F (6%, 0.5584)				\$17,467,309

An allowance of \$500,000 per well site has been included to purchase property adjacent to the wells for construction of the water treatment facilities. The cost estimate for the water treatment facilities does not

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identify a land area requirement for purchase, nor does the write-up for Alternative 1 identify land area purchase requirements.

The cost estimate does identify approximately 9,400 square feet of building space required for each facility. Assuming a multiplier between 2 and 4 times the building space for roads, parking and open space, up to 1-acre of land could be required for the water treatment facility at each of the specified well sites. Property requirements for each specified well site could mean purchasing 2 to 4 residential properties. Depending on property size, property dwellings and location, it may require more than the land cost allowance identified (\$500,000 per site) to purchase properties.

A detailed, parametric estimate was completed by CH2M HILL for a 3.0 mgd Nano filtration water treatment plant (WTP). The cost estimate for the 3.0 mgd WTP was included as the WTP cost for deep well No. 10.

Commentary on the estimate details is as follows:

- **Format and Unit Costs**
  - The estimate is categorized into a standard estimating format, generally following the 16 division, Construction Specification Institute (CSI) format.
  - Unit costs used in the estimate are direct construction costs and do not include bonds, insurance, mobilization/demobilization, contractor overhead, contractor profit or contingency. These items are added separately on the capital cost estimate summary sheet.
  - Quantities used in the estimate were not confirmed and are assumed representative of items and quantities required for facilities described.
- **Civil / Site work**
  - Cost estimate for earthwork (excavation, backfill & spoils removal) for the buildings and facility structures.
  - Estimated unit pricing used for excavation and structural backfill appears to be adequate.
  - Estimated unit pricing for native backfill and hauling excess soils appears to be lower than anticipated for a conceptual estimate of this nature.
- **Architectural / Structural**
  - Cost estimate for concrete, buildings and miscellaneous specialties.
  - Estimated unit pricing for concrete appears to be lower than anticipated for a conceptual estimate of this nature. Potential impact could be an additional 20% to 25% costs.
  - Reference the Air Stripper Degas estimate. There are several estimate quantity items for which the cost estimate extension has not been completed. This amounts to approximately \$30,000 of unaccounted cost.
  - The masonry appears to address the enclosure of the building including walls and roof. Unit pricing used appears adequate.
  - Estimated unit pricing for metals appears to be adequate.
  - Estimated unit pricing for doors appears to be adequate.
- **Process Equipment**
  - Cost estimate for purchase of process equipment required for the WTP including cranes and hoists. Our assumption is that pricing for the purchase of process equipment is current and adequate, as there is not sufficient information to confirm pricing used.
  - Cost estimate for installation of the WTP process equipment. Installation of process equipment is based on a percentage (20%) of the cost of purchased equipment. This appears to be adequate for equipment listed.

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- Reference the Air Stripper Degas estimate. It appears that the estimate for process equipment installation was omitted. Also, cost basis for the Allowance for Misc. Items is not correct (purchase cost of process equipment is not correct).
- Reference the In-Plant PS FWPS estimate. It appears that the estimate for process equipment installation was omitted.
- Reference the Liquid Chemical NaOH estimate. It appears that the estimate for process equipment installation was omitted.
- Our assumption is that pricing for purchase and installation of the bridge crane is current and adequate, as there is not sufficient information to confirm pricing used.
  - Mechanical cost estimate for process piping, fittings and valves.
  - From an overall estimate standpoint, the unit pricing used for piping, fittings and valves appears adequate for this level of estimate.
  - There are several instances where the cost estimate extension has not been completed. This amounts to \$25,000 to \$50,000 of unaccounted cost.
- Electrical
  - Cost estimate for electrical equipment and installation labor and materials.
  - Cost estimates for electrical equipment (MCC sections, AFD's, level transmitters, etc.) appear to range from adequate to slightly higher (10% to 15%) than would be expected for an estimate at this phase. Magnetic flow meter cost estimates; however, appears to be slightly lower than expected.
  - Inclusion of cost estimates for incoming primary voltage level equipment (switchgear and power distribution) is not apparent. This may be addressed at the estimate summary level and included in the yard electrical allowance.
  - Quantities used for wire, cable and raceway appear lower than what would be expected for this level estimate.
  - Cost estimates for electrical installation are not readily apparent. It is possible this could be included in the miscellaneous items allowance or the electrical allowance used in the estimate.
  - There are several instances where the cost estimate extension has not been completed. This amounts to \$50,000 to \$75,000 of unaccounted cost.
- Miscellaneous Allowances
  - Based on percentage of overall cost estimate.
  - Includes allowances for finishes, instrumentation and controls (I&C), mechanical and electrical.
  - These are allowances built into CH2M HILL's Parametric Estimate. There is not sufficient information to review or provide commentary.
- Additional Project Cost Allowances
  - Demolition. Additional cost estimate for demolition was not included.
  - Overall Site work. An allowance of 10% of the project cost sub-total was included for site work related items. The assumption is that this would include demolition of site structures, roads, access drives, parking, site grading, fencing and landscaping. The allowance appears adequate for developing a 1-acre site.
  - Plant Computer System. An allowance of 5% of the project cost sub-total was included for computer, data gathering, and remote monitoring equipment related items. Our assumption is that the 5% allowance is adequate, as there is not sufficient information to confirm actual requirements or work scope.

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- Yard Electrical. An allowance of 7% of the project cost sub-total was included for electrical switchyard related items. The assumption is that this would include electrical distribution equipment consisting of incoming metering, primary distribution transformers, power cabling and raceways. Our assumption is that the 7% allowance is adequate, as there is not sufficient information to confirm actual requirements or work scope.
- Yard Piping. An allowance of 10% of the project cost sub-total was included for yard piping related items. The assumption is that this would include underground connecting pipelines for the process work. Our assumption is that the 10% allowance is adequate, as there is not sufficient information to confirm actual requirements or work scope.

The WTP cost estimates for deep well No. 6 and No. 8 appear to be a ratio of the WTP cost estimate for deep well No. 10. The ratio used is not readily apparent. For purposes of this review, the extrapolated cost of the WTP for deep wells 6 and 10 is determined from the ratio of the well capacities, using an exponential 7/10 factor. Factoring the capacity ratio recognizes that certain costs, i.e., site work, may remain constant as the WTP capacity decreases.

The Rule of Six-Tenths is a capacity factoring method of estimating (CFE) that is used during the early, feasibility phase of a project. It is a relatively quick and accurate means of determining estimated costs. The cost of a new plant or facility is derived from the cost of a similar plant of known capacity and similar process flow. CFE relies on the nonlinear relationship between capacity and cost. The basic equation is:

$$\text{Estimated Cost of Plant B} = (\text{Plant B Capacity}/\text{Plant A Capacity})^e \times \text{Plant A Cost}$$

where exponent “e” is the proration factor. The value of the exponent typically lies between 0.5 and 0.85, depending on the type of plant or facility. An exponent of 0.6 is generally used as the “default” if no other information is available. A factor of 0.7 was used for this evaluation to reflect water treatment and pumping operations.

- Deep Well No. 6 WTP. Ratio of  $(1.63/2.36)^{.70} \times \$9,868,000 = \$7,616,000$ .
- Deep Well No. 8 WTP. Ratio of  $(1.36/2.36)^{.70} \times \$9,868,000 = \$6,709,000$ .
- Using this factoring method, it appears that the WTP cost estimate for Deep Wells No. 6 and No. 8 may be on the low side.

The present worth calculations are in alignment assuming that the construction of the WTP’s will occur in the year 2020. With the current economy, the inflation rate (3%) and the P/F investment rate (6%) used should be confirmed.

### **Shallow Aquifer Water Treatment Facility**

A detailed, parametric estimate was completed by CH2M HILL for a WTP for the shallow aquifer water wells. The estimate is categorized into a standard estimating format, generally following the 16 division, CSI format. Commentary on the estimate details is as follows:

- Format and Unit Costs
  - The estimate is categorized into a standard estimating format, generally following the 16 Division, CSI format.
  - Unit costs used in the estimate are direct construction costs and do not include bonds, insurance, mobilization/demobilization, contractor overhead, contractor profit or contingency. These items are added separately on the capital cost estimate summary sheet.
  - Quantities used in the estimate were not confirmed and are assumed representative of items and quantities required for facilities described.

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- Civil / Site work
  - Cost estimate for earthwork (excavation, backfill & spoils removal) for the buildings and facility structures.
  - Estimated unit pricing used for excavation and structural backfill appears to be adequate.
  - Estimated unit pricing for native backfill and hauling excess soils appears to lower than anticipated for a conceptual estimate of this nature.
  - Reference the Vertical Turbine PS: FWPS estimate. There are several site work estimate quantity items for which the cost estimate extension has not been completed. This amounts to approximately \$130,000 of unaccounted cost.
  - Reference the Filter BW PS BWSPS estimate. There are several site work estimate quantity items for which the cost estimate extension has not been completed. This amounts to approximately \$25,000 of unaccounted cost.
- Architectural / Structural
  - Cost estimate for concrete, buildings and miscellaneous specialties.
  - Estimated unit pricing for concrete appears to be lower than anticipated for a conceptual estimate of this nature. Potential impact could be an additional 20% to 25% costs.
  - Reference the Vertical Turbine PS: FWPS estimate. There are several concrete estimate quantity items for which the cost estimate extension has not been completed. This amounts to approximately \$180,000 of unaccounted cost.
  - Reference the Filter BW PS BWSPS estimate. There are several concrete estimate quantity items for which the cost estimate extension has not been completed. This amounts to approximately \$100,000 of unaccounted cost.
  - The masonry appears to address the enclosure of the building including walls and roof. Unit pricing used appears adequate.
  - Estimated unit pricing for metals appears to be adequate.
  - Estimated unit pricing for doors appears to be adequate.
- Process Equipment
  - Cost estimate for purchase of process equipment required for the WTP including cranes and hoists. Our assumption is that pricing for the purchase of process equipment is current and adequate, as there is not sufficient information to confirm pricing used.
  - Cost estimate for installation of the WTP process equipment. Installation of process equipment does not appear to be recognized or included in the estimate. The Deep Well WTP estimate included equipment installation based on a percentage (20%) of the cost of purchased equipment.
  - Reference the Inline Rapid Mix RMX estimate. It appears that the estimate for the 3-ton monorail hoist is high (\$57,750). Other estimates for 3-ton monorail hoists are \$3,260 which seems more in line.
- Mechanical
  - Cost estimate for process piping, fittings and valves.
  - From an overall estimate standpoint, the unit pricing used for piping, fittings and valves appear adequate for this level of estimate.
  - There are several instances where the cost estimate extension has not been completed. This amounts to \$25,000 to \$50,000 of unaccounted cost.
- Electrical
  - Cost estimate for electrical equipment and installation labor and materials.

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- Cost estimates for electrical equipment (MCC sections, AFD's, level transmitters, etc.) appear to range from adequate to slightly higher (10% to 15%) than would be expected for an estimate at this phase. cost estimate, however, appears to be slightly lower than expected.
- Inclusion of cost estimates for incoming primary voltage level equipment (switchgear and power distribution) is not apparent. This may be addressed at the estimate summary level and included in the yard electrical allowance.
- Quantities used for wire, cable and raceway appear lower than what would be expected for this level estimate.
- Cost estimates for electrical installation are not readily apparent. It is possible this could be included in the miscellaneous items allowance or the electrical allowance used in the estimate.
- **Miscellaneous Allowances**
  - Based on percentage of overall cost estimate.
  - Includes allowances for finishes, instrumentation and controls (I&C), mechanical and electrical.
  - These are allowances built into CH2M HILL's Parametric Estimate. There is not sufficient information to review or provide commentary.
- **Additional Project Cost Allowances**
  - Demolition. Additional cost estimate for demolition was not included.
  - Overall Site work. An allowance of 10% of the project cost sub-total was included for site work related items. The assumption is that this would include demolition of site structures, roads, access drives, parking, site grading, fencing and landscaping. Our assumption is that the 10% allowance is adequate, as there is not sufficient information to confirm physical size of site or layouts for work scope.
  - Plant Computer System. An allowance of 5% of the project cost sub-total was included for computer, data gathering, and remote monitoring equipment related items. Our assumption is that the 5% allowance is adequate, as there is not sufficient information to confirm actual requirements or work scope.
  - Yard Electrical. An allowance of 7% of the project cost sub-total was included for electrical switchyard related items. The assumption is that this would include electrical distribution equipment consisting of incoming metering, primary distribution transformers, power cabling and raceways. Our assumption is that the 7% allowance is adequate, as there is not sufficient information to confirm actual requirements or work scope.
  - Yard Piping. An allowance of 14% of the project cost sub-total was included for yard piping related items. The assumption is that this would include underground connecting pipelines for the process work. Our assumption is that the 14% allowance is adequate, as there is not sufficient information to confirm actual requirements or work scope.

**Shallow Aquifer Well Field**

A total of fourteen (14) shallow aquifer wells are anticipated. Limited estimate information is available in the Application. The estimate summary for the Shallow Water Aquifer Well Field(s) includes:

- Allowance for land acquisition of \$160,000 per well site.
  - The location of the shallow aquifer wells is south of the City of Waukesha in what appears to be open farm fields.
  - Based on current analysis of land prices in this area, the \$160,000 would allow the purchase of up to 16-acres of land per site if located in open farmland. If some well sites are in more urban areas, the size of property may be significantly reduced.

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- Allowance for drilling wells and building pump houses of \$300,000 per well site.
  - Assuming a well depth of 200 feet and an approximate pump house size of 400 square feet, the allowance included appears to be adequate for drilling the well and building the pump house.
- Allowance of \$1,394,000 for site work (\$750,000) and electrical utility work (\$644,000) for all well sites (14 total).
  - Site work for each well site is anticipated to be minimal. Site requirements could include site grading, paving, parking, fencing and landscaping. Based on these assumptions, the \$750,000 allowance appears to be adequate.
  - Electrical utility work for each well site is anticipated to include providing 480V power to each site to power the water pump, lighting and other electrical needs. Assuming that a power source is located within 1,000 feet of the well site, the \$644,000 allowance appears to be adequate.
- Allowance of \$4,970,400 for interconnecting piping for all well sites.
  - Assumption is that this is the water pipeline connecting the 14 well sites to the Shallow Aquifer Central Water Treatment facility. Approximate length of this pipeline is 22,000 In ft.
  - Based on preliminary routing of pipeline, it appears the estimate cost allowance is adequate for this pipeline.

#### **Supply/Finished Water Pipeline to Waukesha**

The finish water pipeline is approximately eleven (11) miles of 24-inch diameter, underground pipeline that runs from the WTP to the Hillcrest Reservoir. Preliminary routing of the pipeline is shown on the Alternate 1 Overview Map and Tile Maps.

- The length of pipeline was checked by “scaling” the preliminary routing on the overview and tile maps. The pipeline length included in the cost estimate is eleven miles. “Scaling” the route maps identified nine miles of pipeline.
- Based on the satellite views of the overview and tile maps, a determination was made regarding the mix of pipeline routing for open country, low urban, medium urban, etc. Individual routing impacts, such as road crossings, creek crossings, road removal/replacement, etc. were determined.
- Pipeline unit pricing was checked. Quantities and unit pricing were then assembled to determine an overall cost estimate for comparison to the parametric cost estimate.
- Summarizing, the Application’s parametric cost estimate is lower than the cost estimate determined with this check by approximately 15%. However, this would tend to fall into the accuracy level range of a conceptual estimate such as this due to the preliminary quantities, the unit pricing and subjective determination of categorization of quantities to which unit pricing is applied.

#### **Distribution System Improvements**

The distribution system improvements include approximately ten (10) miles of 16-inch and 20-inch diameter, underground pipeline. Actual location and routing of this pipeline is not clear on the Alternate 1 Overview Map.

- An arbitrary and subjective determination was made regarding the mix of pipeline routing for open country, low urban, medium urban, etc. Individual routing impacts such as road crossings, creek crossings, road removal/replacement, etc. were also arbitrary and subjective.
- Pipeline unit pricing was checked. Quantities and unit pricing were then assembled to determine an overall cost estimate for comparison to the parametric cost estimate.

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- Summarizing, the Application's parametric cost estimate is higher than the cost estimate determined with this check by approximately 12%. However, this would tend to fall into the accuracy level range of a conceptual estimate such as this due to the preliminary quantities, the unit pricing and subjective determination of categorization of quantities to which unit pricing is applied.

### **Wastewater Force Main**

The wastewater force main pipeline is approximately five (5) miles of 6-inch diameter, underground pipeline that runs from the WTP to the wastewater treatment plant. Routing of this pipeline is shown on the Alternate 1 Overview Map and Tile Maps.

- The length of pipeline was checked by "scaling" the preliminary routing on the overview and tile maps. The pipeline lengths aligned very closely.
- Based on the satellite views of the overview and tile maps, a determination was made regarding the mix of pipeline routing for open country, low urban, medium urban, etc. Individual routing impacts such as road crossings, creek crossings, road removal/replacement, etc. were determined.
- Pipeline unit pricing was checked. Quantities and unit pricing were then assembled to determine an overall cost estimate for comparison to the parametric cost estimate.
- Summarizing, the Application's parametric cost estimate is lower than the cost estimate determined with this check by approximately 40%. This variance is a bit higher than might be expected with a conceptual estimate such as this. However, the subjective nature of quantity determination, unit pricing and unit pricing categorization of quantities is mostly likely causing this larger variance.

### **Summary: Alternate No. 1 - Continue Use of Deep & Shallow Aquifers**

Commentary regarding the Alternatives will be similar, as cost information and assumptions used to develop the estimates overlaps all of the Alternatives. A general overview of the comments regarding the cost estimate review of Alternative No. 1:

- Land cost used in the cost estimates generally aligns with pricing that Boldt found in researching the cost of land in the areas noted by Alternative No. 1.
- Unit cost used in the water treatment plant estimates can be considered usual and customary. Earthwork and concrete unit pricing appears to be lower than anticipated. Some mechanical and electrical unit pricing appears to be higher than anticipated.
- Within the WTP estimates, a number of line items that have quantities and unit pricing identified, but the cost estimate extension was not completed. This amounts to some significant estimate line item costs being unaccounted. The overall value of these un-extended items does not amount to a significant impact on the cost estimate.
- Referencing the deep well treatment facilities, extrapolation of the cost estimates for deep well number 6 and number 8 appear to be on the low side.
- The cost review of the pipeline estimates for this alternative was based on the preliminary routing of the pipelines, along with a subjective determination of the productivity mix associated with the routing. It is our opinion that the cost estimates for the pipeline installation for this alternative can be considered usual and customary for this level of estimate.
- Mark-ups applied to the construction cost estimates were reviewed and found to be in general alignment with Boldt's opinion for mark-up percentages. The overall mark-up amounts were very close, however, the percentage splits varied.

Comparing the Application's total project capital cost estimate for Alternative No. 1 with Boldt's cost estimate review and opinions, including markups, the resultant estimates are within 5% of each other.

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Based on the conceptual nature of the cost estimate, our opinion is that information used to prepare the Application's cost estimate is usual and customary.

### **b. Water Supply Alternative 2: Shallow Aquifer & Fox River Alluvium**

#### **General Overview**

Alternative 2 will use the shallow aquifer south of Waukesha for the entire water supply. This would consist of adding new wells in the Fox River alluvium and the Troy Bedrock Valley. Implementation of Alternative 2 will require the following:

- New central water treatment facility located south of Waukesha near the new shallow aquifer wells.
- Installation of fourteen (14) new shallow aquifer wells south of Waukesha near Vernon Marsh in the Troy Bedrock Valley aquifer.
- Installation of four (4) new shallow aquifer wells south of Waukesha in the Fox River alluvium aquifer.
- New pumping station for water transmission to the Hillcrest reservoir.
- Transmission pipelines to convey the water.
  - From shallow wells to new treatment facility. (22,000 lin. ft.)
  - From new treatment facility to Hillcrest pumping station. (~ 48,000 lin. ft.)
- Sludge pipeline between new water treatment facility and existing Waukesha WWTP. (~ 27,500 lin. ft.)

#### **Shallow Aquifer Water Treatment Facility**

A detailed, parametric estimate was completed by CH2M HILL for a WTP for the shallow aquifer water wells. Commentary on the estimate details is as follows:

- Format and Unit Costs
  - The estimate is categorized into a standard estimating format, generally following the 16 Division, CSI format.
  - Unit costs used in the estimate are direct construction costs and do not include bonds, insurance, mobilization/demobilization, contractor overhead, contractor profit or contingency. These items are added separately on the capital cost estimate summary sheet.
  - Quantities used in the estimate were not confirmed and are assumed representative of items and quantities required for facilities described.
- Civil / Site work
  - Cost estimate for earthwork (excavation, backfill & spoils removal) for the buildings and facility structures.
  - Estimated unit pricing used for excavation and structural backfill appears to be adequate.
  - Estimated unit pricing for native backfill and hauling excess soils appears to be lower than anticipated for a conceptual estimate of this nature.
  - Reference the Vertical Turbine PS: FWPS estimate. There are several site work estimate quantity items for which the cost estimate extension has not been completed. This amounts to approximately \$180,000 of unaccounted cost.
  - Reference the Filter BW PS BWSPS estimate. There are several site work estimate quantity items for which the cost estimate extension has not been completed. This amounts to approximately \$25,000 of unaccounted cost.

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- Architectural / Structural
  - Cost estimate for concrete, buildings and miscellaneous specialties.
  - Estimated unit pricing for concrete appears to be lower than anticipated for a conceptual estimate of this nature. Potential impact could be an additional 20% to 25% costs.
  - Reference the Vertical Turbine PS: FWPS estimate. There are several concrete estimate quantity items for which the cost estimate extension has not been completed. This amounts to approximately \$700,000 of unaccounted cost.
  - Reference the Filter BW PS BWSPS estimate. There are several concrete estimate quantity items for which the cost estimate extension has not been completed. This amounts to approximately \$100,000 of unaccounted cost.
  - The masonry appears to address the enclosure of the building including walls and roof. Unit pricing used appears adequate.
  - Estimated unit pricing for metals appears to be adequate.
  - Estimated unit pricing for doors appears to be adequate.
- Process Equipment
  - Cost estimate for purchase of process equipment required for the WTP including cranes and hoists. Our assumption is that pricing for the purchase of process equipment is current and adequate, as there is not sufficient information to confirm pricing used.
  - Cost estimate for installation of the WTP process equipment. Installation of process equipment does not appear to be recognized or included in the estimate. The Deep Well WTP estimate included equipment installation based on a percentage (20%) of the cost of purchased equipment.
  - Reference the Inline Rapid Mix RMX estimate. It appears that the estimate for the 3-ton monorail hoist is high (\$57,750). Other estimates for 3-ton monorail hoists are \$3,260, which is more in line.
- Mechanical
  - Cost estimate for process piping, fittings and valves.
  - From an overall estimate standpoint, the unit pricing used for piping, fittings and valves appear adequate for this level of estimate.
  - There are several instances where the cost estimate extension has not been completed. This amounts to \$25,000 to \$50,000 of unaccounted cost.
- Electrical
  - Cost estimate for electrical equipment and installation labor and materials.
  - Cost estimates for electrical equipment (MCC sections, AFD's, level transmitters, etc.) appear to range from adequate to slightly higher (10% to 15%) than would be expected for an estimate at this phase.
  - Inclusion of cost estimates for incoming primary voltage level equipment (switchgear and power distribution) is not apparent. This may be addressed at the estimate summary level and included in the yard electrical allowance.
  - Quantities used for wire, cable and raceway appear lower than what would be expected for this level estimate.
  - Cost estimates for electrical installation are not readily apparent. It is possible this could be included in the miscellaneous items allowance or the electrical allowance used in the estimate.

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- Miscellaneous Allowances
  - Based on percentage of overall cost estimate.
  - Includes allowances for finishes, instrumentation and controls (I&C), mechanical and electrical.
  - These are allowances built into CH2M HILL's Parametric Estimate. There is not sufficient information to review or provide commentary.
- Additional Project Cost Allowances
  - Demolition. Additional cost estimate for demolition was not included.
  - Overall site work. An allowance of 10% of the project cost sub-total was included for site work related items. The assumption is that this would include demolition of site structures, roads, access drives, parking, site grading, fencing and landscaping. Our assumption is that the 10% allowance is adequate, as there is not sufficient information to confirm physical size of site or layouts for work scope.
  - Plant Computer System. An allowance of 5% of the project cost sub-total was included for computer, data gathering, and remote monitoring equipment related items. Our assumption is that the 5% allowance is adequate, as there is not sufficient information to confirm actual requirements or work scope.
  - Yard Electrical. An allowance of 7% of the project cost sub-total was included for electrical switchyard related items. The assumption is that this would include electrical distribution equipment to include incoming metering, primary distribution transformers, power cabling and raceways. Our assumption is that the 7% allowance is adequate, as there is not sufficient information to confirm actual requirements or work scope.
  - Yard Piping. An allowance of 14% of the project cost sub-total was included for yard piping related items. The assumption is that this would include underground connecting pipelines for the process work. Our assumption is that the 14% allowance is adequate, as there is not sufficient information to confirm actual requirements or work scope.

**Shallow Aquifer Well Field – Troy Bedrock Valley / Vernon Marsh**

A total of fourteen (14) shallow aquifer wells are anticipated. Limited estimate information is available in the Application. The estimate summary for the Shallow Water Aquifer Well Field(s) includes:

- Allowance for land acquisition of \$160,000 per well site.
  - The location of the shallow aquifer wells is south of the City of Waukesha in what appears to be open farm fields.
  - Based on current analysis of land prices in this area, the \$160,000 would allow the purchase of up to 16-acres of land per site if located in open farmland. If some well sites are in more urban areas, the size of property may be significantly reduced.
- Allowance for drilling well and building pump house of \$300,000 per well site.
  - Assuming a well depth of 200 feet and an approximate pump house size of 400 square feet, the allowance included appears to be adequate for drilling the well and building the pump house.
- Allowance of \$1,394,000 for site work (\$750,000) and electrical utility work (\$644,000) for all well sites (14 total).
  - Site work for each well site is anticipated to be minimal. Site requirements could include site grading, paving, parking, fencing and landscaping. Based on these assumptions, the \$750,000 allowance appears to be adequate.
  - Electrical utility work for each well site is anticipated to include providing 480V power to each site to power the water pump, lighting and other electrical needs. Assuming that a power source is located within 1,000 feet of the well site, the \$644,000 allowance appears to be adequate.

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- Allowance of \$4,970,400 for interconnecting piping for all well sites.
  - Assumption is that this is the water pipeline connecting the 14 well sites to the Shallow Aquifer Central Water Treatment facility. Approximate length of this pipeline is 22,000.
  - Based on preliminary routing of pipeline, it appears the estimate cost allowance is adequate for this pipeline.

### **Shallow Aquifer Well Field – Fox River Alluvium**

A total of four (4) shallow aquifer wells are anticipated. Limited estimate information is available in the Application. The estimate summary for the Shallow Water Aquifer Well Field(s) includes:

- Allowance for land acquisition of \$250,000 per well site.
  - The location of the shallow aquifer wells is south of the City of Waukesha in what appears to be open fields, though closer to urban development.
  - Based on current analysis of land prices in this area, the \$250,000 should be adequate to allow the purchase of land for these well sites.
- Allowance for drilling well and building pump house of \$700,000 per well site.
  - This allowance is significantly higher than for the well sites in the Troy Bedrock Valley / Vernon Marsh areas.
  - Assuming that well depths may be greater, and possibly access to sites may be the reason for higher estimated cost for these wells.
- Allowance of \$495,000 for site work and electrical utility work for all well sites (4 total).
  - Site work for each well site is anticipated to be minimal. Site requirements could include site grading, paving, parking, fencing and landscaping.
  - Electrical utility work for each well site is anticipated to include providing 480V power to each site to power the water pump, lighting and other electrical needs. Assuming that a power source is located within 1,000 feet of the well site.
  - The exact breakdown of the allowance between site work and electrical utility work is not clear. Based on a ratio of the cost allowance from the Vernon Marsh well fields, this allowance appears adequate for the site work and electrical utility work.
- Allowance of \$715,200 for interconnecting piping for all well sites
  - Assumption is that this is the water pipeline connecting the four well sites to the Shallow Aquifer Central Water Treatment facility. Approximate length of this pipeline is 9,100 feet.
  - Based on preliminary routing of pipeline, it appears the estimate cost allowance is adequate for this pipeline.

### **Supply/Finished Water Pipeline to Waukesha**

The finished water pipeline is approximately eleven miles of 36-inch diameter, underground pipeline that runs from the WTP to the Hillcrest Reservoir. Routing of this pipeline is shown on the Alternate 2 Overview Map and Tile Maps.

- The length of pipeline was checked by “scaling” the preliminary routing on the overview and tile maps. The pipeline length included in the cost estimate is eleven miles. “Scaling” the route maps identified nine miles of pipeline.
- Based on the satellite views of the overview and tile maps, a determination was made regarding the mix of pipeline routing for open country, low urban, medium urban, etc. Individual routing impacts, such as road crossings, creek crossings, road removal/replacement, etc. were determined.
- Pipeline unit pricing was checked. Quantities and unit pricing were then assembled to determine an overall cost estimate for comparison to the parametric cost estimate.

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- Summarizing, the Application's parametric cost estimate is higher than the cost estimate determined with this check by approximately 12%. However, this would tend to fall into the accuracy level range of a conceptual estimate such as this due to the preliminary quantities, the unit pricing and subjective determination of categorization of quantities to which unit pricing is applied.

#### **Distribution System Improvements**

The Alternate No. 2 pipeline distribution system improvements do not include any back-up information regarding pipeline length, pipe sizing or pipe routing. Our assumption is that the cost estimate for the distribution system improvements follows the same estimating process as the other pipeline estimates.

#### **Wastewater Force Main**

The wastewater force main pipeline is approximately five miles of six-inch diameter, underground pipeline that runs from the WTP to the wastewater treatment plant. Routing of this pipeline is shown on the Alternate 2 Overview Map and Tile Maps.

- The length of pipeline was checked by "scaling" the preliminary routing on the overview and tile maps. The pipeline lengths aligned very closely.
- Based on the satellite views of the overview and tile maps, a determination was made regarding the mix of pipeline routing for open country, low urban, medium urban, etc. Individual routing impacts such as road crossings, creek crossings, road removal/replacement, etc. were determined.
- Pipeline unit pricing was checked. Quantities and unit pricing were then assembled to determine an overall cost estimate for comparison to the parametric cost estimate.
- Summarizing, the Application's parametric cost estimate is lower than the cost estimate determined with this check by approximately 40%. This variance is a bit higher than might be expected with a conceptual estimate such as this. However, the subjective nature of quantity determination, unit pricing and unit pricing categorization of quantities is mostly likely causing this larger variance.

#### **Summary: Alternative No. 2 - Shallow & Fox River Alluvium**

Commentary regarding the Alternatives will be similar, as cost information and assumptions used to develop the estimates overlaps all of the Alternatives. A general overview of the comments regarding the cost estimate review of Alternative No. 2:

- Land cost used in the cost estimates generally align with pricing that Boldt found in researching the cost of land in the areas noted by Alternative No. 2.
- Unit cost used in the water treatment plant estimates can be considered usual and customary. Earthwork and concrete unit pricing appear to be lower than anticipated. Some mechanical and electrical unit pricing appears to be higher than anticipated.
- Within the water treatment plant estimates, a number of line items that have quantities and unit pricing identified, but the cost estimate extension was not completed. This amounts to some significant estimate line item costs being unaccounted. The overall value of these un-extended items does not amount to a significant impact to the overall estimate.
- The cost review of the pipeline estimates for this alternative was based on the preliminary routing of the pipelines, along with a subjective determination of the productivity mix associated with the routing. It is our opinion that the cost estimates for the pipeline installation for this alternative can be considered usual and customary for this level of estimate.
- Mark-ups applied to the construction cost estimates were reviewed and found to be in general alignment with Boldt's opinion for mark-up percentages. The overall mark-up amounts were very close, however, the percentage splits varied.

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Comparing the Application's total project capital cost estimate for Alternative No. 2 with Boldt's cost estimate review and opinions, including markups, the resultant estimates are within 3% of each other. Based on the conceptual nature of the cost estimate, our opinion is that information used to prepare the Application's cost estimate is usual and customary.

**c. Water Supply Alternative 3: Lake Michigan and Shallow Aquifer**

**General Overview**

Alternative 3 will use water supplied from a Lake Michigan water utility and the shallow aquifer south of Waukesha for the entire water supply. Implementation of Alternative 3 will require the following:

- Shallow Aquifer Water Supply (Note: The shallow aquifer water supply is the same as in Alternative No. 1).
  - New central water treatment facility located south of Waukesha near the new shallow aquifer wells.
  - Installation of fourteen (14) new shallow aquifer wells south of Waukesha near Vernon Marsh in the Troy Bedrock Valley aquifer.
  - Transmission pipelines to convey the water from shallow aquifer wells.
    - From shallow wells to new central water treatment facility. (22,000 lin. ft.)
    - From new central water treatment facility to Hillcrest pumping station. (~ 48,000 lin. ft. )
    - Sludge pipeline between new central water treatment facility and existing Waukesha WWTP. (~ 27,500 lin. ft.)
- Lake Michigan Water Supply.
  - Transmission pipeline from Lake Michigan water supply to Hillcrest Reservoir (~71,000 lin. ft.). The Application estimate is using Alternative 3A-1: Milwaukee Supply as basis.
  - Booster pump station (Parkway) for Lake Michigan transmission pipeline.
  - Transmission pipelines to distribute water through the City.
  - Transmission pipeline to return water to Lake Michigan watershed via Underwood Creek. The Application is using Alternative 3B-1: Underwood Creek as basis.
  - Return water pump station for Underwood Creek transmission.

**Shallow Aquifer Water Supply**

The shallow aquifer water supply system is the same as in Alternative No. 1. The shallow aquifer water supply system consists of the shallow aquifer water treatment plant, the shallow aquifer well field, the shallow aquifer supply pipeline between the water treatment plant and the Hillcrest reservoir, and the wastewater force main between the water treatment plant and the wastewater treatment plant.

**Distribution System Improvements**

The distribution system improvements, similar to Alternative No. 1, include approximately five (5) miles of 16-inch and 20-inch diameter, underground pipeline. Actual location and routing of this pipeline is not clear on the Alternate 3 Overview Map(s).

- An arbitrary and subjective determination was made regarding the mix of pipeline routing for open country, low urban, medium urban, etc. Individual routing impacts such as road crossings, creek crossings, road removal/replacement, etc. were also arbitrary and subjective.
- Pipeline unit pricing was checked. Quantities and unit pricing were then assembled to determine an overall cost estimate for comparison to the parametric cost estimate.
- Summarizing, the Application's parametric cost estimate is higher than the cost estimate determined with this check by approximately 12%. However, this would tend to fall into the

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accuracy level range of a conceptual estimate such as this due to the preliminary quantities, the unit pricing and subjective determination of categorization of quantities to which unit pricing is applied.

### **Lake Michigan Water Supply Pipeline (3A-1)**

The Lake Michigan water supply pipeline is approximately thirteen-and-a-half (13.5) miles of 24-inch diameter, underground pipeline that runs from the corner of 60<sup>th</sup> and Howard to the Hillcrest Reservoir. Routing of this pipeline is shown on the Alternate 3A-1 Overview Map and Tile Maps.

- On October 25, 2011, representatives from Boldt, DNR and PSC walked the utility corridors in which a portion of the water supply pipeline is currently being considered for routing.
- Access into the utility corridors appears to be fairly good. Aside from the main streets crossing the corridor, there are other access points along the corridor from other utilities and private land owners. The current assumption is that easements or access will be available through negotiations with the entities owning the property required for access.
- Available room for installation of the pipeline(s) varies along the utility corridors. Portions of the corridor are very congested with underground electrical utilities, below grade tower foundations and above ground height restrictions. With the limited information available on pipeline routing, depths, access, etc., our opinion is that the utility corridors provide a reasonable path for the routing of the pipeline.
- The length of pipeline was checked by “scaling” the preliminary routing on the overview and tile maps. The pipeline length included in the cost estimate is 13.5 miles. “Scaling” confirmed this amount.
- Based on the satellite views of the overview and tile maps, a determination was made regarding the mix of pipeline routing for open country, low urban, medium urban, etc. Individual routing impacts such as road crossings, creek crossings, road removal/replacement, etc. were determined.
- Pipeline unit pricing was checked. Quantities and unit pricing were then assembled to determine an overall cost estimate for comparison to the parametric cost estimate.

### **Parkway Booster Pump Station**

A detailed, parametric estimate was completed by CH2M HILL for the booster pump station for the Lake Michigan water supply pipeline under Alternative No. 4. The cost estimate allowance for the Alternative No. 3 booster pump station is approximately 60% of the Alternative No. 4 booster pump station cost estimate. A rough comparison of the cost estimates can be made using the Lake Michigan water supply water flow rates (Alternative No. 3 = 4.5 mgd; Alternative No. 4 = 10.9 mgd). Extrapolating the cost estimate using an exponential seven-tenths factor can be made as follows:

- Alternative No. 3 Pump Station. Ratio of  $(4.5/10.9)^{.70} \times \$8,573,000 = \$4,615,000$ .

Factoring the capacity ratio recognizes that certain costs, i.e. site work, may remain constant as the booster pump station capacity decreases. This extrapolated comparison indicates the cost estimate for the Alternative No. 3 booster pump station appears adequate.

### **Underwood Creek Return Flow Pipeline (3B-1)**

The Underwood Creek return flow pipeline is approximately eleven (11.4) miles of 24-inch diameter, underground pipeline that runs from the WWTP to Underwood Creek. Routing of this pipeline is shown on the Alternate 3B-1 Overview Map and Tile Maps. Please reference the commentary above under Lake Michigan Water Supply Pipeline, as the Underwood Creek Return Flow Pipeline has similar routing.

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**WWTP Effluent Pump Station**

A detailed, parametric estimate was completed by CH2M HILL for the WWTP effluent pump station for the Lake Michigan water supply pipeline under Alternative No. 4. The cost estimate allowance for the Alternative No. 3 effluent pump station is approximately 60% of the Alternative No. 4 effluent pump station cost estimate. A rough comparison of the cost estimates can be made using the Lake Michigan water supply water flow rates (Alternative No. 3 = 4.5 mgd; Alternative No. 4 = 10.9 mgd). Extrapolating the cost estimate using an exponential (7/10) factor can be made as follows:

- Alternative No. 3 Pump Station. Ratio of  $(4.5/10.9)^{70} \times \$3,508,000 = \$1,888,000$ .

Factoring the capacity ratio recognizes that certain costs, i.e., site work, may remain constant as the booster pump station capacity decreases. This extrapolated comparison indicates the cost estimate for the Alternative No. 3 effluent pump station appears adequate.

**Summary: Alternative No. 3 - Lake Michigan and Shallow Aquifers**

Commentary regarding of the Alternatives will be similar, as cost information and assumptions used to develop the estimates overlaps all of the Alternatives. A general overview of the comments regarding the cost estimate review of Alternative No. 3:

- Land cost used in the cost estimates generally align with pricing that Boldt found in researching the cost of land in the areas noted by Alternative No. 3.
- Unit cost used in the water treatment plant estimates can be considered usual and customary. Earthwork and concrete unit pricing appear to be lower than anticipated. Some mechanical and electrical unit pricing appears to be higher than anticipated.
- Within the water treatment plant estimates, a number of line items that have quantities and unit pricing identified, but the cost estimate extension was not completed. This amounts to some significant estimate line item costs being unaccounted. The overall value of these un-extended items does not amount to a significant impact to the overall estimate.
- On October 25, 2011, Boldt and representatives from the DNR and PSC walked the utility corridors in which a portion of the water supply pipeline is currently being considered for routing. As noted in the detailed commentary above, access into the utility corridor appears to be fairly good. Congestion along the corridor, both overhead and underground, is evident to varying degrees. Our opinion is that, based on preliminary information, the utility corridors provide a reasonable path for the pipeline routing.
- The cost review of the pipeline estimates for this alternative was based on the preliminary routing of the pipelines, along with a subjective determination of the productivity mix associated with the routing. It is our opinion that the cost estimates for the pipeline installation for this alternative can be considered usual and customary for this level of estimate.
- Mark-ups applied to the construction cost estimates were reviewed and found to be in general alignment with Boldt's opinion for mark-up percentages. The overall mark-up amounts were very close, however the percentage splits varied.

Comparing the Application's total project capital cost estimate for Alternative No. 3 with Boldt's cost estimate review and opinions, including markups, the resultant estimates are within 4% of each other. Based on the conceptual nature of the cost estimate, our opinion is that information used to prepare the Application's cost estimate is usual and customary.

#### **d. Water Supply Alternative 4: Lake Michigan Water Supply via Milwaukee**

##### **General Overview**

Alternative 4 will use water supplied from Lake Michigan via a connection to Milwaukee's water system at a large transmission main near 60<sup>th</sup> Street and Howard Avenue. Implementation of Alternative 4 will require the following:

- Transmission pipeline from Lake Michigan water supply to Hillcrest Reservoir (~71,000 lin. ft.). The Application estimate is using Alternative 3A-1: Milwaukee Supply as basis.
- Booster pump station (Parkway) for Lake Michigan transmission pipeline
- Transmission pipelines to distribute water through City
- Transmission pipeline to return water to Lake Michigan watershed from the Waukesha wastewater treatment plan to Underwood Creek. The Application is using Alternative 3B-1: Underwood Creek as basis.
- Return water pump station for Underwood Creek transmission

##### **Lake Michigan Water Supply Pipeline (3A-1)**

The Lake Michigan water supply pipeline is approximately eleven (11) miles of 36-inch diameter, underground pipeline that runs from the corner of 60<sup>th</sup> and Howard to the Hillcrest Reservoir. Routing of this pipeline is shown on the Alternate 3A-1 Overview Map and Tile Maps.

- On October 25, 2011, representatives from Boldt, DNR and PSC walked the utility corridors in which a portion of the water supply pipeline is currently being considered for routing.
- Access into the utility corridors appears to be fairly good. Aside from the main streets crossing the corridor, there are other access points along the corridor from other utilities and private land owners. The current assumption is that easements or access will be available through negotiations with the entities owning the property required for access.
- Available room for installation of the pipeline(s) varies along the utility corridors. Portions of the corridor are very congested with underground electrical utilities, below grade tower foundations and above ground height restrictions. With the limited information available on pipeline routing, depths, access, etc., our opinion is that the utility corridors provide a reasonable path for the routing of the pipeline.
- The length of pipeline was checked by "scaling" the preliminary routing on the overview and tile maps. The pipeline length included in the cost estimate is 11 miles. "Scaling" the route maps identified nine miles of pipeline.
- Based on the satellite views of the overview and tile maps, a determination was made regarding the mix of pipeline routing for open country, low urban, medium urban, etc. Individual routing impacts such as road crossings, creek crossings, road removal/replacement, etc. were determined.
- Pipeline unit pricing was checked. Quantities and unit pricing were then assembled to determine an overall cost estimate for comparison to the parametric cost estimate.

##### **Parkway Booster Pump Station**

A detailed, parametric estimate was completed by CH2MHill for a booster pump station for the Lake Michigan water supply pipeline. Commentary on the estimate details is as follows:

- Format and Unit Costs
  - The estimate is categorized into a standard estimating format, generally following the 16 division, CSI format.

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- Unit costs used in the estimate are direct construction costs and do not include bonds, insurance, mobilization/demobilization, contractor overhead, contractor profit or contingency. These items are added separately on the capital cost estimate summary sheet.
- Quantities used in the estimate were not confirmed and are assumed representative of items and quantities required for facilities described.
- Overall booster pump station estimate assessment:
  - Unit pricing for civil, structural, architectural, mechanical, electrical and process is generally the same as used in the Alternate 1 and Alternate 2 treatment plant estimates.
  - There are several site work estimate quantity items for which cost extensions have not been carried through. This amounts to approximately \$35,000 of unaccounted cost.
  - There are several concrete estimate quantity items for which cost extensions have not been carried through. This amounts to approximately \$120,000 of unaccounted cost.
  - The cost for the 655,000 gallon steel forebay tank appears to have been left out of the estimate. This amounts to approximately \$280,000 of unaccounted cost.
  - Miscellaneous allowances, based on percentage of overall cost estimate, for finishes, instrumentation and controls (I&C), mechanical and electrical are built into CH2MHILL's Parametric Estimate. There is not sufficient information to review or provide commentary.
- Additional Project Cost Allowances
  - The WTP estimates in Alternates 1 and 2 included a summary sheet with addressed additional project cost allowances for demolition, site work, computer system, yard electrical and yard piping.
  - The booster pump estimate does not include any of these allowances. Should some or all of these additional project cost allowances be included in the booster pump estimate?

### **Distribution System Improvements**

The distribution system improvements include approximately five (5) miles of 16-inch and 20-inch diameter, underground pipeline. Actual location and routing of this pipeline is not clear on the Alternate 3 Overview Map(s).

- An arbitrary and subjective determination was made regarding the mix of pipeline routing for open country, low urban, medium urban, etc. Individual routing impacts such as road crossings, creek crossings, road removal/replacement, etc. were also arbitrary and subjective.
- Pipeline unit pricing was checked. Quantities and unit pricing were then assembled to determine an overall cost estimate for comparison to the parametric cost estimate.
- Summarizing, the Application's parametric cost estimate is higher than the cost estimate determined with this check by approximately 12%. However, this would tend to fall into the accuracy level range of a conceptual estimate such as this due to the preliminary quantities, the unit pricing and subjective determination of categorization of quantities to which unit pricing is applied.

### **Underwood Creek Return Flow Pipeline (3B-1)**

The Underwood Creek return flow pipeline is approximately eleven (11) miles of 36-inch diameter, underground pipeline that runs from the WWTP to Underwood Creek. Routing of this pipeline is shown on the Alternate 3B-1 Overview Map and Tile Maps. Please reference the commentary above under Lake Michigan Water Supply Pipeline as the Underwood Creek Return Flow Pipeline has similar routing.

### **WWTP Effluent Pump Station**

A detailed, parametric estimate was completed by CH2MHill for the WWTP effluent pump station for the Underwood Creek return flow pipeline. Commentary on the estimate details is as follows:

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- Format and Unit Costs
  - The estimate is categorized into a standard estimating format, generally following the 16 division, CSI format.
  - Unit costs used in the estimate are direct construction costs and do not include bonds, insurance, mobilization/demobilization, contractor overhead, contractor profit or contingency. These items are added separately on the capital cost estimate summary sheet.
  - Quantities used in the estimate were not confirmed and are assumed representative of items and quantities required for facilities described.
- Overall effluent pump station estimate assessment:
  - Unit pricing for civil, structural, architectural, mechanical, electrical and process is generally the same as used in the Alternate 1 and Alternate 2 treatment plant estimates.
  - Miscellaneous allowances, based on percentage of overall cost estimate, for finishes, instrumentation and controls (I&C), mechanical and electrical are built into CH2MHILLI's Parametric Estimate. There is not sufficient information to review or provide commentary.
- Additional Project Cost Allowances
  - The WTP estimates in Alternates 1 and 2 included a summary sheet which addressed additional project cost allowances for demolition, site work, computer system, yard electrical and yard piping.
  - The effluent pump station estimate does not include any of these allowances. Should some or all of these additional project cost allowances be included in the booster pump estimate?

### **Summary: Alternative No. 4 - Lake Michigan**

Commentary regarding of the Alternatives will be similar, as cost information and assumptions used to develop the estimates overlaps all of the Alternatives. A general overview of the comments regarding the cost estimate review of Alternative No.4:

- Unit cost used in the pump station estimates can be considered usual and customary. Earthwork and concrete unit pricing appear to be lower than anticipated. Some mechanical and electrical unit pricing appears to be higher than anticipated.
- Within the pump station estimates, several line items have quantities and unit pricing identified, but the cost estimate extension was not completed. This amounts to some significant estimate line item costs being unaccounted. The overall value of these un-extended items does not amount to a significant impact to the overall estimate.
- On October 25, 2011, Boldt and representatives from the DNR and PSC walked the utility corridors in which a portion of the water supply pipeline is currently being considered for routing. As noted in the detailed commentary above, access into the utility corridor appears to be fairly good. Congestion along the corridor, both overhead and underground, is evident to varying degrees. Our opinion is that, based on preliminary information, the utility corridors provide a reasonable path for the pipeline routing.
- The cost review of the pipeline estimates for this alternative was based on the preliminary routing of the pipelines, along with a subjective determination of the productivity mix associated with the routing. It is our opinion that the cost estimates for the pipeline installation for this alternative can be considered usual and customary for this level of estimate.
- Mark-ups applied to the construction cost estimates were reviewed and found to be in general alignment with Boldt's opinion for mark-up percentages. The overall mark-up amounts were very close, however, the percentage splits varied.

Comparing the Application's total project capital cost estimate for Alternative No. 4 with Boldt's cost estimate review and opinions, including markups, the resultant estimates vary by approximately 12%, with Boldt's cost estimate opinion be lower than the Application's cost estimate. This variance is greater than

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in the other alternatives. However, due to the preliminary quantities, the unit pricing and subjective determination of categorization of quantities to which unit pricing is applied, our opinion is that this tends to fall within an accuracy level range anticipated for a conceptual estimate such as this.

### **e. Water Supply Alternative 5: Lake Michigan Water Supply via Oak Creek**

#### **General Overview**

For ease of reference, this report has assigned Alternative 5 to reference water supplied from Lake Michigan via a connection to Oak Creek's water system near the intersection of Ryan Road and 5<sup>th</sup> Street in Oak Creek. Implementation of Alternative 5 will require the following:

- Transmission pipeline from Lake Michigan Oak Creek water supply to Hillcrest Reservoir. The Application estimate is using Alternative 3A-3: Oak Creek Supply as basis.
- Oak Creek WTP Supply Station
- Booster pump station (Greenfield Park) for Lake Michigan transmission pipeline
- Transmission pipelines to distribute water through City
- Transmission pipeline to return water to Lake Michigan watershed from the Waukesha wastewater treatment plant to Underwood Creek. The Application is using Alternative 3B-1: Underwood Creek as basis.
- Return water pump station for Underwood Creek transmission

#### **Lake Michigan Water Supply Pipeline (3A-3)**

The Lake Michigan water supply pipeline is approximately twenty-seven (27) miles of 36-inch diameter, underground pipeline that runs from Oak Creek to the Hillcrest Reservoir. Routing of this pipeline is shown on the Alternate 3A-3 Overview Map and Tile Maps.

- The length of pipeline was checked by "scaling" the preliminary routing on the overview and tile maps. The pipeline length included in the cost estimate is 27 miles. "Scaling" the route maps identified 25 miles of pipeline.
- The satellite views of the overview and tile maps were used to determine the mix of pipeline routing for open country, low urban, medium urban, etc. Individual routing impacts such as road crossings, creek crossings, road removal/replacement, etc. were determined.
- Utility corridor access is the same as noted under Alternative No. 4 – Lake Michigan Water Supply via Milwaukee.
- Installation of the pipeline(s) through the utility corridors is the same as noted under Alternative No. 4 – Lake Michigan Water Supply via Milwaukee.
- Pipeline unit pricing was checked. Quantities and unit pricing were then assembled to determine an overall cost estimate for comparison to the parametric cost estimate.

#### **Oak Creek WTP Supply Station**

A detailed, parametric estimate was completed by CH2M HILL for a pump station for Alternative No. 4 – Lake Michigan Water Supply via Milwaukee. Using this as the basis for evaluation for the Oak Creek WTP Supply Station, the cost estimate used by the Application appears to be higher than that indicated using the factoring method below.

- Oak Creek WTP Supply Station. Ratio of  $(18.5/10.9)^{.70} \times \$3,508,000 = \$5,100,000$

#### **Greenfield Park Booster Pump Station**

A detailed, parametric estimate was completed by CH2M HILL for the Parkway booster pump station for Alternative No. 4 – Lake Michigan Water Supply via Milwaukee. Using this as the basis for evaluation for

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the Oak Creek Greenfield Park Booster Pump Station, the cost estimate used by the Application appears to be lower than that indicated using the factoring method below.

- Greenfield Park Booster Pump Station. Ratio of  $(18.5/10.9)^{.70} \times \$8,573,000 = \$12,415,000$

In the Application, the total estimated cost for the Oak Creek Pump Stations is \$17,960,000. Combining the factored comparisons above equates to an estimated cost of \$17,515,000. This comparison indicates that the Application's estimate for the total appears adequate for the Oak Creek Pump Stations.

**Distribution System Improvements**

The distribution system improvements for Alternative No. 5 - Oak Creek Water Supply are assumed to be the same as for Alternative No. 4 - Milwaukee Water Supply. Please reference commentary under Alternative No. 4.

**Underwood Creek Return Flow Pipeline (3B-1)**

The Underwood Creek return flow pipeline is approximately eleven (11) miles of 36-inch diameter, underground pipeline that runs from the Waukesha WWTP to Underwood Creek. Routing of this pipeline is shown on the Alternate 3B-1 Overview Map and Tile Maps. Please reference the commentary under Alternative No. 4 - Lake Michigan Water Supply since the Underwood Creek Return Flow Pipeline has similar routing.

**WWTP Effluent Pump Station**

A detailed, parametric estimate was completed by CH2MHill for the WWTP effluent pump station for the Underwood Creek return flow pipeline. Please reference commentary under Alternative No. 4 for further details.

**Summary: Alternative No. 5 - Lake Michigan Water Supply via Oak Creek**

Commentary regarding of the Alternatives will be similar, as cost information and assumptions used to develop the estimates overlaps all of the Alternatives. A general overview of the comments regarding the cost estimate review of Alternative No.5:

- Unit cost used in the pump station estimates can be considered usual and customary. Earthwork and concrete unit pricing appear to be lower than anticipated. Some mechanical and electrical unit pricing appears to be higher than anticipated.
- Within the pump station estimates, several line items have quantities and unit pricing identified, but the cost estimate extension was not completed. This amounts to some significant estimate line item costs being unaccounted. The overall value of these un-extended items does not amount to a significant impact to the overall estimate.
- On October 25, 2011, Boldt and representatives from the DNR and PSC walked the utility corridors in which a portion of the water supply pipeline is currently being considered for routing. As noted in the detailed commentary above, access into the utility corridor appears to be fairly good. Congestion along the corridor, both overhead and underground, is evident to varying degrees. Our opinion is that, based on preliminary information, the utility corridors provide a reasonable path for the pipeline routing.
- The cost review of the pipeline estimates for this alternative was based on the preliminary routing of the pipelines, along with a subjective determination of the productivity mix associated with the routing. It is our opinion that the cost estimates for the pipeline installation for this alternative can be considered usual and customary for this level of estimate.
- Mark-ups applied to the construction cost estimates were reviewed and found to be in general alignment with Boldt's opinion for mark-up percentages. The overall mark-up amounts were very close, however, the percentage splits varied.

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Comparing the Application's total project capital cost estimate for Alternative No. 5 Oak Creek Water Supply with Boldt's cost estimate review and opinions, including markups, the resultant estimates vary by approximately 15%, with Boldt's cost estimate opinion be lower than the Application's cost estimate. This variance is greater than in the other alternatives. However, due to the preliminary quantities, the unit pricing and subjective determination of categorization of quantities to which unit pricing is applied, our opinion is that this tends to fall within an accuracy level range anticipated for a conceptual estimate such as this.

**f. Water Supply Alternative 6: Lake Michigan Water Supply via Racine**

**General Overview**

For ease of reference, this report has assigned Alternative 6 to reference water supplied from Lake Michigan via a connection to Racine's water system near the intersection of Spring Road and Newman Avenue in Racine. Implementation of Alternative 6 will require the following:

- Transmission pipeline from Lake Michigan Racine water supply to Hillcrest Reservoir. The Application estimate is using Alternative 3A-4: Racine Supply as basis.
- Newman Avenue Supply Station
- Booster pump station (Eight Mile Road) for Lake Michigan transmission pipeline
- Transmission pipelines to distribute water through City
- Transmission pipeline to return water to Lake Michigan watershed from the Waukesha wastewater treatment plan to Underwood Creek. The Application is using Alternative 3B-1: Underwood Creek as basis.
- Return water pump station for Underwood Creek transmission

**Lake Michigan Water Supply Pipeline (3A-4)**

The Lake Michigan water supply pipeline is approximately thirty-nine (39) miles of 36-inch and 42-inch diameter, underground pipeline that runs from Racine to the Hillcrest Reservoir. Routing of this pipeline is shown on the Alternate 3A-4 Overview Map and Tile Maps.

- The length of pipeline was checked by "scaling" the preliminary routing on the overview and tile maps. The pipeline length included in the cost estimate is 39 miles. "Scaling" the route maps identified 39 miles of pipeline.
- The satellite views of the overview and tile maps were used to determine the mix of pipeline routing for open country, low urban, medium urban, etc. Individual routing impacts such as road crossings, creek crossings, road removal/replacement, etc. were determined.
- Utility corridor access is the same as noted under Alternative No. 4 – Lake Michigan Water Supply via Milwaukee.
- Installation of the pipeline(s) through the utility corridors is the same as noted under Alternative No. 4 – Lake Michigan Water Supply via Milwaukee.
- Pipeline unit pricing was checked. Quantities and unit pricing were then assembled to determine an overall cost estimate for comparison to the parametric cost estimate.

**Racine Pump Stations**

Two (2) pumping stations are estimated for the Racine Water Supply. One is located on Newman Avenue. The other is located on Eight Mile Road. Please reference Alternative No. 5 – Lake Michigan Water Supply via Oak Creek for description of similar pump stations. In the Application, the total estimated cost for the Racine Pump Stations is \$17,061,000. The factored comparisons used in

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Alternative No. 5 equates to an estimated cost of \$17,515,000. This comparison indicates that the Application's estimate for the total appears adequate for the Racine Pump Stations.

### **Distribution System Improvements**

The distribution system improvements for Alternative No. 6 - Racine Water Supply are assumed to be the same as for Alternative No. 4 - Milwaukee Water Supply. Please reference commentary under Alternative No. 4.

### **Underwood Creek Return Flow Pipeline (3B-1)**

The Underwood Creek return flow pipeline is approximately eleven (11) miles of 36-inch diameter, underground pipeline that runs from the Waukesha WWTP to Underwood Creek. Routing of this pipeline is shown on the Alternate 3B-1 Overview Map and Tile Maps. Please reference the commentary under Alternative No. 4 - Lake Michigan Water Supply since the Underwood Creek Return Flow Pipeline has similar routing.

### **WWTP Effluent Pump Station**

A detailed, parametric estimate was completed by CH2MHill for the WWTP effluent pump station for the Underwood Creek return flow pipeline. Please reference commentary under Alternative No. 4 for further details.

### **Summary: Alternative No. 6 - Lake Michigan Water Supply via Racine**

Commentary regarding of the Alternatives will be similar, as cost information and assumptions used to develop the estimates overlaps all of the Alternatives. A general overview of the comments regarding the cost estimate review of Alternative No.6:

- Unit cost used in the pump station estimates can be considered usual and customary. Earthwork and concrete unit pricing appear to be lower than anticipated. Some mechanical and electrical unit pricing appears to be higher than anticipated.
- Within the pump station estimates, several line items have quantities and unit pricing identified, but the cost estimate extension was not completed. This amounts to some significant estimate line item costs being unaccounted. The overall value of these un-extended items does not amount to a significant impact to the overall estimate.
- On October 25, 2011, Boldt and representatives from the DNR and PSC walked the utility corridors in which a portion of the water supply pipeline is currently being considered for routing. As noted in the detailed commentary above, access into the utility corridor appears to be fairly good. Congestion along the corridor, both overhead and underground, is evident to varying degrees. Our opinion is that, based on preliminary information, the utility corridors provide a reasonable path for the pipeline routing.
- The cost review of the pipeline estimates for this alternative was based on the preliminary routing of the pipelines, along with a subjective determination of the productivity mix associated with the routing. It is our opinion that the cost estimates for the pipeline installation for this alternative can be considered usual and customary for this level of estimate.
- Mark-ups applied to the construction cost estimates were reviewed and found to be in general alignment with Boldt's opinion for mark-up percentages. The overall mark-up amounts were very close, however, the percentage splits varied.

Comparing the Application's total project capital cost estimate for Alternative No. 6 Racine Water Supply with Boldt's cost estimate review and opinions, including markups, the resultant estimates vary by approximately 22%, with Boldt's cost estimate opinion be lower than the Application's cost estimate. This variance is greater than in the other alternatives. The main variance is in the estimate for the Racine

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pipeline route. It is anticipated that factors used to address the preliminary quantities, the unit pricing, installation difficulty and subjective determination of categorization of quantities to which unit pricing is applied has resulted in this variance. In our opinion, the variance in the estimates are on the higher side, but would tend to fall within an accuracy level range anticipated for a conceptual estimate such as this.

**g. Water Supply Alternative 7: River Bank Inducement (RBI) Wells**

**General Overview**

Alternative 7 will use the shallow wells along the Fox River south of Waukesha. This is similar to Alternative Nos. 1 and 2. Implementation of Alternative 7 will require the following:

- New shallow aquifer water treatment facility (6.8 mgd) located south of Waukesha in the same location as Alternative Nos. 1 and 2.
- Installation of ten (10) new shallow aquifer wells along the Fox River south of Waukesha.
- Transmission pipelines to convey the water.
  - From shallow wells to new treatment facility. (24,000 lin. ft.)
  - From new treatment facility to Hillcrest pumping station. (~ 48,000 lin. ft.)
- Sludge pipeline between new water treatment facility and existing Waukesha WWTP. (~ 27,500 lin. ft.)

**Shallow Aquifer Treatment Plant**

A detailed, parametric estimate was completed by CH2M HILL for a 10.9 mgd water treatment plant. In Boldt's review of that estimate, it was discovered that approximately \$1,250,000 should be added for productivity and missing quantity/unit price extensions. The anticipated capacity of the RBI water treatment plant is 6.8 mgd. Extrapolating the adjusted cost estimate using an exponential (7/10) factor can be made as follows:

- RBI Water Treatment Plant. Ratio of  $(10.9/6.8)^{70} \times \$29,114,000 = \$20,925,000$ 

<u>Land Acquisition (constant)</u>	<u>\$ 2,000,000</u>
Total Extrapolated Comparison	\$22,925,000

Factoring the capacity ratio recognizes that certain costs, i.e., site work, may remain constant as the water treatment plant capacity decreases. Land cost is assumed to be constant. This extrapolated comparison indicates the cost estimate used for the RBI water treatment plant is within accuracy range anticipated for this level estimate.

**Shallow Aquifer Well Field**

A total of ten (10) shallow aquifer wells are anticipated. The RBI cost estimate used information developed by CH2MHILL as basis for the RBI alternative.

- Allowance for land acquisition of \$160,000 per well site.
  - The location of the shallow aquifer wells is south of the City of Waukesha along the Fox River, potentially in urban areas.
  - Based on current analysis of land prices in this area, an allowance of \$250,000/well site may be more appropriate than the \$160,000 included in the estimate.
- Allowance for drilling well and building pump house of \$255,000 per well site.
  - Assuming a well depth of 150 feet and an approximate pump house size of 400 square feet, the allowance included appears to be about \$100,000 low based on our analysis.

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- Allowance of \$995,000 for site work and electrical utility work for all well sites appears to be adequate.
- Allowance of \$1,788,000 for interconnecting piping for all well sites.
  - Our analysis indicates the estimate for interconnecting piping for all well sites should be closer to \$3,200,000.
  - Pipeline routing is preliminary and appears to run through urban areas and areas close to the river. Our recommendation is to increase the amount of the cost estimate.

### **Supply/Finished Water Pipeline to Waukesha**

The finished water pipeline is approximately eleven (11) miles of 20-inch diameter, underground pipeline that runs from the WTP to the Hillcrest Reservoir. Preliminary routing of the pipeline is shown on the Alternate 1 Overview Map and Tile Maps.

- The length of pipeline was checked by “scaling” the preliminary routing on the overview and tile maps. The pipeline length included in the cost estimate is 10 miles. “Scaling” the route maps identified nine (9) miles of pipeline.
- Based on the satellite views of the overview and tile maps, a determination was made regarding the mix of pipeline routing for open country, low urban, medium urban, etc. Individual routing impacts such as road crossings, creek crossings, road removal/replacement, etc. were determined.
- Pipeline unit pricing was checked. Quantities and unit pricing were then assembled to determine an overall cost estimate for comparison to the parametric cost estimate.
- Summarizing, the Application’s parametric cost estimate is lower than the cost estimate determined with this check by approximately 10%. However, this would tend to fall into the accuracy level range of a conceptual estimate such as this due to the preliminary quantities, the unit pricing and subjective determination of categorization of quantities to which unit pricing is applied.

### **Distribution System Improvements**

The distribution system improvements include approximately five (5) miles of 16-inch and 20-inch diameter, underground pipeline. Actual location and routing of this pipeline is not clear on the Alternate 1 Overview Map.

- An arbitrary and subjective determination was made regarding the mix of pipeline routing for open country, low urban, medium urban, etc. Individual routing impacts, such as road crossings, creek crossings, road removal/replacement, etc. were also arbitrary and subjective.
- Pipeline unit pricing was checked. Quantities and unit pricing were then assembled to determine an overall cost estimate for comparison to the parametric cost estimate.
- Summarizing, the Application’s parametric cost estimate is higher than the cost estimate determined with this check by approximately 12%. However, this would tend to fall into the accuracy level range of a conceptual estimate such as this due to the preliminary quantities, the unit pricing and subjective determination of categorization of quantities to which unit pricing is applied.

### **Wastewater Force Main**

The wastewater force main pipeline is approximately five (5) miles of 6-inch diameter, underground pipeline that runs from the WTP to the wastewater treatment plant. Routing of this pipeline is shown on the Alternate 1 Overview Map and Tile Maps.

- The length of pipeline was checked by “scaling” the preliminary routing on the overview and tile maps. The pipeline lengths aligned very closely.

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- Based on the satellite views of the overview and tile maps, a determination was made regarding the mix of pipeline routing for open country, low urban, medium urban, etc. Individual routing impacts, such as road crossings, creek crossings, road removal/replacement, etc. were determined.
- Pipeline unit pricing was checked. Quantities and unit pricing were then assembled to determine an overall cost estimate for comparison to the parametric cost estimate.
- Summarizing, the Application's parametric cost estimate is lower than the cost estimate determined with this check by approximately 40%. This variance is a bit higher than might be expected with a conceptual estimate such as this. However, the subjective nature of quantity determination, unit pricing and unit pricing categorization of quantities is mostly likely causing this larger variance.

### **Summary: RBI Alternative**

Commentary regarding the Alternatives will be similar, as cost information and assumptions used to develop the estimates overlaps all of the Alternatives. A general overview of the comments regarding the cost estimate review of the RBI Alternative:

- The RBI alternative uses much of the same cost methodology, assumptions and unit costs as was used by CH2MHILL for Alternate Nos. 1 through 4.
- The cost estimate(s) for the Shallow Aquifer Water Treatment Plant appear adequate.
- The cost estimate for the Shallow Aquifer Well fields is approximately 50% lower than what our cost estimate review indicates. This difference is mainly in the cost estimate for the pipeline.
- The cost estimates for the supply pipeline to the Hillcrest reservoir, the distribution system improvements and the wastewater force main are approximately 6% lower than what our cost review indicates.
- Mark-ups applied to the construction cost estimates were reviewed and found to be in general alignment with Boldt's opinion for mark-up percentages. The overall mark-up amounts were very close, however, the percentage splits varied.

Comparing the RBI total project capital cost estimate with Boldt's cost estimate review and opinions, including markups, the resultant estimates are within 6% of each other. Based on the conceptual nature of the cost estimate, our opinion is that information used to prepare the RBI's cost estimate is usual and customary.

## **h. Alternative 8: Return Flow Alternatives**

### **General Overview**

Alternative 8 addresses three alternatives for returning discharge water to the Lake Michigan source watershed. These alternatives include the following:

- Underwood Creek Return. Returning treated effluent to Underwood Creek, a tributary to the Menomonee River that flows into Lake Michigan.
- Root River Return. Returning treated effluent to the Root River, a tributary that empties into Lake Michigan.
- Lake Michigan Direct Return. Returning treated effluent directly into Lake Michigan, not through tributaries.

In each of the return flow alternatives, the pipeline routing from the Waukesha Treatment Plant to 124<sup>th</sup> Street is the same. Most of this route is through existing utility corridors. From 124<sup>th</sup> Street to each of the individual alternative's discharge, the pipeline route varies.

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- On October 25, 2011, representatives from Boldt, DNR and PSC walked the utility corridors in which a portion of the return flow pipeline is currently being considered for routing.
- Access into the utility corridors appears to be fairly good. Aside from the main streets crossing the corridor, there are other access points along the corridor from other utilities and private land owners. The current assumption is that easements or access will be available through negotiations with the entities owning the property required for access.
- Available room for installation of the pipeline(s) varies along the utility corridors. Portions of the corridor are very congested with underground electrical utilities, below grade tower foundations and above ground height restrictions. With the limited information available on pipeline routing, depths, access, etc., our opinion is that the utility corridors provide a reasonable path for the routing of the pipeline.
- The length of pipeline was checked by “scaling” the preliminary routing on the overview and tile maps.
- Based on the satellite views of the overview and tile maps, a determination was made regarding the mix of pipeline routing for open country, low urban, medium urban, etc. Individual routing impacts such as road crossings, creek crossings, road removal/replacement, etc. were determined.
- Pipeline unit pricing was checked. Quantities and unit pricing were then assembled to determine an overall cost estimate for comparison to the parametric cost estimate.

Each alternative considers a pump station at the Waukesha Wastewater Treatment Plant to pump the treated effluent to its discharge location. A detailed, parametric estimate was completed by CH2MHill for the WWTP effluent pump station. Please reference Alternative No. 4 for commentary on the estimate details for the pumping station.

#### **Underwood Creek Return Flow Pipeline (3B-1)**

The Underwood Creek return flow pipeline is approximately eleven and one-half (11.5) miles of 36-inch diameter, underground pipeline that runs from the Waukesha WWTP to Underwood Creek. Routing of this pipeline is shown on the Alternate 3B-1 Overview Map and Tile Maps.

#### **Root River Return Flow Pipeline (3B-2)**

The Root River return flow pipeline is approximately fifteen and one-half (15.5) miles of 36-inch diameter, underground pipeline that runs from the Waukesha WWTP to the Root River. Routing of this pipeline is shown on the Alternate 3B-2 Overview Map and Tile Maps.

#### **Lake Michigan Direct Return Flow Pipeline (3B-3)**

The Lake Michigan direct return flow pipeline is approximately twenty three and one-half (23.5) miles of 36-inch diameter, underground pipeline that runs from the Waukesha WWTP and discharges directly into Lake Michigan. The discharge outfall structure extends one-half mile into Lake Michigan. Routing of this pipeline is shown on the Alternate 3B-3 Overview Map and Tile Maps.

#### **Summary: Return Flow Alternatives**

Commentary regarding the Alternatives will be similar, as cost information and assumptions used to develop the estimates overlaps all of the Alternatives. A general overview of the comments regarding the cost estimate review of the Return Flow Alternative:

- Cost review of the pipeline estimates was based on preliminary routing of the pipelines, along with a subjective determination of the productivity mix associated with the routing. It is our opinion that the cost estimates for the pipeline installation for this alternative can be considered usual and customary for this level of estimate.

**Waukesha Water Application Cost Estimate Technical Review**  
**March 2012**

- Mark-ups applied to the construction cost estimates were reviewed and found to be in general alignment with Boldt's opinion for mark-up percentages. The overall mark-up amounts were very close, however, the percentage splits varied.

Comparing the Application's capital cost estimate with Boldt's cost estimate review and opinions, including markups, the resultant return flow alternative estimates range between 2% and 18% variance. Based on the conceptual nature of the cost estimate, our opinion is that information used to prepare the Return Flow Alternative's cost estimates are usual and customary.

## **4. Summary**

Boldt has performed an extensive review of the information presented in the Waukesha Application for Lake Michigan Water Supply in regards to the cost estimates and other items requested by the Wisconsin Department of Natural Resources. The items included in the request for review from the DNR are described in more detail at the beginning of this report. In summary, our findings and opinions are as follows:

- The Application's estimate development, format and methodology are representative of usual and customary costs based on the current conceptual status of the project.
- The utility corridors currently proposed in the Application provide a reasonable path for the pipeline routing based on the preliminary information provided.
- It should be noted that the Application's cost estimates are in 2010 dollars. Escalation allowances have not been addressed or included.
- The parametric estimating method used for cost determination in the Application would be considered at a conceptual or "order of magnitude" level of detail. Accuracy of these types of estimates is normally considered in the +/- 30% range. The contingency factor used in the Application's estimate is 25%. In our opinion, an anticipated contingency for this level cost estimate would be in the range of 15% to 20%. However, the basis for these cost estimates is to compare alternatives. With the fluid nature of project scope and potential significant changes as the project develops, the 25% contingency used is consistent and reasonable.
- Cost estimates developed for the Riverbank Inducement alternative are representative of usual and customary costs based on the current conceptual status of the project.
- The DNR has proposed using a range of 50% for defining "similar in cost" for water supply alternatives. Boldt is not aware of a specific construction industry standard for evaluating project alternatives in regards to a "similar in cost" variance parameter. Based on experience, if there is a 25% to 30% variance in cost between alternatives, bids, proposals, etc., we feel this is enough variance to indicate vast differences in scope of work, project interpretation, pricing, etc. This in turn would indicate the alternatives are not similar in cost.
- A supply source / return flow summary spreadsheet is included for review.
- A present worth calculation spreadsheet is included for review.

Please reference the overall report for additional details, explanations and findings.

## **Appendices**

The following documents comprise the working documents to support the technical review of the Waukesha Water Application.

- a) Alternative No. 1 – Continue Use of Deep and Shallow Aquifers Worksheets
- b) Alternative No. 2 – Shallow Aquifer and Fox River Alluvium Worksheets
- c) Alternative No. 3 – Lake Michigan and Shallow Aquifer Worksheets
- d) Alternative No. 4 – Lake Michigan Water Supply Worksheets
- e) Alternative No. 5 – Oak Creek Water Supply Worksheets
- f) Alternative No. 6 - Racine Water Supply Worksheets
- g) Alternative No. 7 – Riverbank Inducement Wells Worksheets
- h) Alternative No. 8 – Return Flow Discharge Worksheets
- i) Supply Source / Return Flow Summary Spreadsheet
- j) Present Worth Calculation Spreadsheet

**Project Information:**

**Project:** Application for Lake Michigan Water Supply      **Location:** Waukesha, WI  
**Customer:** Wisconsin DNR      **Arch/Engr:** CH2MHILL  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton  
**Estimator:** S Ford

**Alternate:** No. 1 - Deep & Shallow Aquifers Summary

Description	BTS Conceptual Cost Estimate Summary		CH2MHILL Parametric Cost Estimate Summary	
<b>Deep Well Treatment Plant</b>		\$ 21,185,440		\$ 17,467,000
Application Base Cost Estimate	\$	17,467,000		
Concrete/Earthwork Unit Pricing (parametric units appear low)	\$	200,000		
Cost Estimate Extensions (not extended)	\$	200,000		
Well No. 6 WTP (Potential variance from extrapolation)	\$	1,037,000		
Well No. 8 WTP (Potential variance from extrapolation)	\$	1,380,000		
Additional Project Cost (impact to % adders)	\$	901,440		
<b>Shallow Aquifer Water Treatment Plant</b>		\$ 31,114,000		\$ 29,864,000
Application Base Cost Estimate	\$	29,864,000		
Concrete/Earthwork Unit Pricing (parametric units appear low)	\$	750,000		
Cost Estimate Extensions (not extended)	\$	500,000		
<b>Shallow Acquifer Wellfield</b>		\$ 12,500,000		\$ 12,800,000
BTS Estimate	\$	12,500,000		
<b>Supply Pipeline to Waukesha</b>		\$ 21,300,000		\$ 18,573,000
<b>Distribution System Improvements</b>		\$ 14,173,000		\$ 15,855,933
<b>Wastewater Force Main</b>		\$ 4,615,000		\$ 3,332,000
<b>Sub-Total Construction Costs w/o Markups</b>		\$ 104,887,440		\$ 97,891,933
<b>Bonds &amp; Insurance Markup</b>	3.0%	\$ 3,146,623	3%	\$ 2,937,000
<b>Mob/Demob Markup</b>	3.0%	\$ 3,146,623	5%	\$ 4,895,000
<b>Sub-Total for OH&amp;P Markups</b>		\$ 111,180,686		\$ 105,723,933
<b>Contractor Overhead Markup</b>			8%	\$ 8,458,000
Construction Management	2.5%	\$ 2,779,517		
General Conditions	7.5%	\$ 8,338,551		
Equipment	3.0%	\$ 3,335,421		
<b>Contractor Profit Markup</b>	3.0%	\$ 3,769,025	4%	\$ 4,229,000
<b>Sub-Total Construction Costs</b>		\$ 129,403,201		\$ 118,410,933
<b>Contingency</b>	20.0%	\$ 25,880,640	25%	\$ 29,603,000
<b>Total Construction Costs with Markups</b>		\$ 155,283,841		\$ 148,013,933
<b>Design &amp; Engineering</b>				
Design & Engineering	12.0%	\$ 18,634,061	8%	\$ 11,842,000
Administration of Design during Construction	4.0%	\$ 6,211,354	8%	\$ 11,842,000
<b>Sub-Total, Design &amp; Engineering</b>		\$ 24,845,415		\$ 23,684,000
<b>Permits, Legal, Administration (allowance)</b>	12.0%	\$ 18,634,061	12%	\$ 17,762,000
<b>Total Project Capital Cost Estimate</b>		\$ 198,763,317		\$ 189,459,933
<b>Annual Operation &amp; Maintenance</b>		\$ 7,200,000		
<b>50-Year Present Worth (6%)</b>		\$ 312,250,000		

**Project Information:**

Project: Application for Lake Michigan Water Supply  
 Customer: Wisconsin DNR  
 Arch/Engr: CH2MHILL  
 Location: Waukesha, WI  
 Type: Estimate Review of Alternates  
 Area Office: Boldt / Appleton

Alternate: No. 1 - Shallow Aquifer Well Field - Vernon Marsh

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Purchase Land Assuming 5-acres per well site	5	acre	\$ 15,000	\$ 75,000
Well / Pumphouse				
Well Drilling Assume ~ 200 ft well depth	200	ft	\$ 1,500	\$ 300,000
Pump/Piping Pump equipment & interior piping	1	lsum	\$ 60,000	\$ 60,000
Pumphouse Assume 20 ft x 20 ft building	400	sqft	\$ 175	\$ 70,000
Sitework				
Site grading	1	lsum	\$ 15,000	\$ 15,000
Roads/Paving Assume 100 ft of road + parking	4,700	sqft	\$ 3	\$ 14,100
Fencing	2,000	lnft	\$ 15	\$ 30,000
Landscaping	1	lsum	\$ 5,000	\$ 5,000
Electrical Utility				
Power to Site Assume 1,000 ft per well site to bring in power	1	lsum	\$ 25,000	\$ 25,000
Site Distribution Lighting, pump connection, RTU connection	1	lsum	\$ 15,000	\$ 15,000
Sub-Total, per Well Site	1	each		\$ 609,100
Total Well Site Development, All Sites	14	each	\$ 609,100	\$ 8,527,400
Interconnecting Piping between Well Sites	22,000	lnft		
Note: Using aerial map showing pipe routing; assuming 16" pipe size.				
Open Country	19,000	lnft	\$ 104	\$ 1,976,000
Low Urban	2,000	lnft	\$ 115	\$ 230,000
Medium Urban	1,000	lnft	\$ 133	\$ 133,000
Creek Crossing	6	each	\$ 23,000	\$ 138,000
Road Crossing	6	each	\$ 46,000	\$ 276,000
Highway Crossing	1	each	\$ 46,000	\$ 46,000
Railroad Crossing	1	each	\$ 69,000	\$ 69,000
Allowance for Road Removal & Replacement (16 ft wide)	48,000	sqft	\$ 6	\$ 288,000
Allowance for Groundwater	22,000	lnft	\$ 9	\$ 189,750
Allowance for Cost of ROW purchase or use	1	lsum	\$ 250,000	\$ 250,000
Valves & Appurtenances Allowance	10%			\$ 359,575
<b>Total Estimate for Wellfield Sites w/o Treatment Facility</b>	-			<b>\$ 12,482,725</b>

**Observations / Commentary**

- 1) Total estimate included in Application is \$12,800,000
- 2) Current property purchase pricing appears to be lower than estimated.
- 3) Interconnecting piping estimate is less than that included in Application.
  - a) Total length of piping is not confirmed
  - b) Average pipe size is not confirmed
- 4) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.

Category	Boldt Suggested Unit Pricing			CH2MHILL Unit Pricing	
	Construction Difficulty Factor	Production lnft/day	Unit Price - \$/lnft	Construction Difficulty Factor	Segment Unit \$/lnft
Open Country	0.90	500	\$104	0.74	\$142
Low Urban	1.00	400	\$115	1.00	\$192
Medium Urban	1.15	250	\$133	1.19	\$228
High Urban	1.40	125	\$161	1.37	\$263
Groundwater	1.30	125	\$150	1.30	\$250
Forest	1.15	250	\$133	1.15	\$221
Gravel Roads	1.00		\$115	0.85	\$163
Creek Crossing	2.00		\$230	2.00	\$384
HWY Crossing	4.00		\$460	4.00	\$768
Unit Cost, \$/dia-in			16-inch dia	\$12.00	16-inch dia

Location of Pipeline	Distance (lnft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
From wells to WTP	22,000		19,000	2,000	1,000	-	-	-	3,000	6	6	1	1
			-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
Total, lnft	22,000		19,000	2,000	1,000	-	-	-	3,000	6	6	1	1
Total, miles	4.17												

**Project Information:**

Project: Application for Lake Michigan Water Supply  
 Customer: Wisconsin DNR  
 Arch/Engr: CH2MHILL  
 Location: Waukesha, WI  
 Type: Estimate Review of Alternates  
 Area Office: Boldt / Appleton

Alternate: **No. 1 - Finish Water Pipeline**

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Finish Water Pipeline from WTP to Reservoir				
Note: Using aerial map showing pipe routing; 24" pipe size.				
Open Country	5,500	Inft	\$ 157	\$ 862,125
Low Urban	5,500	Inft	\$ 165	\$ 907,500
Medium Urban	12,500	Inft	\$ 182	\$ 2,268,750
High Urban	24,500	Inft	\$ 223	\$ 5,457,375
Forest	-	each	\$ 250	\$ -
Road Crossing (assume 100 Inft)	49	each	\$ 16,500	\$ 808,500
Creek Crossing (assume 100 Inft)	-	each	\$ 33,000	\$ -
Highway Crossing (assume 100 Inft)	9	each	\$ 66,000	\$ 594,000
Railroad Crossing (assume 100 Inft)	2	each	\$ 99,000	\$ 198,000
Allowance for Road Removal & Replacement (16 ft wide)	680,000	sqft	\$ 6	\$ 4,080,000
Allowance for Groundwater	48,000	Inft	\$ 12	\$ 576,000
Allowance for Cost of ROW purchase or use	1	lsum	\$ 250,000	\$ 250,000
Sub-Total, Pipeline Estimate				\$ 16,002,250
Valves & Appurtenances Allowance	10%			\$ 1,600,225
<b>Total Estimate for Finish Water Pipeline</b>	<b>9</b>	<b>miles</b>	<b>\$ 1,936,272</b>	<b>\$ 17,602,475</b>
<b>Adjusted for Finish Water Pipeline Length in Application</b>	<b>11</b>	<b>miles</b>	<b>\$ 1,936,272</b>	<b>\$ 21,298,995</b>
<b>Observations / Commentary</b>				
1) Total estimate included in Application is \$18,573,000				
2) The cost estimate prepared by CH2MHILL is in the range expected for a conceptual estimate based on parameters set forth.				
3) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.				

Category	Boldt Suggested Unit Pricing			CH2MHill Unit Pricing	
	Construction Difficulty Factor	Production Inft/day	Unit Price - \$/Inft	Construction Difficulty Factor	Segment A & B Unit - \$/Inft
Open Country	0.95	500	\$157	0.74	\$213
Low Urban	1.00	400	\$165	1.00	\$288
Medium Urban	1.10	250	\$182	1.19	\$343
High Urban	1.35	125	\$223	1.37	\$395
Groundwater	1.30	125	\$215	1.30	\$374
Forest	1.15	250	\$190	1.15	\$331
Gravel Roads	1.00		\$165	0.85	\$245
Creek Crossing	2.00		\$330	2.00	\$576
HWY Crossing	4.00		\$660	4.00	\$1,152
Unit Cost, \$/dia-in			24-inch diameter	\$12.00	24-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
At WTP	1,000		-	1,000	-	-	-	-	1,000	-	-	-	-
CRI: WTP to CRH	5,500		5,500	-	-	-	-	-	-	2	-	-	-
CRI: CRH to Oakdale	4,500		-	4,500	-	-	-	-	4,500	1	-	-	-
Oakdale: CRI to Sunset	10,500		-	-	-	10,500	-	-	10,500	10	-	2	-
Sunset: Oakdale to West	5,500		-	-	2,000	3,500	-	-	5,500	6	-	2	1
West: Sunset to Diagonal	8,000		-	-	5,000	3,000	-	-	8,000	10	-	1	1
Diagonal: West to Reservoir	13,000		-	-	5,500	7,500	-	-	13,000	20	-	4	-
Total, Inft	48,000		5,500	5,500	12,500	24,500	-	-	42,500	49	-	9	2
Total, miles	9.09												

**Project Information:**

Project: Application for Lake Michigan Water Supply  
 Customer: Wisconsin DNR  
 Arch/Engr: CH2MHILL  
 Location: Waukesha, WI  
 Type: Estimate Review of Alternates  
 Area Office: Boldt / Appleton

Alternate: No. 1 - Distribution System Improvements

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Distribution System Improvements				
Note: Routing not specifically shown on aerial maps				
<b>Segment A (20" diameter) -</b>				
Open Country	-	Inft	\$ 124	\$ -
Low Urban	-	Inft	\$ 135	\$ -
Medium Urban	7,920	Inft	\$ 149	\$ 1,176,120
High Urban	5,280	Inft	\$ 182	\$ 962,280
Forest	-	Inft	\$ 155	\$ -
Road Crossing (assume 100 Inft)	14	each	\$ 13,500	\$ 189,000
Creek Crossing (assume 100 Inft)	1	each	\$ 27,000	\$ 27,000
Highway Crossing (assume 100 Inft)	2	each	\$ 54,000	\$ 108,000
Railroad Crossing (assume 100 Inft)	-	each	\$ 81,000	\$ -
Allowance for Road Removal & Replacement (16 ft wide)	168,960	sqft	\$ 6	\$ 1,013,760
Allowance for Groundwater	13,200	Inft	\$ 4	\$ 53,460
Allowance for Cost of ROW purchase or use	1	Isum	\$ 100,000	\$ 100,000
<b>Sub-Total Segment A</b>				<b>\$ 3,629,620</b>
<b>Segment B (16" diameter) -</b>				
Open Country	-	Inft	\$ 104	\$ -
Low Urban	-	Inft	\$ 115	\$ -
Medium Urban	5,808	Inft	\$ 132	\$ 768,108
High Urban	5,280	Inft	\$ 161	\$ 850,080
Forest	-	Inft	\$ 132	\$ -
Road Crossing (assume 100 Inft)	12	each	\$ 11,500	\$ 138,000
Creek Crossing (assume 100 Inft)	1	each	\$ 23,000	\$ 23,000
Highway Crossing (assume 100 Inft)	2	each	\$ 46,000	\$ 92,000
Railroad Crossing (assume 100 Inft)	-	each	\$ 69,000	\$ -
Allowance for Road Removal & Replacement (16 ft wide)	141,926	sqft	\$ 6	\$ 851,558
Allowance for Groundwater	11,088	Inft	\$ 3	\$ 38,254
Allowance for Cost of ROW purchase or use	1	Isum	\$ 100,000	\$ 100,000
<b>Sub-Total Segment B</b>				<b>\$ 2,861,000</b>
<b>Segment C (16" diameter) -</b>				
Open Country	-	Inft	\$ 104	\$ -
Low Urban	-	Inft	\$ 115	\$ -
Medium Urban	26,928	Inft	\$ 132	\$ 3,561,228
High Urban	-	Inft	\$ 161	\$ -
Forest	-	Inft	\$ 132	\$ -
Road Crossing (assume 50 Inft)	26	each	\$ 5,750	\$ 149,500
Creek Crossing (assume 50 Inft)	2	each	\$ 11,500	\$ 23,000
Highway Crossing (assume 100 Inft)	5	each	\$ 46,000	\$ 230,000
Railroad Crossing (assume 100 Inft)	1	each	\$ 69,000	\$ 69,000
Allowance for Road Removal & Replacement (16 ft wide)	344,678	sqft	\$ 6	\$ 2,068,070
Allowance for Groundwater	26,928	Inft	\$ 3	\$ 92,902
Allowance for Cost of ROW purchase or use	1	Isum	\$ 200,000	\$ 200,000
<b>Sub-Total Segment C</b>				<b>\$ 6,393,700</b>
<b>Sub-Total, Pipeline Estimate</b>				<b>\$ 12,884,320</b>
Valves & Appurtenances Allowance	10%			\$ 1,288,432
<b>Total Estimate for Distribution System Improvements</b>				<b>\$ 14,172,752</b>
<b>Observations / Commentary</b>				
1) Total estimate included in Application is \$15,855,000				
2) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.				

Category	Boldt Suggested Unit Pricing				CH2MHill Unit Pricing		
	Construction Difficulty Factor	Segment A Unit \$/Inft	Construction Difficulty Factor	Segment B Unit \$/Inft	Construction Difficulty Factor	Segment A Unit \$/Inft	Segment B Unit \$/Inft
Open Country	0.92	\$124	0.90	\$104	0.74	\$178	\$142
Low Urban	1.00	\$135	1.00	\$115	1.00	\$240	\$192
Medium Urban	1.10	\$149	1.15	\$132	1.19	\$286	\$228
High Urban	1.35	\$182	1.40	\$161	1.37	\$329	\$263
Groundwater	1.30	\$176	1.30	\$150	1.30	\$312	\$250
Forest	1.15	\$155	1.15	\$132	1.15	\$276	\$221
Gravel Roads	1.00	\$135	1.00	\$115	0.85	\$204	\$163
Creek Crossing	2.00	\$270	2.00	\$230	2.00	\$480	\$384
HWY Crossing	4.00	\$540	4.00	\$460	4.00	\$960	\$768
Unit Cost, \$/dia-in		20-inch dia		16-inch dia	\$12.00	20-inch dia	16-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Replace Road	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
Segment A	13,200	20" diameter	-	-	7,920	5,280	-	-	10,560	14	1	2	-
Segment B	11,088	16" diameter	-	-	5,808	5,280	-	-	8,870	12	1	2	-
Segment C	26,928	16" diameter	-	-	26,928	-	-	-	21,542	26	2	5	1
			-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
<b>Total, Inft</b>	<b>51,216</b>		<b>-</b>	<b>-</b>	<b>40,656</b>	<b>10,560</b>	<b>-</b>	<b>-</b>	<b>40,973</b>	<b>52</b>	<b>4</b>	<b>9</b>	<b>1</b>
<b>Total, miles</b>	<b>9.70</b>												

**Project Information:**

Project: Application for Lake Michigan Water Supply  
 Customer: Wisconsin DNR  
 Arch/Engr: CH2MHILL  
 Location: Waukesha, WI  
 Type: Estimate Review of Alternates  
 Area Office: Boldt / Appleton

Alternate: **No. 1 - Wastewater Force Main**

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Wastewater Force Main				
Note: Using aerial map showing pipe routing; 6" pipe size.				
Open Country	5,500	Inft	\$ 47	\$ 258,500
Low Urban	9,500	Inft	\$ 55	\$ 522,500
Medium Urban	7,250	Inft	\$ 64	\$ 464,000
High Urban	5,250	Inft	\$ 83	\$ 435,750
Forest	-	each	\$ 64	\$ -
Road Crossing	21	each	\$ 5,500	\$ 115,500
Creek Crossing	-	each	\$ 11,000	\$ -
Highway Crossing	2	each	\$ 22,000	\$ 44,000
Railroad Crossing	-	each	\$ 33,000	\$ -
Allowance for Road Removal & Replacement (16 ft wide)	332,000	Inft	\$ 6	\$ 1,992,000
Allowance for Groundwater	27,500	Inft	\$ 4	\$ 113,438
Allowance for Cost of ROW purchase or use	1	Isum	\$ 250,000	\$ 250,000
Sub-Total, Pipeline Estimate				\$ 4,195,688
Valves & Appurtenances Allowance	10%			\$ 419,569
<b>Total Estimate for Wastewater Force Main</b>				<b>\$ 4,615,256</b>
<b>Observations / Commentary</b>				
1) Total estimate included in Application is \$3,332,000				
2) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.				

Category	Boldt Suggested Unit Pricing			CH2MHill Unit Pricing		
	Construction Difficulty Factor	Segment A Unit \$/Inft	Segment B Unit \$/Inft	Construction Difficulty Factor	Segment A Unit \$/Inft	Segment B Unit \$/Inft
Open Country	0.85	\$47	\$47	0.74	\$53	\$53
Low Urban	1.00	\$55	\$55	1.00	\$72	\$72
Medium Urban	1.15	\$64	\$64	1.19	\$86	\$86
High Urban	1.50	\$83	\$83	1.37	\$99	\$99
Groundwater	1.30	\$72	\$72	1.30	\$94	\$94
Forest	1.15	\$64	\$64	1.15	\$83	\$83
Gravel Roads	1.00	\$55	\$55	0.85	\$61	\$61
Creek Crossing	2.00	\$110	\$110	2.00	\$144	\$144
HWY Crossing	4.00	\$220	\$220	4.00	\$288	\$288
Unit Cost, \$/dia-in		6-inch diameter	6-inch diameter	\$12.00	6-inch dia	6-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
At WTP	1,000		-	1,000	-	-	-	-	-	-	-	-	-
CRI: WTP to CRH	5,500		5,500	-	-	-	-	-	-	2	-	-	-
CRI: CRH to Oakdale	4,500		-	4,500	-	-	-	-	4,500	1	-	-	-
Oakdale: CRI to Sunset	10,500		-	-	5,250	5,250	-	-	10,250	10	-	2	-
Sunset: Oakdale to Sentry	2,000		-	-	2,000	-	-	-	2,000	2	-	-	-
Sentry: Sunset to WWTP	4,000		-	4,000	-	-	-	-	4,000	6	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
Total, Inft	27,500		5,500	9,500	7,250	5,250	-	-	20,750	21	-	2	-
Total, miles	5.21												

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton  
**Estimator:** S Ford

**Location:** Waukesha, WI  
**Arch/Engr:** CH2MHILL

**Alternate:** No. 2 - Shallow & Fox River Alluvium Summary

Description	BTS Conceptual Cost Estimate Summary		CH2MHILL Parametric Cost Estimate Summary	
<b>Shallow Aquifer Wells</b>		\$ 16,213,000		\$ 17,815,000
Application Base Cost Estimate - Fox River Alluvium	\$	3,713,000	\$	5,011,000
Application Base Cost Estimate - Vernon Marsh	\$	12,500,000	\$	12,804,000
<b>Shallow Aquifer Water Treatment Plant</b>		\$ 39,995,000		\$ 37,355,000
Application Base Cost Estimate	\$	37,355,000		
Concrete/Earthwork Unit Pricing (parametric units appear low)	\$	900,000		
Cost Estimate Extensions (not extended)	\$	1,100,000		
Additional Project Cost (impact to % adders)	\$	640,000		
<b>Supply Pipeline to Waukesha</b>		\$ 24,822,000		\$ 27,855,000
<b>Distribution System Improvements</b>		\$ 8,465,000		\$ 8,465,000
<b>Wastewater Force Main</b>		\$ 4,615,000		\$ 3,332,000
<b>Sub-Total Construction Costs w/o Markups</b>		\$ 94,110,000		\$ 94,822,000
<b>Bonds &amp; Insurance Markup</b>	3.0%	\$ 2,823,300	3%	\$ 2,845,000
<b>Mob/Demob Markup</b>	3.0%	\$ 2,823,300	5%	\$ 4,742,000
<b>Sub-Total for OH&amp;P Markups</b>		\$ 99,756,600		\$ 102,409,000
<b>Contractor Overhead Markup</b>			8%	\$ 8,193,000
Construction Management	2.5%	\$ 2,493,915		
General Conditions	7.5%	\$ 7,481,745		
Equipment	3.0%	\$ 2,992,698		
<b>Contractor Profit Markup</b>	3.0%	\$ 3,381,749	4%	\$ 4,097,000
<b>Sub-Total Construction Costs</b>		\$ 116,106,707		\$ 114,699,000
<b>Contingency</b>	20.0%	\$ 23,221,341	25%	\$ 28,675,000
<b>Total Construction Costs with Markups</b>		\$ 139,328,048		\$ 143,374,000
<b>Design &amp; Engineering</b>				
Design & Engineering	12.0%	\$ 16,719,366	8%	\$ 11,470,000
Administration of Design during Construction	4.0%	\$ 5,573,122	8%	\$ 11,470,000
<b>Sub-Total, Design &amp; Engineering</b>		\$ 22,292,488		\$ 22,940,000
<b>Permits, Legal, Administration (allowance)</b>	12.0%	\$ 16,719,366	12%	\$ 17,205,000
<b>Total Project Capital Cost Estimate</b>		\$ 178,339,902		\$ 183,519,000
<b>Annual Operation &amp; Maintenance</b>		\$ 7,400,000		
<b>50-Year Present Worth (6%)</b>		\$ 294,979,000		

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Arch/Engr:** CH2MHILL  
**Location:** Waukesha, WI  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton

**Alternate:** No. 2 - Shallow Aquifer Well Fields - Fox River Alluvium

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Purchase Land Assuming 5-acres per well site	5	acre	\$ 25,000	\$ 125,000
Well / Pumphouse				
Well Drilling Assume ~ 200 ft well depth	200	ft	\$ 1,500	\$ 300,000
Pump/Piping Pump equipment & interior piping	1	lsum	\$ 60,000	\$ 60,000
Pumphouse Assume 20 ft x 20 ft building	400	sqft	\$ 175	\$ 70,000
Sitework				
Site grading	1	lsum	\$ 15,000	\$ 15,000
Roads/Paving Assume 100 ft of road + parking	4,700	sqft	\$ 3	\$ 14,100
Fencing	2,000	lnft	\$ 15	\$ 30,000
Landscaping	1	lsum	\$ 5,000	\$ 5,000
Electrical Utility				
Power to Site Assume 1,000 ft per well site to bring in power	1	lsum	\$ 25,000	\$ 25,000
Site Distribution Lighting, pump connection, RTU connection	1	lsum	\$ 15,000	\$ 15,000
Sub-Total, per Well Site	1	each		\$ 659,100
Total Well Site Development, All Sites	4	each	\$ 659,100	\$ 2,636,400
Interconnecting Piping between Well Sites	9,100	lnft		
Note: Using aerial map showing pipe routing; assuming 16" pipe size.				
Open Country	5,000	lnft	\$ 104	\$ 520,000
Low Urban	-	lnft	\$ 115	\$ -
Medium Urban	-	lnft	\$ 133	\$ -
Creek Crossing (assume 100 ft)	1	each	\$ 23,000	\$ 23,000
Road Crossing (assume 100 lnft)	6	each	\$ 46,000	\$ 276,000
Railroad Crossing (assume 100 lnft)	-	each	\$ 69,000	\$ -
Allowance for Road Removal & Replacement (16 ft wide)	-	sqft	\$ 6	\$ -
Allowance for Groundwater	9,100	lnft	\$ 17	\$ 156,975
Allowance for Cost of ROW purchase or use	1	lsum	\$ 100,000	\$ 100,000
			\$ -	\$ -
<b>Total Estimate for Wellfield Sites w/o Treatment Facility</b>				<b>\$ 3,712,375</b>

**Observations / Commentary**

- 1) Total estimate included in Application is \$5,010,200
- 2) Current property purchase pricing appears to be lower than estimated.
- 3) Interconnecting piping estimate is less than that included in Application.
  - a) Total length of piping is not confirmed
  - b) Average pipe size is not confirmed
- 4) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.

Category	Boldt Suggested Unit Pricing			CH2MHILL Unit Pricing	
	Construction Difficulty Factor	Production lnft/day	Unit Price - \$/lnft	Construction Difficulty Factor	Segment Unit \$/lnft
Open Country	0.90	500	\$104	0.74	\$142
Low Urban	1.00	400	\$115	1.00	\$192
Medium Urban	1.15	250	\$133	1.19	\$228
High Urban	1.40	125	\$161	1.37	\$263
Groundwater	1.30	125	\$150	1.30	\$250
Forest	1.15	250	\$133	1.15	\$221
Gravel Roads	1.00		\$115	0.85	\$163
Creek Crossing	2.00		\$230	2.00	\$384
HWY Crossing	4.00		\$460	4.00	\$768
Unit Cost, \$/dia-in			16-inch dia	\$12.00	16-inch dia

Location of Pipeline	Distance (lnft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
From wells to WTP	9,100		5,000	-	-	-	-	4,100	-	6	1	-	-
			-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
Total, lnft	9,100		5,000	-	-	-	-	4,100	-	6	1	-	-
Total, miles	1.72												

**Project Information:**

Project: Application for Lake Michigan Water Supply  
 Customer: Wisconsin DNR  
 Arch/Engr: CH2MHILL  
 Location: Waukesha, WI  
 Type: Estimate Review of Alternates  
 Area Office: Boldt / Appleton

Alternate: No. 2 - Finish Water Pipeline

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Finish Water Pipeline from WTP to Reservoir				
Note: Using aerial map showing pipe routing; 36" pipe size.				
Open Country	5,500	Inft	\$ 200	\$ 1,097,250
Low Urban	5,500	Inft	\$ 210	\$ 1,155,000
Medium Urban	12,500	Inft	\$ 231	\$ 2,887,500
High Urban	24,500	Inft	\$ 273	\$ 6,688,500
Forest	-	each	\$ 242	\$ -
Road Crossing (assume 100 Inft)	49	each	\$ 21,000	\$ 1,029,000
Creek Crossing (assume 100 Inft)	-	each	\$ 42,000	\$ -
Highway Crossing (assume 100 Inft)	9	each	\$ 84,000	\$ 756,000
Railroad Crossing (assume 100 Inft)	2	each	\$ 126,000	\$ 252,000
Allowance for Road Removal & Replacement (16 ft wide)	680,000	sqft	\$ 6	\$ 4,080,000
Allowance for Groundwater	48,000	Inft	\$ 9	\$ 453,600
Allowance for Cost of ROW purchase or use	1	Isum	\$ 250,000	\$ 250,000
Sub-Total, Pipeline Estimate				\$ 18,648,850
Valves & Appurtenances Allowance	10%			\$ 1,864,885
<b>Total Estimate for Finish Water Pipeline</b>	<b>9</b>	<b>miles</b>		<b>\$ 20,513,735</b>
<b>Adjusted for Finish Water Pipeline Length in Application</b>	<b>11</b>	<b>miles</b>	<b>\$ 2,256,511</b>	<b>\$ 24,821,619</b>
<b>Observations / Commentary</b>				
1) Total estimate included in Application is \$27,855,000				
2) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.				

Category	Boldt Suggested Unit Pricing			CH2MHILL Unit Pricing	
	Construction Difficulty Factor	Production Inft/day	Unit Price - \$/Inft	Construction Difficulty Factor	Segment A & B Unit - \$/Inft
Open Country	0.95	500	\$200	0.74	\$320
Low Urban	1.00	400	\$210	1.00	\$432
Medium Urban	1.10	250	\$231	1.19	\$514
High Urban	1.30	125	\$273	1.37	\$592
Groundwater	1.30	125	\$273	1.30	\$562
Forest	1.15	250	\$242	1.15	\$497
Gravel Roads	1.00		\$210	0.85	\$367
Creek Crossing	2.00		\$420	2.00	\$864
HWY Crossing	4.00		\$840	4.00	\$1,728
Unit Cost, \$/dia-in			36-inch diameter	\$12.00	36-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
At WTP	1,000		-	1,000	-	-	-	-	1,000	-	-	-	-
CRI: WTP to CRH	5,500		5,500	-	-	-	-	-	-	2	-	-	-
CRI: CRH to Oakdale	4,500		-	4,500	-	-	-	-	4,500	1	-	-	-
Oakdale: CRI to Sunset	10,500		-	-	-	10,500	-	-	10,500	10	-	2	-
Sunset: Oakdale to West	5,500		-	-	2,000	3,500	-	-	5,500	6	-	2	1
West: Sunset to Diagonal	8,000		-	-	5,000	3,000	-	-	8,000	10	-	1	1
Diagonal: West to Reservoir	13,000		-	-	5,500	7,500	-	-	13,000	20	-	4	-
Total, Inft	48,000		5,500	5,500	12,500	24,500	-	-	42,500	49	-	9	2
Total, miles	9.09												

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton  
**Estimator:** S Ford

**Location:** Waukesha, WI  
**Arch/Engr:** CH2MHILL

**Alternate:** No. 3 - Lake Michigan & Shallow Aquifers Summary

Description	BTS Conceptual Cost Estimate Summary		CH2MHILL Parametric Cost Estimate Summary	
<b>Shallow Aquifer Water Treatment Plant</b>		\$ 31,114,000		\$ 29,864,000
Application Base Cost Estimate	\$	29,864,000		
Concrete/Earthwork Unit Pricing (parametric units appear low)	\$	750,000		
Cost Estimate Extensions (not extended)	\$	500,000		
<b>Shallow Aquifer Wellfield</b>		\$ 12,500,000		\$ 12,800,000
<b>Supply Pipeline to Waukesha</b>		\$ 21,300,000		\$ 18,573,000
<b>Distribution System Improvements</b>		\$ 7,222,000		\$ 8,465,000
<b>Wastewater Force Main</b>		\$ 4,615,000		\$ 3,332,000
<b>Sub-Total, Shallow Aquifer Water Supply</b>		\$ 76,751,000		\$ 73,034,000
<b>Lake Michigan Supply Pipeline (24")</b>		\$ 27,440,000		\$ 25,682,000
<b>Parkway Booster Station</b>		\$ 5,283,000		\$ 5,282,822
<b>Return Flow Pipeline, Underwood Creek (24")</b>		\$ 23,326,150		\$ 17,011,000
<b>Return Flow Pump Station</b>		\$ 2,162,000		\$ 2,161,686
<b>Sub-Total, Lake Michigan Supply</b>		\$ 58,211,150		\$ 50,137,508
<b>Sub-Total Construction Costs w/o Markups</b>		\$ 134,962,150		\$ 123,171,508
<b>Bonds &amp; Insurance Markup</b>	3.0%	\$ 4,048,865	3%	\$ 3,696,000
<b>Mob/Demob Markup</b>	3.0%	\$ 4,048,865	5%	\$ 6,159,000
<b>Sub-Total for OH&amp;P Markups</b>		\$ 143,059,879		\$ 133,026,508
<b>Contractor Overhead Markup</b>			8%	\$ 10,643,000
Construction Management	2.5%	\$ 3,576,497		
General Conditions	7.5%	\$ 10,729,491		
Equipment	3.0%	\$ 4,291,796		
<b>Contractor Profit Markup</b>	3.0%	\$ 4,849,730	4%	\$ 5,322,000
<b>Sub-Total Construction Costs</b>		\$ 166,507,393		\$ 148,991,508
<b>Contingency</b>	20.0%	\$ 33,301,479	25%	\$ 37,248,000
<b>Total Construction Costs with Markups</b>		\$ 199,808,872		\$ 186,239,508
<b>Design &amp; Engineering</b>				
Design & Engineering	12.0%	\$ 23,977,065	8%	\$ 14,900,000
Administration of Design during Construction	4.0%	\$ 7,992,355	8%	\$ 14,900,000
<b>Sub-Total, Design &amp; Engineering</b>		\$ 31,969,419		\$ 29,800,000
<b>Permits, Legal, Administration (allowance)</b>	12.0%	\$ 23,977,065	12%	\$ 22,349,000
<b>Total Project Capital Cost Estimate</b>		\$ 255,755,356		\$ 238,388,508
<b>Annual Operation &amp; Maintenance</b>		\$ 7,500,000		
<b>50-Year Present Worth (6%)</b>		\$ 373,971,000		

**Project Information:**

Project: Application for Lake Michigan Water Supply  
 Customer: Wisconsin DNR  
 Arch/Engr: CH2MHILL  
 Location: Waukesha, WI  
 Type: Estimate Review of Alternates  
 Area Office: Boldt / Appleton

Alternate: No. 3 - Milwaukee Water Supply Pipeline (24")

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Lake Michigan water supply from 60th/Howard to Hillcrest Reservoir				
Note: Using aerial map showing pipe routing; 24" pipe size.				
Open Country	-	Inft	\$ 157	\$ -
Low Urban	28,000	Inft	\$ 165	\$ 4,620,000
Medium Urban	14,000	Inft	\$ 182	\$ 2,541,000
High Urban	19,500	Inft	\$ 215	\$ 4,182,750
Forest	1,500	Inft	\$ 190	\$ 284,625
Wetlands	8,000	Inft	\$ 429	\$ 3,432,000
Road Crossing (assume 100 Inft)	21	each	\$ 16,500	\$ 346,500
Creek Crossing (assume 100 Inft)	7	each	\$ 33,000	\$ 231,000
Highway Crossing (assume 100 Inft)	18	each	\$ 66,000	\$ 1,188,000
Railroad Crossing (assume 100 Inft)	-	each	\$ 99,000	\$ -
Allowance for Horizontal Boring	9,000	Inft	\$ 500	\$ 4,500,000
Allowance for Road Removal & Replacement (16 ft wide)	432,000	sqft	\$ 6	\$ 2,592,000
Allowance for Groundwater	71,000	Inft	\$ 7	\$ 527,175
Allowance for Cost of ROW purchase or use	1	Isum	\$ 500,000	\$ 500,000
<b>Sub-Total, Pipeline Estimate</b>				<b>\$ 24,945,050</b>
Valves & Appurtenances Allowance	10%			\$ 2,494,505
<b>Total Estimate for Finish Water Pipeline</b>				<b>\$ 27,439,555</b>
<b>Observations / Commentary</b>				
1) Total estimate included in Application is \$25,682,000				
2) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.				

Category	Boldt Suggested Unit Pricing			CH2MHILL Unit Pricing	
	Construction Difficulty Factor	Production Inft/day	Unit Price - \$/Inft	Construction Difficulty Factor	Segment A & B Unit - \$/Inft
Open Country	0.95	500	\$157	0.74	\$213
Low Urban	1.00	400	\$165	1.00	\$288
Medium Urban	1.10	250	\$182	1.19	\$343
High Urban	1.30	125	\$215	1.37	\$395
Groundwater	1.30	125	\$215	1.30	\$374
Forest	1.15	250	\$190	1.15	\$331
Gravel Roads	1.00		\$165	0.85	\$241
Creek Crossing	2.00		\$330	2.00	\$576
HWY Crossing	4.00		\$660	4.00	\$1,152
Unit Cost, \$/dia-in			24-inch diameter	\$12.00	24-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Road Crossing	Creek Crossing	HWY Crossing	Horiz Bore
Hillcrest Reservoir to Trail	5,500		-	1,500	2,500	-	-	1,500	1,000	3	-	-	-
Trail: Hillcrest to 124th	32,500		-	25,500	-	6,000	1,000	-	-	-	6	5	5,000
124th: Trail to RootRiver	4,000		-	1,000	3,000	-	-	-	4,000	-	-	2	1,000
Root River: 124th to Beloit	12,000		-	-	5,000	-	7,000	-	5,000	-	-	3	1,000
Howard: Beloit to 60th	17,000		-	-	3,500	13,500	-	-	17,000	18	1	8	2,000
	-		-	-	-	-	-	-	-	-	-	-	-
	-		-	-	-	-	-	-	-	-	-	-	-
<b>Total, Inft</b>	<b>71,000</b>		<b>-</b>	<b>28,000</b>	<b>14,000</b>	<b>19,500</b>	<b>8,000</b>	<b>1,500</b>	<b>27,000</b>	<b>21</b>	<b>7</b>	<b>18</b>	<b>9,000</b>
<b>Total, miles</b>	<b>13.45</b>												

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Arch/Engr:** CH2MHILL  
**Location:** Waukesha, WI  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton

**Alternate:** No. 3 - Underwood Creek Return Flow Pipeline (24")

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Return water flow from WWTP to Underwood Creek				
Note: Using aerial map showing pipe routing; 24" pipe size.				
Open Country	4,000	Inft	\$ 157	\$ 627,000
Low Urban	37,000	Inft	\$ 165	\$ 6,105,000
Medium Urban	9,000	Inft	\$ 182	\$ 1,633,500
High Urban	6,000	Inft	\$ 215	\$ 1,287,000
Forest	4,000	Inft	\$ 190	\$ 759,000
Road Crossing (assume 100 Inft)	17	each	\$ 16,500	\$ 280,500
Creek Crossing (assume 100 Inft)	25	each	\$ 33,000	\$ 825,000
Highway Crossing (assume 100 Inft)	8	each	\$ 66,000	\$ 528,000
Railroad Crossing (assume 100 Inft)	2	each	\$ 99,000	\$ 198,000
Allowance for Horizontal Boring	6,000	Inft	\$ 500	\$ 3,000,000
Allowance for Road Removal & Replacement (16 ft wide)	288,000	sqft	\$ 6	\$ 1,728,000
Allowance for Groundwater	60,000	Inft	\$ 7	\$ 445,500
Allowance for Cost of ROW purchase or use	1	Isum	\$ 500,000	\$ 500,000
Allowance for Outfall Structure at Underwood Creek	1	Isum	\$ 100,000	\$ 100,000
<b>Sub-Total, Pipeline Estimate</b>				<b>\$ 18,016,500</b>
Valves & Appurtenances Allowance	10%			\$ 1,801,650
<b>Total Estimate for Finish Water Pipeline</b>				<b>\$ 19,818,150</b>
Waukesha WWTP Pumping Station (allowance based on Alt 4)	1	ea		\$ 3,508,000
<b>Sub-Total Construction Costs w/o Markups</b>				<b>\$ 23,326,150</b>
<b>Observations / Commentary</b>				
1) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.				

Category	Boldt Suggested Unit Pricing			CH2MHILL Unit Pricing	
	Construction Difficulty Factor	Production Inft/day	Unit Price - \$/Inft	Construction Difficulty Factor	Segment A & B Unit \$/Inft
Open Country	0.95	500	\$157	0.74	\$213
Low Urban	1.00	400	\$165	1.00	\$288
Medium Urban	1.10	250	\$182	1.19	\$343
High Urban	1.30	125	\$215	1.37	\$395
Groundwater	1.30	125	\$215	1.30	\$374
Forest	1.15	250	\$190	1.15	\$331
Gravel Roads	1.00		\$165	0.85	\$241
Creek Crossing	2.00		\$330	2.00	\$576
HWY Crossing	4.00		\$660	4.00	\$1,152
Unit Cost, \$/dia-in			24-inch diameter	\$12.00	24-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Horiz Boring	Road Crossing	Water Crossing	HWY Crossing	RR Crossing
WWTP to SR59	16,000		4,000	6,000	6,000	-	-	-	12,000	-	12	-	1	1
Corridor: SR59 to Calhoun	19,000		-	18,000	1,000	-	-	-	-	4,000	-	12	3	-
Corridor: Calhoun to 124th	15,000		-	9,000	-	6,000	-	-	-	1,000	-	5	2	-
124th: Corridor to Underwood Creek	10,000		-	4,000	2,000	-	-	4,000	6,000	1,000	5	-	2	1
Miscellaneous	-		-	-	-	-	-	-	-	-	-	8	-	-
	-		-	-	-	-	-	-	-	-	-	-	-	-
	-		-	-	-	-	-	-	-	-	-	-	-	-
<b>Total, Inft</b>	<b>60,000</b>		<b>4,000</b>	<b>37,000</b>	<b>9,000</b>	<b>6,000</b>	<b>-</b>	<b>4,000</b>	<b>18,000</b>	<b>6,000</b>	<b>17</b>	<b>25</b>	<b>8</b>	<b>2</b>
<b>Total, miles</b>	<b>11.4</b>													

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Arch/Engr:** CH2MHILL  
**Location:** Waukesha, WI  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton

**Alternate:** No. 3 - Distribution System Improvements

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Distribution System Improvements				
Note: Routing not specifically shown on aerial maps				
<b>Segment A (20" diameter) -</b>				
Open Country	-	Inft	\$ 124	\$ -
Low Urban	-	Inft	\$ 135	\$ -
Medium Urban	7,784	Inft	\$ 149	\$ 1,155,924
High Urban	7,000	Inft	\$ 182	\$ 1,275,750
Forest	-	Inft	\$ 155	\$ -
Road Crossing (assume 100 Inft)	6	each	\$ 13,500	\$ 81,000
Creek Crossing (assume 100 Inft)	2	each	\$ 27,000	\$ 54,000
Highway Crossing (assume 100 Inft)	1	each	\$ 54,000	\$ 54,000
Railroad Crossing (assume 100 Inft)	-	each	\$ 81,000	\$ -
Allowance for Road Removal & Replacement (16 ft wide)	189,235	sqft	\$ 6	\$ 1,135,411
Allowance for Groundwater	14,784	Inft	\$ 4	\$ 59,875
Allowance for Cost of ROW purchase or use	1	lsum	\$ 100,000	\$ 100,000
Sub-Total Segment A				\$ 3,915,960
<b>Segment B (16" diameter) -</b>				
Open Country	-	Inft	\$ 104	\$ -
Low Urban	-	Inft	\$ 115	\$ -
Medium Urban	5,560	Inft	\$ 132	\$ 735,310
High Urban	5,000	Inft	\$ 161	\$ 805,000
Forest	-	Inft	\$ 132	\$ -
Road Crossing (assume 100 Inft)	6	each	\$ 11,500	\$ 69,000
Creek Crossing (assume 100 Inft)	2	each	\$ 23,000	\$ 46,000
Highway Crossing (assume 100 Inft)	1	each	\$ 46,000	\$ 46,000
Railroad Crossing (assume 100 Inft)	-	each	\$ 69,000	\$ -
Allowance for Road Removal & Replacement (16 ft wide)	135,168	sqft	\$ 6	\$ 811,008
Allowance for Groundwater	10,560	Inft	\$ 3	\$ 36,432
Allowance for Cost of ROW purchase or use	1	lsum	\$ 100,000	\$ 100,000
Sub-Total Segment B				\$ 2,648,750
Valves & Appurtenances Allowance	10%			\$ 656,471
<b>Total Estimate for Distribution System Improvements</b>				<b>\$ 7,221,181</b>

**Observations / Commentary**

- 1) Total estimate included in Application is \$8,465,000
- 2) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.

Category	Boldt Suggested Unit Pricing				CH2MHill Unit Pricing		
	Construction Difficulty Factor	Segment A Unit \$/Inft	Construction Difficulty Factor	Segment B Unit \$/Inft	Construction Difficulty Factor	Segment A Unit \$/Inft	Segment B Unit \$/Inft
Open Country	0.92	\$124	0.90	\$104	0.74	\$178	\$142
Low Urban	1.00	\$135	1.00	\$115	1.00	\$240	\$192
Medium Urban	1.10	\$149	1.15	\$132	1.19	\$286	\$228
High Urban	1.35	\$182	1.40	\$161	1.37	\$329	\$263
Groundwater	1.30	\$176	1.30	\$150	1.30	\$312	\$250
Forest	1.15	\$155	1.15	\$132	1.15	\$276	\$221
Gravel Roads	1.00	\$135	1.00	\$115	0.85	\$204	\$163
Creek Crossing	2.00	\$270	2.00	\$230	2.00	\$480	\$384
HWY Crossing	4.00	\$540	4.00	\$460	4.00	\$960	\$768
Unit Cost, \$/dia-in		20-inch dia		16-inch dia	\$12.00	20-inch dia	16-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
Segment A	14,784	20" diameter	-	-	7,784	7,000	-	-	6	2	1	-
Segment B	10,560	16" diameter	-	-	5,560	5,000	-	-	6	2	1	-
			-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-
<b>Total, Inft</b>	<b>25,344</b>		<b>-</b>	<b>-</b>	<b>13,344</b>	<b>12,000</b>	<b>-</b>	<b>-</b>	<b>12</b>	<b>4</b>	<b>2</b>	<b>-</b>
<b>Total, miles</b>	<b>4.80</b>											

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton  
**Estimator:** S Ford

**Location:** Waukesha, WI  
**Arch/Engr:** CH2MHILL

**Alternate:** No. 4 - Lake Michigan Water Summary

Description	BTS Conceptual Cost Estimate Summary		CH2MHILL Parametric Cost Estimate Summary	
Lake Michigan Supply Pipeline (36")		\$ 32,645,470		\$ 38,522,000
<b>Parkway Booster Station</b>		\$ 9,152,322		\$ 8,573,000
Application Base Cost Estimate	\$	8,578,122		
Cost Estimate Extensions (not extended)	\$	435,000		
Additional Project Cost (impact to % adders)	\$	139,200		
Return Flow Pipeline, Underwood Creek (36")		\$ 23,624,700		\$ 25,515,000
Return Flow Pump Station		\$ 3,508,000		\$ 3,508,000
Distribution System Improvements		\$ 7,222,000		\$ 8,465,000
<b>Sub-Total Construction Costs w/o Markups</b>		\$ 76,152,492		\$ 84,583,000
<b>Bonds &amp; Insurance Markup</b>	3.0%	\$ 2,284,575	3%	\$ 2,538,000
<b>Mob/Demob Markup</b>	3.0%	\$ 2,284,575	5%	\$ 4,230,000
<b>Sub-Total for OH&amp;P Markups</b>		\$ 80,721,642		\$ 91,351,000
<b>Contractor Overhead Markup</b>			8%	\$ 7,309,000
Construction Management	2.5%	\$ 2,018,041		
General Conditions	7.5%	\$ 6,054,123		
Equipment	3.0%	\$ 2,421,649		
<b>Contractor Profit Markup</b>	3.0%	\$ 2,736,464	4%	\$ 3,655,000
<b>Sub-Total Construction Costs</b>		\$ 93,951,919		\$ 102,315,000
<b>Contingency</b>	20.0%	\$ 18,790,384	25%	\$ 25,579,000
<b>Total Construction Costs with Markups</b>		\$ 112,742,302		\$ 127,894,000
<b>Design &amp; Engineering</b>				
Design & Engineering	12.0%	\$ 13,529,076	8%	\$ 10,232,000
Administration of Design during Construction	4.0%	\$ 4,509,692	8%	\$ 10,232,000
<b>Sub-Total, Design &amp; Engineering</b>		\$ 18,038,768		\$ 20,464,000
<b>Permits, Legal, Administration (allowance)</b>	12.0%	\$ 13,529,076	12%	\$ 15,348,000
<b>Total Project Capital Cost Estimate</b>		\$ 144,310,147		\$ 163,706,000
<b>Annual Operation &amp; Maintenance</b>		\$ 6,200,000		
<b>50-Year Present Worth (6%)</b>		\$ 242,035,000		

**Project Information:**

Project: Application for Lake Michigan Water Supply  
 Customer: Wisconsin DNR  
 Arch/Engr: CH2MHILL  
 Location: Waukesha, WI  
 Type: Estimate Review of Alternates  
 Area Office: Boldt / Appleton

Alternate: No. 4 - Milwaukee Water Supply Pipeline (36")

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Lake Michigan water supply from 60th/Howard to Hillcrest Reservoir				
Note: Using aerial map showing pipe routing; 36" pipe size.				
Open Country	-	Inft	\$ 200	\$ -
Low Urban	28,000	Inft	\$ 210	\$ 5,880,000
Medium Urban	14,000	Inft	\$ 231	\$ 3,234,000
High Urban Using high urban rate for congested areas along trail	19,500	Inft	\$ 273	\$ 5,323,500
Forest	1,500	Inft	\$ 242	\$ 362,250
Wetlands	8,000	Inft	\$ 546	\$ 4,368,000
Road Crossing (assume 100 Inft)	21	each	\$ 21,000	\$ 441,000
Creek Crossing (assume 100 Inft)	7	each	\$ 42,000	\$ 294,000
Highway Crossing (assume 100 Inft)	18	each	\$ 84,000	\$ 1,512,000
Railroad Crossing (assume 100 Inft)	-	each	\$ 126,000	\$ -
Allowance for Horizontal Boring	9,000	Inft	\$ 500	\$ 4,500,000
Allowance for Road Removal & Replacement (16 ft wide)	432,000	sqft	\$ 6	\$ 2,592,000
Allowance for Groundwater	71,000	Inft	\$ 9	\$ 670,950
Allowance for Cost of ROW purchase or use	1	Isum	\$ 500,000	\$ 500,000
Sub-Total, Pipeline Estimate				\$ 29,677,700
Valves & Appurtenances Allowance	10%			\$ 2,967,770
<b>Total Estimate for Finish Water Pipeline</b>				<b>\$ 32,645,470</b>
<b>Observations / Commentary</b>				
1) Total estimate included in Application is \$38,522,000				
2) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.				

Category	Boldt Suggested Unit Pricing			CH2MHill Unit Pricing	
	Construction Difficulty Factor	Production Inft/day	Unit Price - \$/Inft	Construction Difficulty Factor	Segment A & B Unit \$/Inft
Open Country	0.95	500	\$200	0.74	\$320
Low Urban	1.00	400	\$210	1.00	\$432
Medium Urban	1.10	250	\$231	1.19	\$514
High Urban	1.30	125	\$273	1.37	\$592
Groundwater	1.30	125	\$273	1.30	\$562
Forest	1.15	250	\$242	1.15	\$497
Gravel Roads	1.00		\$210	0.85	\$367
Creek Crossing	2.00		\$420	2.00	\$864
HWY Crossing	4.00		\$840	4.00	\$1,728
Unit Cost, \$/dia-in			36-inch diameter	\$12.00	36-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Road Crossing	Creek Crossing	HWY Crossing	Horiz Bore
Hillcrest Reservoir to Trail	5,500		-	1,500	2,500	-	-	1,500	1,000	3	-	-	-
Trail: Hillcrest to 124th	32,500		-	25,500	-	6,000	1,000	-	-	-	6	5	5,000
124th: Trail to RootRiver	4,000		-	1,000	3,000	-	-	-	4,000	-	-	-	2,000
Root River: 124th to Beloit	12,000		-	-	5,000	-	7,000	-	5,000	-	-	3	1,000
Howard: Beloit to 60th	17,000		-	-	3,500	13,500	-	-	17,000	18	1	8	2,000
	-		-	-	-	-	-	-	-	-	-	-	-
	-		-	-	-	-	-	-	-	-	-	-	-
<b>Total, Inft</b>	<b>71,000</b>		<b>-</b>	<b>28,000</b>	<b>14,000</b>	<b>19,500</b>	<b>8,000</b>	<b>1,500</b>	<b>27,000</b>	<b>21</b>	<b>7</b>	<b>18</b>	<b>9,000</b>
<b>Total, miles</b>	<b>13.45</b>												

**Project Information:**

Project: Application for Lake Michigan Water Supply  
 Customer: Wisconsin DNR  
 Arch/Engr: CH2MHILL  
 Location: Waukesha, WI  
 Type: Estimate Review of Alternates  
 Area Office: Boldt / Appleton

Alternate: No. 4 - Underwood Creek Return Flow Pipeline (36")

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Return water flow from WWTP to Underwood Creek				
Note: Using aerial map showing pipe routing; 36" pipe size.				
Open Country	4,000	Inft	\$ 200	\$ 798,000
Low Urban	37,000	Inft	\$ 210	\$ 7,770,000
Medium Urban	9,000	Inft	\$ 231	\$ 2,079,000
High Urban	6,000	Inft	\$ 273	\$ 1,638,000
Forest	4,000	Inft	\$ 242	\$ 966,000
Road Crossing (assume 100 Inft)	17	each	\$ 21,000	\$ 357,000
Creek Crossing (assume 100 Inft)	25	each	\$ 42,000	\$ 1,050,000
Highway Crossing (assume 100 Inft)	8	each	\$ 84,000	\$ 672,000
Railroad Crossing (assume 100 Inft)	2	each	\$ 126,000	\$ 252,000
Allowance for Horizontal Boring	6,000	Inft	\$ 500	\$ 3,000,000
Allowance for Road Removal & Replacement (16 ft wide)	288,000	sqft	\$ 6	\$ 1,728,000
Allowance for Groundwater	60,000	Inft	\$ 9	\$ 567,000
Allowance for Cost of ROW purchase or use	1	Isum	\$ 500,000	\$ 500,000
Allowance for Outfall Structure at Underwood Creek	1	Isum	\$ 100,000	\$ 100,000
Sub-Total, Pipeline Estimate				\$ 21,477,000
Valves & Appurtenances Allowance	10%			\$ 2,147,700
<b>Total Estimate for Finish Water Pipeline</b>				<b>\$ 23,624,700</b>
Waukesha WWTP Pumping Station (allowance based on Alt 4)	1	ea		\$ 3,508,000
<b>Sub-Total Construction Costs w/o Markups</b>				<b>\$ 27,132,700</b>
<b>Observations / Commentary</b>				
1) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.				

Category	Boldt Suggested Unit Pricing			CH2MHILL Unit Pricing	
	Construction Difficulty Factor	Production Inft/day	Unit Price - \$/Inft	Construction Difficulty Factor	Segment A & B Unit - \$/Inft
Open Country	0.95	500	\$200	0.74	\$320
Low Urban	1.00	400	\$210	1.00	\$432
Medium Urban	1.10	250	\$231	1.19	\$514
High Urban	1.30	125	\$273	1.37	\$592
Groundwater	1.30	125	\$273	1.30	\$562
Forest	1.15	250	\$242	1.15	\$497
Gravel Roads	1.00		\$210	0.85	\$367
Creek Crossing	2.00		\$420	2.00	\$864
HWY Crossing	4.00		\$840	4.00	\$1,728
Unit Cost, \$/dia-in			36-inch diameter	\$12.00	36-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Horiz Boring	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
WWTP to SR59	16,000		4,000	6,000	6,000	-	-	-	12,000	-	12	-	1	1
Corridor: SR59 to Calhoun	19,000		-	18,000	1,000	-	-	-	-	4,000	-	12	3	-
Corridor: Calhoun to 124th	15,000		-	9,000	-	6,000	-	-	-	1,000	-	5	2	-
124th: Corridor to Underwood Creek	10,000		-	4,000	2,000	-	-	4,000	6,000	1,000	5	-	2	1
Miscellaneous	-		-	-	-	-	-	-	-	-	-	8	-	-
	-		-	-	-	-	-	-	-	-	-	-	-	-
	-		-	-	-	-	-	-	-	-	-	-	-	-
<b>Total, Inft</b>	<b>60,000</b>		<b>4,000</b>	<b>37,000</b>	<b>9,000</b>	<b>6,000</b>	<b>-</b>	<b>4,000</b>	<b>18,000</b>	<b>6,000</b>	<b>17</b>	<b>25</b>	<b>8</b>	<b>2</b>
<b>Total, miles</b>	<b>11.4</b>													

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Arch/Engr:** CH2MHILL  
**Location:** Waukesha, WI  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton

**Alternate:** No. 4 - Distribution System Improvements

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Distribution System Improvements				
Note: Routing not specifically shown on aerial maps				
<b>Segment A (20" diameter) -</b>				
Open Country	-	Inft	\$ 124	\$ -
Low Urban	-	Inft	\$ 135	\$ -
Medium Urban	7,784	Inft	\$ 149	\$ 1,155,924
High Urban	7,000	Inft	\$ 182	\$ 1,275,750
Forest	-	Inft	\$ 155	\$ -
Road Crossing (assume 100 Inft)	6	each	\$ 13,500	\$ 81,000
Creek Crossing (assume 100 Inft)	2	each	\$ 27,000	\$ 54,000
Highway Crossing (assume 100 Inft)	1	each	\$ 54,000	\$ 54,000
Railroad Crossing (assume 100 Inft)	-	each	\$ 81,000	\$ -
Allowance for Road Removal & Replacement (16 ft wide)	189,235	sqft	\$ 6	\$ 1,135,411
Allowance for Groundwater	14,784	Inft	\$ 4	\$ 59,875
Allowance for Cost of ROW purchase or use	1	lsum	\$ 100,000	\$ 100,000
Sub-Total Segment A				\$ 3,915,960
<b>Segment B (16" diameter) -</b>				
Open Country	-	Inft	\$ 104	\$ -
Low Urban	-	Inft	\$ 115	\$ -
Medium Urban	5,560	Inft	\$ 132	\$ 735,310
High Urban	5,000	Inft	\$ 161	\$ 805,000
Forest	-	Inft	\$ 132	\$ -
Road Crossing (assume 100 Inft)	6	each	\$ 11,500	\$ 69,000
Creek Crossing (assume 100 Inft)	2	each	\$ 23,000	\$ 46,000
Highway Crossing (assume 100 Inft)	1	each	\$ 46,000	\$ 46,000
Railroad Crossing (assume 100 Inft)	-	each	\$ 69,000	\$ -
Allowance for Road Removal & Replacement (16 ft wide)	135,168	sqft	\$ 6	\$ 811,008
Allowance for Groundwater	10,560	Inft	\$ 3	\$ 36,432
Allowance for Cost of ROW purchase or use	1	lsum	\$ 100,000	\$ 100,000
Sub-Total Segment B				\$ 2,648,750
Valves & Appurtenances Allowance	10%			\$ 656,471
<b>Total Estimate for Distribution System Improvements</b>				<b>\$ 7,221,181</b>

**Observations / Commentary**

- 1) Total estimate included in Application is \$8,465,000
- 2) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.

Category	Boldt Suggested Unit Pricing				CH2MHill Unit Pricing		
	Construction Difficulty Factor	Segment A Unit \$/Inft	Construction Difficulty Factor	Segment B Unit \$/Inft	Construction Difficulty Factor	Segment A Unit \$/Inft	Segment B Unit \$/Inft
Open Country	0.92	\$124	0.90	\$104	0.74	\$178	\$142
Low Urban	1.00	\$135	1.00	\$115	1.00	\$240	\$192
Medium Urban	1.10	\$149	1.15	\$132	1.19	\$286	\$228
High Urban	1.35	\$182	1.40	\$161	1.37	\$329	\$263
Groundwater	1.30	\$176	1.30	\$150	1.30	\$312	\$250
Forest	1.15	\$155	1.15	\$132	1.15	\$276	\$221
Gravel Roads	1.00	\$135	1.00	\$115	0.85	\$204	\$163
Creek Crossing	2.00	\$270	2.00	\$230	2.00	\$480	\$384
HWY Crossing	4.00	\$540	4.00	\$460	4.00	\$960	\$768
Unit Cost, \$/dia-in		20-inch dia		16-inch dia	\$12.00	20-inch dia	16-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
Segment A	14,784	20" diameter	-	-	7,784	7,000	-	-	6	2	1	-
Segment B	10,560	16" diameter	-	-	5,560	5,000	-	-	6	2	1	-
			-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-
Total, Inft	25,344		-	-	13,344	12,000	-	-	12	4	2	-
Total, miles	4.80											

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton  
**Estimator:** S Ford

**Location:** Waukesha, WI  
**Arch/Engr:** CH2MHILL

**Alternate:** No. 5 - Lake Michigan Water from Oak Creek Summary

Description	BTS Conceptual Cost Estimate Summary		CH2MHILL Parametric Cost Estimate Summary	
<b>Lake Michigan Supply Pipeline from Oak Creek</b>		\$ 62,682,600		\$ 79,417,000
<b>Booster Pump Stations</b>		\$ 17,970,000		\$ 17,970,000
Oak Creek WTP Supply Stations	\$ 8,810,000		\$ 8,810,000	
Greenfield Park Booster Stations	\$ 9,160,000		\$ 9,160,000	
<b>Return Flow Pipeline, Underwood Creek (36")</b>		\$ 23,624,700		\$ 25,515,000
<b>Return Flow Pump Station</b>		\$ 3,508,000		\$ 3,508,000
<b>Distribution System Improvements</b>		\$ 7,222,000		\$ 8,465,000
<b>Sub-Total Construction Costs w/o Markups</b>		\$ 115,007,300		\$ 134,875,000
<b>Bonds &amp; Insurance Markup</b>	3.0%	\$ 3,450,219	3%	\$ 4,047,000
<b>Mob/Demob Markup</b>	3.0%	\$ 3,450,219	5%	\$ 6,744,000
<b>Sub-Total for OH&amp;P Markups</b>		\$ 121,907,738		\$ 145,666,000
<b>Contractor Overhead Markup</b>			8%	\$ 11,654,000
Construction Management	2.5%	\$ 3,047,693		
General Conditions	7.5%	\$ 9,143,080		
Equipment	3.0%	\$ 3,657,232		
<b>Contractor Profit Markup</b>	3.0%	\$ 4,132,672	4%	\$ 5,827,000
<b>Sub-Total Construction Costs</b>		\$ 141,888,416		\$ 163,147,000
<b>Contingency</b>	25.0%	\$ 35,472,104	25%	\$ 40,787,000
<b>Total Construction Costs with Markups</b>		\$ 177,360,520		\$ 203,934,000
<b>Design &amp; Engineering</b>				
Design & Engineering	12.0%	\$ 21,283,262	8%	\$ 16,315,000
Administration of Design during Construction	4.0%	\$ 7,094,421	8%	\$ 16,315,000
<b>Sub-Total, Design &amp; Engineering</b>		\$ 28,377,683		\$ 32,630,000
<b>Permits, Legal, Administration (allowance)</b>	12.0%	\$ 21,283,262	12%	\$ 24,473,000
<b>Total Project Capital Cost Estimate</b>		\$ 227,021,466		\$ 261,037,000
<b>Annual Operation &amp; Maintenance</b>		\$ 6,200,000		
<b>50-Year Present Worth (6%)</b>		\$ 324,746,000		

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Arch/Engr:** CH2MHILL  
**Location:** Waukesha, WI  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton

**Alternate:** No. 5 - Oak Creek Water Supply Pipeline

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Lake Michigan water supply from Oak Creek to Hillcrest Reservoir				
Note: Using aerial map showing pipe routing; 36" pipe size.				
Open Country	-	Inft	\$ 200	\$ -
Low Urban	26,700	Inft	\$ 210	\$ 5,607,000
Medium Urban	83,400	Inft	\$ 231	\$ 19,265,400
High Urban	6,000	Inft	\$ 273	\$ 1,638,000
Forest	1,500	Inft	\$ 242	\$ 362,250
Wetlands	15,000	Inft	\$ 546	\$ 8,190,000
Road Crossing (assume 100 Inft)	23	each	\$ 21,000	\$ 483,000
Creek Crossing (assume 100 Inft)	10	each	\$ 42,000	\$ 420,000
Highway Crossing (assume 100 Inft)	14	each	\$ 84,000	\$ 1,176,000
Interstate Crossing (assume 1000 Inft)	3	each	\$ 840,000	\$ 2,520,000
Railroad Crossing (assume 100 Inft)	1	each	\$ 126,000	\$ 126,000
Allowance for Horizontal Boring	12,000	Inft	\$ 500	\$ 6,000,000
Allowance for Road Removal & Replacement (16 ft wide)	870,400	sqft	\$ 6	\$ 5,222,400
Allowance for Groundwater	132,600	Inft	\$ 9	\$ 1,253,070
Allowance for Cost of ROW purchase or use	1	Isum	\$ 500,000	\$ 500,000
<b>Sub-Total, Pipeline Estimate</b>				\$ 52,763,120
Valves & Appurtenances Allowance	10%			\$ 5,276,312
<b>Total Estimate for Finish Water Pipeline</b>	25 miles		\$ 2,321,577	\$ 58,039,432
<b>Adjusted for Pipeline Length in Application</b>	27 miles		\$ 2,321,577	\$ 62,682,587
<b>Observations / Commentary</b>				
1) Total estimate included in Application is \$79,417,000				
2) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.				

Category	Boldt Suggested Unit Pricing			CH2MHILL Unit Pricing	
	Construction Difficulty Factor	Production Inft/day	Unit Price - \$/Inft	Construction Difficulty Factor	Segment A & B Unit - \$/Inft
Open Country	0.95	500	\$200	0.74	\$320
Low Urban	1.00	400	\$210	1.00	\$432
Medium Urban	1.10	250	\$231	1.19	\$514
High Urban	1.30	125	\$273	1.37	\$592
Groundwater	1.30	125	\$273	1.30	\$562
Forest	1.15	250	\$242	1.15	\$497
Gravel Roads	1.00		\$210	0.85	\$367
Creek Crossing	2.00		\$420	2.00	\$864
HWY Crossing	4.00		\$840	4.00	\$1,728
Unit Cost, \$/dia-in			36-inch diameter	\$12.00	36-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Road Crossing	Creek Crossing	HWY Crossing	Interstate Crossing	Horiz Bore
Hillcrest Reservoir to Trail	5,500		-	1,500	2,500	-	-	1,500	1,000	3	-	-	-	-
Trail: Hillcrest to 124th	32,500		-	-	25,500	6,000	1,000	-	-	-	6	5	-	5,000
124th: Trail to RootRiver	4,000		-	1,000	3,000	-	-	-	4,000	-	-	2	-	1,000
Root River: 124th to Beloit	12,000		-	-	5,000	-	7,000	-	5,000	-	-	3	-	1,000
Root River: Beloit to Grange	12,800		-	1,600	4,200	-	7,000	-	4,200	4	2	3	1	1,000
92nd: Grange to Rawson	10,200		-	5,000	5,200	-	-	-	5,200	2	-	-	-	-
Rawson: 92nd to SR38	31,000		-	-	31,000	-	-	-	31,000	6	-	-	2	4,000
Diagonal: SR38 to Puetz	11,300		-	7,300	4,000	-	-	-	-	2	-	-	-	-
Diagonal: Puetz to End	13,300		-	10,300	3,000	-	-	-	4,000	6	2	1	-	-
	-		-	-	-	-	-	-	-	-	-	-	-	-
	-		-	-	-	-	-	-	-	-	-	-	-	-
	-		-	-	-	-	-	-	-	-	-	-	-	-
<b>Total, Inft</b>	132,600		-	26,700	83,400	6,000	15,000	1,500	54,400	23	10	14	3	12,000
<b>Total, miles</b>	25.11													

**Project Information:**

Project: Application for Lake Michigan Water Supply  
 Customer: Wisconsin DNR  
 Arch/Engr: CH2MHILL  
 Location: Waukesha, WI  
 Type: Estimate Review of Alternates  
 Area Office: Boldt / Appleton

Alternate: No. 6 - Underwood Creek Return Flow Pipeline

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Return water flow from WWTP to Underwood Creek				
Note: Using aerial map showing pipe routing; 36" pipe size.				
Open Country	4,000	Inft	\$ 200	\$ 798,000
Low Urban	37,000	Inft	\$ 210	\$ 7,770,000
Medium Urban	9,000	Inft	\$ 231	\$ 2,079,000
High Urban Using high urban rate for congested areas along trail	6,000	Inft	\$ 273	\$ 1,638,000
Forest	4,000	Inft	\$ 242	\$ 966,000
Road Crossing (assume 100 Inft)	17	each	\$ 21,000	\$ 357,000
Creek Crossing (assume 100 Inft)	25	each	\$ 42,000	\$ 1,050,000
Highway Crossing (assume 100 Inft)	8	each	\$ 84,000	\$ 672,000
Railroad Crossing (assume 100 Inft)	2	each	\$ 126,000	\$ 252,000
Allowance for Horizontal Boring	6,000	Inft	\$ 500	\$ 3,000,000
Allowance for Road Removal & Replacement (16 ft wide)	288,000	sqft	\$ 6	\$ 1,728,000
Allowance for Groundwater	60,000	Inft	\$ 9	\$ 567,000
Allowance for Cost of ROW purchase or use	1	isum	\$ 500,000	\$ 500,000
Allowance for Outfall Structure at Underwood Creed	1	isum	\$ 100,000	\$ 100,000
Sub-Total, Pipeline Estimate				\$ 21,477,000
Valves & Appurtenances Allowance	10%			\$ 2,147,700
<b>Total Estimate for Finish Water Pipeline</b>				<b>\$ 23,624,700</b>
<b>Observations / Commentary</b>				
1) Total estimate included in Application is \$17,011,000.				
2) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.				

Category	Boldt Suggested Unit Pricing			CH2MHill Unit Pricing	
	Construction Difficulty Factor	Production Inft/day	Unit Price - \$/Inft	Construction Difficulty Factor	Segment A & B Unit \$/Inft
Open Country	0.95	500	\$200	0.74	\$320
Low Urban	1.00	400	\$210	1.00	\$432
Medium Urban	1.10	250	\$231	1.19	\$514
High Urban	1.30	125	\$273	1.37	\$592
Groundwater	1.30	125	\$273	1.30	\$562
Forest	1.15	250	\$242	1.15	\$497
Gravel Roads	1.00		\$210	0.85	\$367
Creek Crossing	2.00		\$420	2.00	\$864
HWY Crossing	4.00		\$840	4.00	\$1,728
Unit Cost, \$/dia-in			36-inch diameter	\$12.00	36-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Horiz Boring	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
WWTP to SR59	16,000		4,000	6,000	6,000	-	-	-	12,000	-	12	-	1	1
Corridor: SR59 to Calhoun	19,000		-	18,000	1,000	-	-	-	-	4,000	-	12	3	-
Corridor: Calhoun to 124th	15,000		-	9,000	-	6,000	-	-	-	1,000	-	5	2	-
124th: Corridor to Underwood Creek	10,000		-	4,000	2,000	-	-	4,000	6,000	1,000	5	-	2	1
Miscellaneous	-		-	-	-	-	-	-	-	-	-	8	-	-
	-		-	-	-	-	-	-	-	-	-	-	-	-
	-		-	-	-	-	-	-	-	-	-	-	-	-
<b>Total, Inft</b>	<b>60,000</b>		<b>4,000</b>	<b>37,000</b>	<b>9,000</b>	<b>6,000</b>	<b>-</b>	<b>4,000</b>	<b>18,000</b>	<b>6,000</b>	<b>17</b>	<b>25</b>	<b>8</b>	<b>2</b>
<b>Total, miles</b>	<b>11</b>													

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton  
**Estimator:** S Ford

**Location:** Waukesha, WI  
**Arch/Engr:** CH2MHILL

**Alternate:** No. 6 - Lake Michigan Water from Racine Summary

Description	BTS Conceptual Cost Estimate Summary		CH2MHILL Parametric Cost Estimate Summary	
Lake Michigan Supply Pipeline from Racine		\$ 77,523,429		\$ 106,828,000
<b>Booster Pump Stations</b>		\$ 17,061,000		\$ 17,061,000
Newman Ave Supply Station	\$	7,901,000	\$	7,901,000
8-Mile Road Booster Station	\$	9,160,000	\$	9,160,000
<b>Return Flow Pipeline, Underwood Creek</b>		\$ 23,624,700		\$ 25,515,000
<b>Return Flow Pump Station</b>		\$ 3,508,000		\$ 3,508,000
<b>Distribution System Improvements</b>		\$ 7,222,000		\$ 8,465,000
<b>Sub-Total Construction Costs w/o Markups</b>		\$ 128,939,129		\$ 161,377,000
<b>Bonds &amp; Insurance Markup</b>	3.0%	\$ 3,868,174	3%	\$ 4,842,000
<b>Mob/Demob Markup</b>	3.0%	\$ 3,868,174	5%	\$ 8,069,000
<b>Sub-Total for OH&amp;P Markups</b>		\$ 136,675,477		\$ 174,288,000
<b>Contractor Overhead Markup</b>			8%	\$ 13,944,000
Construction Management	2.5%	\$ 3,416,887		
General Conditions	7.5%	\$ 10,250,661		
Equipment	3.0%	\$ 4,100,264		
<b>Contractor Profit Markup</b>	3.0%	\$ 4,633,299	4%	\$ 6,972,000
<b>Sub-Total Construction Costs</b>		\$ 159,076,587		\$ 195,204,000
<b>Contingency</b>	25.0%	\$ 39,769,147	25%	\$ 48,801,000
<b>Total Construction Costs with Markups</b>		\$ 198,845,734		\$ 244,005,000
<b>Design &amp; Engineering</b>				
Design & Engineering	12.0%	\$ 23,861,488	8%	\$ 19,521,000
Administration of Design during Construction	4.0%	\$ 7,953,829	8%	\$ 19,521,000
<b>Sub-Total, Design &amp; Engineering</b>		\$ 31,815,317		\$ 39,042,000
<b>Permits, Legal, Administration (allowance)</b>	12.0%	\$ 23,861,488	12%	\$ 29,281,000
<b>Total Project Capital Cost Estimate</b>		\$ 254,522,540		\$ 312,328,000
<b>Annual Operation &amp; Maintenance</b>		\$ 6,200,000		
<b>50-Year Present Worth (6%)</b>		\$ 352,247,000		

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Arch/Engr:** CH2MHILL  
**Location:** Waukesha, WI  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton

**Alternate:** No. 6 - Racine Water Supply Pipeline

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Lake Michigan water supply from Racine				
Note: Using aerial map showing pipe routing, 36" & 42" pipe size.				
Open Country	159,300	Inft	\$ 263	\$ 41,950,062
Low Urban	13,500	Inft	\$ 277	\$ 3,742,200
Medium Urban	14,500	Inft	\$ 305	\$ 4,421,340
High Urban	-	Inft	\$ 360	\$ -
Forest	7,500	Inft	\$ 360	\$ 2,702,700
Wetlands	10,500	Inft	\$ 319	\$ 3,347,190
Road Crossing (assume 100 Inft)	52	each	\$ 27,720	\$ 1,441,440
Creek Crossing (assume 100 Inft)	22	each	\$ 55,440	\$ 1,219,680
Highway Crossing (assume 100 Inft)	5	each	\$ 110,880	\$ 554,400
Interstate Crossing (assume 1000 Inft)	2	each	\$ 1,108,800	\$ 2,217,600
Railroad Crossing (assume 100 Inft)	1	each	\$ 166,320	\$ 166,320
Allowance for Horizontal Boring	6,000	Inft	\$ 750	\$ 4,500,000
Allowance for Road Removal & Replacement (16 ft wide)	192,000	sqft	\$ 6	\$ 1,152,000
Allowance for Groundwater	205,300	Inft	\$ 12	\$ 2,560,912
Allowance for Cost of ROW purchase or use	1	lsum	\$ 500,000	\$ 500,000
Sub-Total, Pipeline Estimate				\$ 70,475,844
Valves & Appurtenances Allowance	10%		\$	7,047,584
<b>Total Estimate for Finish Water Pipeline</b>				<b>\$ 77,523,429</b>
<b>Observations / Commentary</b>				
1) Total estimate included in Application is \$106,828,000				
2) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.				

Category	Boldt Suggested Unit Pricing				CH2MHill Unit Pricing		
	Construction Difficulty Factor	Production Inft/day	Unit Price - \$/Inft	Unit Price - \$/Inft	Construction Difficulty Factor	Segment A Unit \$/Inft	Segment B Unit \$/Inft
Open Country	0.95	500	\$200	\$279	0.74	\$373	\$320
Low Urban	1.00	400	\$210	\$294	1.00	\$504	\$432
Medium Urban	1.10	250	\$231	\$323	1.19	\$600	\$514
High Urban	1.30	125	\$273	\$382	1.37	\$690	\$592
Groundwater	1.30	125	\$273	\$382	1.30	\$655	\$562
Forest	1.15	250	\$242	\$338	1.15	\$580	\$497
Gravel Roads	1.00		\$210	\$294	0.85	\$428	\$367
Creek Crossing	2.00		\$420	\$588	2.00	\$1,008	\$864
HWY Crossing	4.00		\$840	\$1,176	4.00	\$2,016	\$1,728
Unit Cost, \$/dia-in			36-inch dia	42-inch dia	\$12.00	42-inch dia	36-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Road Crossing	Creek Crossing	HWY Crossing	Interstate Crossing	Horiz Bore
Hillcrest Reservoir to Trail	5,500		-	1,500	2,500	-	-	1,500	1,000	3	-	-	-	-
Trail: Hillcrest to Substation	5,500		-	-	5,000	-	500	-	-	1	1	-	-	1,000
Cross Country: Substation to National	30,800		27,800	-	-	-	3,000	-	1,000	10	4	2	-	1,000
Cross Country: National to Muskego Dam	41,700		29,700	5,000	-	-	7,000	-	-	7	3	2	1	1,000
Cross Country: Muskego Dam to I94	60,400		55,400	-	-	-	-	5,000	-	16	8	1	1	1,000
Cross Country: I94 to CR C	51,400		46,400	4,000	-	-	-	1,000	-	10	6	-	-	1,000
CR C: to End	10,000		-	3,000	7,000	-	-	-	10,000	5	-	-	-	1,000
			-	-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-	-
<b>Total, Inft</b>	<b>205,300</b>		<b>159,300</b>	<b>13,500</b>	<b>14,500</b>	<b>-</b>	<b>10,500</b>	<b>7,500</b>	<b>12,000</b>	<b>52</b>	<b>22</b>	<b>5</b>	<b>2</b>	<b>6,000</b>
<b>Total, miles</b>	<b>38.88</b>													

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Arch/Engr:** CH2MHILL  
**Location:** Waukesha, WI  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton

**Alternate:** No. 5 - Underwood Creek Return Flow Pipeline

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Return water flow from WWTP to Underwood Creek				
Note: Using aerial map showing pipe routing; 36" pipe size.				
Open Country	4,000	Inft	\$ 200	\$ 798,000
Low Urban	37,000	Inft	\$ 210	\$ 7,770,000
Medium Urban	9,000	Inft	\$ 231	\$ 2,079,000
High Urban Using high urban rate for congested areas along trail	6,000	Inft	\$ 273	\$ 1,638,000
Forest	4,000	Inft	\$ 242	\$ 966,000
Road Crossing (assume 100 Inft)	17	each	\$ 21,000	\$ 357,000
Creek Crossing (assume 100 Inft)	25	each	\$ 42,000	\$ 1,050,000
Highway Crossing (assume 100 Inft)	8	each	\$ 84,000	\$ 672,000
Railroad Crossing (assume 100 Inft)	2	each	\$ 126,000	\$ 252,000
Allowance for Horizontal Boring	6,000	Inft	\$ 500	\$ 3,000,000
Allowance for Road Removal & Replacement (16 ft wide)	288,000	sqft	\$ 6	\$ 1,728,000
Allowance for Groundwater	60,000	Inft	\$ 9	\$ 567,000
Allowance for Cost of ROW purchase or use	1	Isum	\$ 500,000	\$ 500,000
Allowance for Outfall Structure at Underwood Creed	1	Isum	\$ 100,000	\$ 100,000
Sub-Total, Pipeline Estimate				\$ 21,477,000
Valves & Appurtenances Allowance	10%			\$ 2,147,700
<b>Total Estimate for Finish Water Pipeline</b>				<b>\$ 23,624,700</b>
<b>Observations / Commentary</b>				
1) Total estimate included in Application is \$17,011,000.				
2) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.				

Category	Boldt Suggested Unit Pricing			CH2MHill Unit Pricing	
	Construction Difficulty Factor	Production Inft/day	Unit Price - \$/Inft	Construction Difficulty Factor	Segment A & B Unit \$/Inft
Open Country	0.95	500	\$200	0.74	\$320
Low Urban	1.00	400	\$210	1.00	\$432
Medium Urban	1.10	250	\$231	1.19	\$514
High Urban	1.30	125	\$273	1.37	\$592
Groundwater	1.30	125	\$273	1.30	\$562
Forest	1.15	250	\$242	1.15	\$497
Gravel Roads	1.00		\$210	0.85	\$367
Creek Crossing	2.00		\$420	2.00	\$864
HWY Crossing	4.00		\$840	4.00	\$1,728
Unit Cost, \$/dia-in			36-inch diameter	\$12.00	36-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Horiz Boring	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
WWTP to SR59	16,000		4,000	6,000	6,000	-	-	-	12,000	-	12	-	1	1
Corridor: SR59 to Calhoun	19,000		-	18,000	1,000	-	-	-	-	4,000	-	12	3	-
Corridor: Calhoun to 124th	15,000		-	9,000	-	6,000	-	-	-	1,000	-	5	2	-
124th: Corridor to Underwood Creek	10,000		-	4,000	2,000	-	-	4,000	6,000	1,000	5	-	2	1
Miscellaneous	-		-	-	-	-	-	-	-	-	-	8	-	-
	-		-	-	-	-	-	-	-	-	-	-	-	-
	-		-	-	-	-	-	-	-	-	-	-	-	-
<b>Total, Inft</b>	<b>60,000</b>		<b>4,000</b>	<b>37,000</b>	<b>9,000</b>	<b>6,000</b>	<b>-</b>	<b>4,000</b>	<b>18,000</b>	<b>6,000</b>	<b>17</b>	<b>25</b>	<b>8</b>	<b>2</b>
<b>Total, miles</b>	<b>11</b>													

**Project Information:**

**Project:** Application for Lake Michigan Water Supply      **Location:** Waukesha, WI  
**Customer:** Wisconsin DNR      **Arch/Engr:** Black & Veatch  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton  
**Estimator:** S Ford

**Alternate:** No. 7 - River Bank Inducement Wells Summary

Description	RBI Wells (GWUDI w/Disinfection)		RBI Wells (GWUDI w/Surface Treatment)	
	BTS Conceptual Cost Estimate Summary	Black & Veatch Cost Estimate Summary	BTS Conceptual Cost Estimate Summary	Black & Veatch Cost Estimate Summary
Shallow Aquifer Water Treatment Plant (6.8 mgd)	\$ 22,925,000	\$ 23,513,000	\$ 24,925,000	\$ 25,553,000
Shallow Aquifer Wellfield	\$ 10,457,000	\$ 6,930,000	\$ 10,457,000	\$ 6,930,000
Supply Pipeline to Waukesha	\$ 16,895,000	\$ 15,475,000	\$ 16,895,000	\$ 15,475,000
Distribution System Improvements	\$ 7,466,000	\$ 8,465,000	\$ 7,466,000	\$ 8,465,000
Wastewater Force Main	\$ 4,615,000	\$ 3,332,000	\$ 4,615,000	\$ 3,332,000
<b>Sub-Total Construction Costs w/o Markups</b>	<b>\$ 62,358,000</b>	<b>\$ 57,715,000</b>	<b>\$ 64,358,000</b>	<b>\$ 59,755,000</b>
Bonds & Insurance Markup	3.0% \$ 1,870,740	3% \$ 1,732,000	3.0% \$ 1,930,740	3% \$ 1,732,000
Mob/Demob Markup	3.0% \$ 1,870,740	5% \$ 2,886,000	3.0% \$ 1,930,740	5% \$ 2,886,000
<b>Sub-Total for OH&amp;P Markups</b>	<b>\$ 66,099,480</b>	<b>\$ 62,333,000</b>	<b>\$ 68,219,480</b>	<b>\$ 64,373,000</b>
<b>Contractor Overhead Markup</b>		8% \$ 4,987,000		8% \$ 5,150,000
Construction Management	2.5% \$ 1,652,487		2.5% \$ 1,705,487	
General Conditions	7.5% \$ 4,957,461		7.5% \$ 5,116,461	
Equipment	3.0% \$ 1,982,984		3.0% \$ 2,046,584	
<b>Contractor Profit Markup</b>	3.0% \$ 2,240,772	4% \$ 2,494,000	3.0% \$ 2,312,640	4% \$ 2,575,000
<b>Sub-Total Construction Costs</b>	<b>\$ 76,933,185</b>	<b>\$ 69,814,000</b>	<b>\$ 79,400,653</b>	<b>\$ 72,098,000</b>
<b>Contingency</b>	20.0% \$ 15,386,637	25% \$ 17,454,000	20.0% \$ 15,880,131	25% \$ 18,025,000
<b>Total Construction Costs with Markups</b>	<b>\$ 92,319,822</b>	<b>\$ 87,268,000</b>	<b>\$ 95,280,783</b>	<b>\$ 90,123,000</b>
<b>Design &amp; Engineering</b>				
Design & Engineering	12.0% \$ 11,078,379	8% \$ 6,982,000	12.0% \$ 11,433,694	8% \$ 7,210,000
Administration of Design during Construction	4.0% \$ 3,692,793	8% \$ 6,982,000	4.0% \$ 3,811,231	8% \$ 7,210,000
<b>Sub-Total, Design &amp; Engineering</b>	<b>\$ 14,771,171</b>	<b>\$ 13,964,000</b>	<b>\$ 15,244,925</b>	<b>\$ 14,420,000</b>
<b>Permits, Legal, Administration (allowance)</b>	12.0% \$ 11,078,379	12% \$ 10,473,000	12.0% \$ 11,433,694	12% \$ 10,815,000
<b>Total Project Capital Cost Estimate</b>	<b>\$ 118,169,372</b>	<b>\$ 111,705,000</b>	<b>\$ 121,959,403</b>	<b>\$ 115,358,000</b>

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Arch/Engr:** Black & Veatch  
**Location:** Waukesha, WI  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton

**Alternate:** No. 7 - RBI w/Disinfection

Description		Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>					
Purchase Land	More urban area, higher priced property	1	each	\$ 250,000	\$ 250,000
Well / Pumphouse					
Well Drilling	Assume ~ 150 ft well depth	150	ft	\$ 1,500	\$ 225,000
Pump/Piping	Pump equipment & interior piping	1	lsum	\$ 60,000	\$ 60,000
Pumphouse	Assume 20 ft x 20 ft building	400	sqft	\$ 175	\$ 70,000
Sitework					
Site grading		1	lsum	\$ 15,000	\$ 15,000
Roads/Paving	Assume 100 ft of road + parking	4,700	sqft	\$ 3	\$ 14,100
Fencing		2,000	lnft	\$ 15	\$ 30,000
Landscaping		1	lsum	\$ 5,000	\$ 5,000
Electrical Utility					
Power to Site	Assume 1,000 ft per well site to bring in power	1	lsum	\$ 25,000	\$ 25,000
Site Distribution	Lighting, pump connection, RTU connection	1	lsum	\$ 15,000	\$ 15,000
Sub-Total, per Well Site		1	each		\$ 709,100
Total Well Site Development, All Sites		10	each	\$ 709,100	\$ 7,091,000
Interconnecting Piping between Well Sites		-			
Note: Using map showing pipe routing from RBI report		24,750	lnft		
Pipeline: 6" diam		10,250	lnft	\$ 70	\$ 717,500
Pipeline: 8" diam		2,250	lnft	\$ 80	\$ 180,000
Pipeline: 10" diam		4,500	lnft	\$ 90	\$ 405,000
Pipeline: 12" diam		1,250	each	\$ 110	\$ 137,500
Pipeline: 14" diam		6,500	each	\$ 130	\$ 845,000
Allowance for Road Removal & Replacement (16 ft wide)		1	lsum	\$ 500,000	\$ 500,000
Allowance for Groundwater		1	lsum	\$ 75,000	\$ 75,000
Allowance for Cost of ROW purchase or use		1	lsum	\$ 200,000	\$ 200,000
					\$ -
					\$ -
Valves & Appurtenances Allowance		10%			\$ 306,000
<b>Total Estimate for Wellfield Sites w/o Treatment Facility</b>		-			\$ 10,457,000
<b>Observations / Commentary</b>					
1) Total estimate included in Application is \$6,930,000					
2) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.					

**Project Information:**

Project: Application for Lake Michigan Water Supply  
 Customer: Wisconsin DNR  
 Arch/Engr: CH2MHILL  
 Location: Waukesha, WI  
 Type: Estimate Review of Alternates  
 Area Office: Boldt / Appleton

Alternate: **No. 7 - Finish Water Pipeline**

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Finish Water Pipeline from WTP to Reservoir				
Note: Using aerial map showing pipe routing; 24" pipe size.				
Open Country	5,500	Inft	\$ 124	\$ 683,100
Low Urban	5,500	Inft	\$ 135	\$ 742,500
Medium Urban	12,500	Inft	\$ 149	\$ 1,856,250
High Urban	24,500	Inft	\$ 182	\$ 4,465,125
Forest	-	each	\$ 250	\$ -
Road Crossing (assume 100 Inft)	49	each	\$ 13,500	\$ 661,500
Creek Crossing (assume 100 Inft)	-	each	\$ 27,000	\$ -
Highway Crossing (assume 100 Inft)	9	each	\$ 54,000	\$ 486,000
Railroad Crossing (assume 100 Inft)	2	each	\$ 81,000	\$ 162,000
Allowance for Road Removal & Replacement (16 ft wide)	680,000	sqft	\$ 6	\$ 4,080,000
Allowance for Groundwater	48,000	Inft	\$ 12	\$ 576,000
Allowance for Cost of ROW purchase or use	1	lsum	\$ 250,000	\$ 250,000
Sub-Total, Pipeline Estimate				\$ 13,962,475
Valves & Appurtenances Allowance	10%			\$ 1,396,248
<b>Total Estimate for Finish Water Pipeline</b>	<b>9</b>	<b>miles</b>	<b>\$ 1,689,459</b>	<b>\$ 15,358,723</b>
<b>Adjusted for Finish Water Pipeline Length in Application</b>	<b>10</b>	<b>miles</b>	<b>\$ 1,689,459</b>	<b>\$ 16,894,595</b>
<b>Observations / Commentary</b>				
1) Total estimate included in Application is \$15,475,000				
2) The cost estimate prepared by CH2MHILL is in the range expected for a conceptual estimate based on parameters set forth.				
3) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.				

Category	Boldt Suggested Unit Pricing			CH2MHill Unit Pricing	
	Construction Difficulty Factor	Production Inft/day	Unit Price - \$/Inft	Construction Difficulty Factor	Segment A & B Unit \$/Inft
Open Country	0.92	500	\$124	0.74	\$178
Low Urban	1.00	400	\$135	1.00	\$240
Medium Urban	1.10	250	\$149	1.19	\$286
High Urban	1.35	125	\$182	1.37	\$329
Groundwater	1.30	125	\$176	1.30	\$312
Forest	1.15	250	\$155	1.15	\$276
Gravel Roads	1.00		\$135	0.85	\$204
Creek Crossing	2.00		\$270	2.00	\$480
HWY Crossing	4.00		\$540	4.00	\$960
Unit Cost, \$/dia-in			20-inch diameter	\$12.00	20-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
At WTP	1,000		-	1,000	-	-	-	-	1,000	-	-	-	-
CRI: WTP to CRH	5,500		5,500	-	-	-	-	-	-	2	-	-	-
CRI: CRH to Oakdale	4,500		-	4,500	-	-	-	-	4,500	1	-	-	-
Oakdale: CRI to Sunset	10,500		-	-	-	10,500	-	-	10,500	10	-	2	-
Sunset: Oakdale to West	5,500		-	-	2,000	3,500	-	-	5,500	6	-	2	1
West: Sunset to Diagonal	8,000		-	-	5,000	3,000	-	-	8,000	10	-	1	1
Diagonal: West to Reservoir	13,000		-	-	5,500	7,500	-	-	13,000	20	-	4	-
<b>Total, Inft</b>	<b>48,000</b>		<b>5,500</b>	<b>5,500</b>	<b>12,500</b>	<b>24,500</b>	<b>-</b>	<b>-</b>	<b>42,500</b>	<b>49</b>	<b>-</b>	<b>9</b>	<b>2</b>
<b>Total, miles</b>	<b>9.09</b>												

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Arch/Engr:** CH2MHILL  
**Location:** Waukesha, WI  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton

**Alternate:** No. 7 - Distribution System Improvements

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Distribution System Improvements				
Note: Routing not specifically shown on aerial maps				
<b>Segment A (20" diameter) -</b>				
Open Country	15,840			
Open Country	-	Inft	\$ 124	\$ -
Low Urban	-	Inft	\$ 135	\$ -
Medium Urban	11,880	Inft	\$ 149	\$ 1,764,180
High Urban	3,960	Inft	\$ 182	\$ 721,710
Forest	-	Inft	\$ 155	\$ -
Road Crossing (assume 100 Inft)	10	each	\$ 13,500	\$ 135,000
Creek Crossing (assume 100 Inft)	1	each	\$ 27,000	\$ 27,000
Highway Crossing (assume 100 Inft)	2	each	\$ 54,000	\$ 108,000
Railroad Crossing (assume 100 Inft)	-	each	\$ 81,000	\$ -
Allowance for Road Removal & Replacement (16 ft wide)	190,080	sqft	\$ 6	\$ 1,140,480
Allowance for Groundwater	15,840	Inft	\$ 4	\$ 64,152
Allowance for Cost of ROW purchase or use	1	Isum	\$ 150,000	\$ 150,000
Sub-Total Segment A				\$ 4,110,522
<b>Segment B (16" diameter) -</b>				
Open Country	10,560			
Open Country	-	Inft	\$ 104	\$ -
Low Urban	-	Inft	\$ 115	\$ -
Medium Urban	7,920	Inft	\$ 132	\$ 1,047,420
High Urban	2,640	Inft	\$ 161	\$ 425,040
Forest	-	Inft	\$ 132	\$ -
Road Crossing (assume 100 Inft)	8	each	\$ 11,500	\$ 92,000
Creek Crossing (assume 100 Inft)	1	each	\$ 23,000	\$ 23,000
Highway Crossing (assume 100 Inft)	2	each	\$ 46,000	\$ 92,000
Railroad Crossing (assume 100 Inft)	-	each	\$ 69,000	\$ -
Allowance for Road Removal & Replacement (16 ft wide)	135,168	sqft	\$ 6	\$ 811,008
Allowance for Groundwater	10,560	Inft	\$ 3	\$ 36,432
Allowance for Cost of ROW purchase or use	1	Isum	\$ 150,000	\$ 150,000
Sub-Total Segment B				\$ 2,676,900
Sub-Total, Pipeline Estimate				\$ 6,787,422
Valves & Appurtenances Allowance	10%			\$ 678,742
<b>Total Estimate for Distribution System Improvements</b>				<b>\$ 7,466,164</b>
<b>Observations / Commentary</b>				
1) Total estimate included in Application is \$8,465,000 estimates are included elsewhere.				

Category	Boldt Suggested Unit Pricing				CH2MHILL Unit Pricing		
	Construction Difficulty Factor	Segment A Unit \$/Inft	Construction Difficulty Factor	Segment B Unit \$/Inft	Construction Difficulty Factor	Segment A Unit \$/Inft	Segment B Unit \$/Inft
Open Country	0.92	\$124	0.90	\$104	0.74	\$178	\$142
Low Urban	1.00	\$135	1.00	\$115	1.00	\$240	\$192
Medium Urban	1.10	\$149	1.15	\$132	1.19	\$286	\$228
High Urban	1.35	\$182	1.40	\$161	1.37	\$329	\$263
Groundwater	1.30	\$176	1.30	\$150	1.30	\$312	\$250
Forest	1.15	\$155	1.15	\$132	1.15	\$276	\$221
Gravel Roads	1.00	\$135	1.00	\$115	0.85	\$204	\$163
Creek Crossing	2.00	\$270	2.00	\$230	2.00	\$480	\$384
HWY Crossing	4.00	\$540	4.00	\$460	4.00	\$960	\$768
Unit Cost, \$/dia-in		20-inch dia		16-inch dia	\$12.00	20-inch dia	16-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Replace Road	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
Segment A	15,840	20" diameter	-	-	11,880	3,960	-	-	11,880	10	1	2	-
Segment B	10,560	16" diameter	-	-	7,920	2,640	-	-	8,448	8	1	2	-
			-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
Total, Inft	26,400		-	-	19,800	6,600	-	-	20,328	18	2	4	-
Total, miles	5.00												

**Project Information:**

Project: Application for Lake Michigan Water Supply  
 Customer: Wisconsin DNR  
 Arch/Engr: CH2MHILL  
 Location: Waukesha, WI  
 Type: Estimate Review of Alternates  
 Area Office: Boldt / Appleton

Alternate: No. 7 - Wastewater Force Main

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Wastewater Force Main				
Note: Using aerial map showing pipe routing; 6" pipe size.				
Open Country	5,500	Inft	\$ 47	\$ 258,500
Low Urban	9,500	Inft	\$ 55	\$ 522,500
Medium Urban	7,250	Inft	\$ 64	\$ 464,000
High Urban	5,250	Inft	\$ 83	\$ 435,750
Forest	-	each	\$ 64	\$ -
Road Crossing	21	each	\$ 5,500	\$ 115,500
Creek Crossing	-	each	\$ 11,000	\$ -
Highway Crossing	2	each	\$ 22,000	\$ 44,000
Railroad Crossing	-	each	\$ 33,000	\$ -
Allowance for Road Removal & Replacement (16 ft wide)	332,000	Inft	\$ 6	\$ 1,992,000
Allowance for Groundwater	27,500	Inft	\$ 4	\$ 113,438
Allowance for Cost of ROW purchase or use	1	lsum	\$ 250,000	\$ 250,000
Sub-Total, Pipeline Estimate				\$ 4,195,688
Valves & Appurtenances Allowance	10%		\$	419,569
<b>Total Estimate for Wastewater Force Main</b>			\$	<b>4,615,256</b>
<b>Observations / Commentary</b>				
1) Total estimate included in Application is \$3,332,000				
2) Estimate above is for direct costs only. Indirect and soft cost estimates are included elsewhere.				

Category	Boldt Suggested Unit Pricing			CH2MHill Unit Pricing		
	Construction Difficulty Factor	Segment A Unit \$/Inft	Segment B Unit \$/Inft	Construction Difficulty Factor	Segment A Unit \$/Inft	Segment B Unit \$/Inft
Open Country	0.85	\$47	\$47	0.74	\$53	\$53
Low Urban	1.00	\$55	\$55	1.00	\$72	\$72
Medium Urban	1.15	\$64	\$64	1.19	\$86	\$86
High Urban	1.50	\$83	\$83	1.37	\$99	\$99
Groundwater	1.30	\$72	\$72	1.30	\$94	\$94
Forest	1.15	\$64	\$64	1.15	\$83	\$83
Gravel Roads	1.00	\$55	\$55	0.85	\$61	\$61
Creek Crossing	2.00	\$110	\$110	2.00	\$144	\$144
HWY Crossing	4.00	\$220	\$220	4.00	\$288	\$288
Unit Cost, \$/dia-in		6-inch diameter	6-inch diameter	\$12.00	6-inch dia	6-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
At WTP	1,000		-	1,000	-	-	-	-	-	-	-	-	-
CRI: WTP to CRH	5,500		5,500	-	-	-	-	-	-	2	-	-	-
CRI: CRH to Oakdale	4,500		-	4,500	-	-	-	-	4,500	1	-	-	-
Oakdale: CRI to Sunset	10,500		-	-	5,250	5,250	-	-	10,250	10	-	2	-
Sunset: Oakdale to Sentry	2,000		-	-	2,000	-	-	-	2,000	2	-	-	-
Sentry: Sunset to WWTP	4,000		-	4,000	-	-	-	-	4,000	6	-	-	-
			-	-	-	-	-	-	-	-	-	-	-
Total, Inft	27,500		5,500	9,500	7,250	5,250	-	-	20,750	21	-	2	-
Total, miles	5.21												

**Project Information:**

**Project:** Application for Lake Michigan Water Supply      **Location:** Waukesha, WI  
**Customer:** Wisconsin DNR      **Arch/Engr:** CH2MHILL  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton  
**Estimator:** S Ford

**Alternate:** No. 8 - Return Flow Alternatives

Description	Underwood Creek Return Flow				Root River Return Flow				Lake Michigan Direct Return Flow			
	BTS Conceptual Cost Estimate Summary		LMWS Application Cost Estimate Summary		BTS Conceptual Cost Estimate Summary		LMWS Application Cost Estimate Summary		BTS Conceptual Cost Estimate Summary		LMWS Application Cost Estimate Summary	
Return Flow Pipeline	\$	23,624,700	\$	25,515,000	\$	29,884,723	\$	35,739,000	\$	49,943,850	\$	53,248,000
Waukesha WWTP Pumping Station	\$	3,508,000	\$	3,508,000	\$	4,000,000	\$	3,508,000	\$	7,500,000	\$	3,508,000
<b>Sub-Total Construction Costs w/o Markups</b>	\$	27,132,700	\$	29,023,000	\$	33,884,723	\$	39,247,000	\$	57,443,850	\$	56,756,000
Bonds & Insurance Markup	3.0%	\$ 813,981	3%	\$ 871,000	3.0%	\$ 1,016,542	3%	\$ 1,178,000	3.0%	\$ 1,723,316	3%	\$ 1,703,000
Mob/Demob Markup	3.0%	\$ 813,981	5%	\$ 1,452,000	3.0%	\$ 1,016,542	5%	\$ 1,963,000	3.0%	\$ 1,723,316	5%	\$ 2,838,000
<b>Sub-Total for OH&amp;P Markups</b>	\$	28,760,662	\$	31,346,000	\$	35,917,806	\$	42,388,000	\$	60,890,481	\$	61,297,000
Contractor Overhead Markup			8%	\$ 2,508,000			8%	\$ 3,392,000			8%	\$ 4,904,000
Construction Management	2.5%	\$ 719,017			2.5%	\$ 897,945			2.5%	\$ 1,522,262		
General Conditions	7.5%	\$ 2,157,050			7.5%	\$ 2,693,835			7.5%	\$ 4,566,786		
Equipment	3.0%	\$ 862,820			3.0%	\$ 1,077,534			3.0%	\$ 1,826,714		
Contractor Profit Markup	3.0%	\$ 974,986	4%	\$ 1,254,000	3.0%	\$ 1,217,614	4%	\$ 1,696,000	3.0%	\$ 2,064,187	4%	\$ 2,452,000
<b>Sub-Total Construction Costs</b>	\$	33,474,535	\$	35,108,000	\$	41,804,735	\$	47,476,000	\$	70,870,431	\$	68,653,000
Contingency	20.0%	\$ 6,694,907	25%	\$ 8,777,000	20.0%	\$ 8,360,947	25%	\$ 11,869,000	20.0%	\$ 14,174,086	25%	\$ 17,164,000
<b>Total Construction Costs with Markups</b>	\$	40,169,441	\$	43,885,000	\$	50,165,682	\$	59,345,000	\$	85,044,517	\$	85,817,000
<b>Design &amp; Engineering</b>												
Design & Engineering	12.0%	\$ 4,820,333	8%	\$ 3,511,000	12.0%	\$ 6,019,882	8%	\$ 4,748,000	12.0%	\$ 10,205,342	8%	\$ 6,866,000
Administration of Design during Construction	4.0%	\$ 1,606,778	8%	\$ 3,511,000	4.0%	\$ 2,006,627	8%	\$ 4,748,000	4.0%	\$ 3,401,781	8%	\$ 6,866,000
<b>Sub-Total, Design &amp; Engineering</b>	\$	6,427,111	\$	7,022,000	\$	8,026,509	\$	9,496,000	\$	13,607,123	\$	13,732,000
Permits, Legal, Administration (allowance)	12.0%	\$ 4,820,333	12%	\$ 5,267,000	12.0%	\$ 6,019,882	12%	\$ 7,122,000	12.0%	\$ 10,205,342	12%	\$ 10,299,000
<b>Total Project Capital Cost Estimate</b>	\$	51,416,885	\$	56,174,000	\$	64,212,073	\$	75,963,000	\$	108,856,982	\$	109,848,000
Annual Operation & Maintenance	\$	119,000			\$	145,000			\$	159,000		
50-Year Present Worth (6%)	\$	53,293,000			\$	66,498,000			\$	111,364,000		

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Arch/Engr:** CH2MHILL  
**Location:** Waukesha, WI  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton

**Alternate:** No. 8 - Underwood Creek Return Flow Pipeline (36 inch)

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Return water flow from WWTP to Underwood Creek				
Note: Using aerial map showing pipe routing; 36" pipe size.				
Open Country	4,000	Inft	\$ 200	\$ 798,000
Low Urban	37,000	Inft	\$ 210	\$ 7,770,000
Medium Urban	9,000	Inft	\$ 231	\$ 2,079,000
High Urban Using high urban rate for congested areas along trail	6,000	Inft	\$ 273	\$ 1,638,000
Forest	4,000	Inft	\$ 242	\$ 966,000
Road Crossing (assume 100 Inft)	17	each	\$ 21,000	\$ 357,000
Creek Crossing (assume 100 Inft)	25	each	\$ 42,000	\$ 1,050,000
Highway Crossing (assume 100 Inft)	8	each	\$ 84,000	\$ 672,000
Railroad Crossing (assume 100 Inft)	2	each	\$ 126,000	\$ 252,000
Allowance for Horizontal Boring	6,000	Inft	\$ 500	\$ 3,000,000
Allowance for Road Removal & Replacement (16 ft wide)	288,000	sqft	\$ 6	\$ 1,728,000
Allowance for Groundwater	60,000	Inft	\$ 9	\$ 567,000
Allowance for Cost of ROW purchase or use	1	Isum	\$ 500,000	\$ 500,000
Allowance for Outfall Structure at Underwood Creekd	1	Isum	\$ 100,000	\$ 100,000
<b>Sub-Total, Pipeline Estimate</b>				<b>\$ 21,477,000</b>
Valves & Appurtenances Allowance	10%			\$ 2,147,700
<b>Total Estimate for Return Flow Pipeline</b>				<b>\$ 23,624,700</b>
Waukesha WWTP Pumping Station (allowance based on Alt 4)	1	ea		\$ 3,508,000
<b>Sub-Total Construction Costs w/o Markups</b>				<b>\$ 27,132,700</b>
Bonds & Insurance Markup			3.0%	\$ 813,981
Mob/Demob Markup			3.0%	\$ 813,981
<b>Sub-Total for OH&amp;P Markups</b>				<b>\$ 28,760,662</b>
<b>Contractor Overhead Markup</b>				
Construction Management			2.5%	\$ 719,017
General Conditions			7.5%	\$ 2,157,050
Equipment			3.0%	\$ 862,820
Contractor Profit Markup			3.0%	\$ 974,986
<b>Sub-Total Construction Costs</b>				<b>\$ 33,474,535</b>
Contingency			20.0%	\$ 6,694,907
<b>Total Construction Costs with Markups</b>				<b>\$ 40,169,441</b>
<b>Design &amp; Engineering</b>				
Design & Engineering			12.0%	\$ 4,820,333
Administration of Design during Construction			4.0%	\$ 1,606,778
<b>Sub-Total, Design &amp; Engineering</b>				<b>\$ 46,596,552</b>
Permits, Legal, Administration (allowance)			12.0%	\$ 4,820,333
<b>Total Project Capital Cost Estimate</b>				<b>\$ 51,416,885</b>

Category	Boldt Suggested Unit Pricing			CH2MHill Unit Pricing	
	Construction Difficulty Factor	Production Inft/day	Unit Price - \$/Inft	Construction Difficulty Factor	Segment A & B Unit \$/Inft
Open Country	0.95	500	\$200	0.74	\$320
Low Urban	1.00	400	\$210	1.00	\$432
Medium Urban	1.10	250	\$231	1.19	\$514
High Urban	1.30	125	\$273	1.37	\$592
Groundwater	1.30	125	\$273	1.30	\$562
Forest	1.15	250	\$242	1.15	\$497
Gravel Roads	1.00		\$210	0.85	\$367
Creek Crossing	2.00		\$420	2.00	\$864
HWY Crossing	4.00		\$840	4.00	\$1,728
Unit Cost, \$/dia-in			36-inch diameter	\$12.00	36-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Horiz Boring	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
WWTP to SR59	16,000		4,000	6,000	6,000	-	-	-	12,000	-	12	-	1	1
Corridor: SR59 to Calhoun	19,000		-	18,000	1,000	-	-	-	-	4,000	-	12	3	-
Corridor: Calhoun to 124th	15,000		-	9,000	-	6,000	-	-	-	1,000	-	5	2	-
124th: Corridor to Underwood Creek	10,000		-	4,000	2,000	-	-	4,000	6,000	1,000	5	-	2	1
Miscellaneous	-		-	-	-	-	-	-	-	-	-	8	-	-
	-		-	-	-	-	-	-	-	-	-	-	-	-
	-		-	-	-	-	-	-	-	-	-	-	-	-
<b>Total, Inft</b>	<b>60,000</b>		<b>4,000</b>	<b>37,000</b>	<b>9,000</b>	<b>6,000</b>	<b>-</b>	<b>4,000</b>	<b>18,000</b>	<b>6,000</b>	<b>17</b>	<b>25</b>	<b>8</b>	<b>2</b>
<b>Total, miles</b>	<b>11.4</b>													

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Arch/Engr:** CH2MHILL  
**Location:** Waukesha, WI  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton

**Alternate:** No. 8 - Root River Return Flow Pipeline (36 inch)

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Return water flow from WWTP to Underwood Creek				
Note: Using aerial map showing pipe routing; 36" pipe size.				
Open Country	4,000	Inft	\$ 200	\$ 798,000
Low Urban	34,000	Inft	\$ 210	\$ 7,140,000
Medium Urban	29,700	Inft	\$ 231	\$ 6,860,700
High Urban Using high urban rate for congested areas along trail	6,000	Inft	\$ 273	\$ 1,638,000
Forest	-	Inft	\$ 242	\$ -
Road Crossing (assume 100 Inft)	14	each	\$ 21,000	\$ 294,000
Creek Crossing (assume 100 Inft)	25	each	\$ 42,000	\$ 1,050,000
Highway Crossing (assume 100 Inft)	17	each	\$ 84,000	\$ 1,428,000
Railroad Crossing (assume 100 Inft)	1	each	\$ 126,000	\$ 126,000
Allowance for Horizontal Boring	7,000	Inft	\$ 500	\$ 3,500,000
Allowance for Road Removal & Replacement (16 ft wide)	368,000	sqft	\$ 6	\$ 2,208,000
Allowance for Groundwater	80,700	Inft	\$ 19	\$ 1,525,230
Allowance for Cost of ROW purchase or use	1	Isum	\$ 500,000	\$ 500,000
Allowance for Outfall Structure at Root River	1	Isum	\$ 100,000	\$ 100,000
<b>Sub-Total, Pipeline Estimate</b>				<b>\$ 27,167,930</b>
Valves & Appurtenances Allowance	10%			\$ 2,716,793
<b>Total Estimate for Return Flow Pipeline</b>				<b>\$ 29,884,723</b>
Waukesha WWTP Pumping Station (allowance based on Alt 4 + longer)	1	ea		\$ 4,000,000
<b>Sub-Total Construction Costs w/o Markups</b>				<b>\$ 33,884,723</b>
Bonds & Insurance Markup			3.0%	\$ 1,016,542
Mob/Demob Markup			3.0%	\$ 1,016,542
<b>Sub-Total for OH&amp;P Markups</b>				<b>\$ 35,917,806</b>
Contractor Overhead Markup				
Construction Management			2.5%	\$ 897,945
General Conditions			7.5%	\$ 2,693,835
Equipment			3.0%	\$ 1,077,534
Contractor Profit Markup			3.0%	\$ 1,217,614
<b>Sub-Total Construction Costs</b>				<b>\$ 41,804,735</b>
Contingency			20.0%	\$ 8,360,947
<b>Total Construction Costs with Markups</b>				<b>\$ 50,165,682</b>
Design & Engineering				
Design & Engineering			12.0%	\$ 6,019,882
Administration of Design during Construction			4.0%	\$ 2,006,627
<b>Sub-Total, Design &amp; Engineering</b>				<b>\$ 8,026,509</b>
Permits, Legal, Administration (allowance)			12.0%	\$ 6,019,882
<b>Total Project Capital Cost Estimate</b>				<b>\$ 64,212,073</b>

Category	Boldt Suggested Unit Pricing			CH2MHill Unit Pricing	
	Construction Difficulty Factor	Production Inft/day	Unit Price - \$/Inft	Construction Difficulty Factor	Segment A & B Unit - \$/Inft
Open Country	0.95	500	\$200	0.74	\$320
Low Urban	1.00	400	\$210	1.00	\$432
Medium Urban	1.10	250	\$231	1.19	\$514
High Urban	1.30	125	\$273	1.37	\$592
Groundwater	1.30	125	\$273	1.30	\$562
Forest	1.15	250	\$242	1.15	\$497
Gravel Roads	1.00		\$210	0.85	\$367
Creek Crossing	2.00		\$420	2.00	\$864
HWY Crossing	4.00		\$840	4.00	\$1,728
Unit Cost, \$/dia-in			36-inch diameter	\$12.00	36-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Horiz Boring	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
WWTP to SR59	16,000		4,000	6,000	6,000	-	-	-	12,000	-	12	-	1	1
Corridor: SR59 to Calhoun	19,000		-	18,000	1,000	-	-	-	-	4,000	-	12	3	-
Corridor: Calhoun to 124th	15,000		-	9,000	-	6,000	-	-	-	1,000	-	5	2	-
124th: Trail to Root River	4,000		-	1,000	3,000	-	-	-	4,000	1,000	-	-	2	-
Root River: 124th to Outfall	26,700		-	-	19,700	-	19,700	-	7,000	1,000	2	8	9	-
	-		-	-	-	-	-	-	-	-	-	-	-	-
	-		-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous												9		
<b>Total, Inft</b>	<b>80,700</b>		<b>4,000</b>	<b>34,000</b>	<b>29,700</b>	<b>6,000</b>	<b>19,700</b>	<b>-</b>	<b>23,000</b>	<b>7,000</b>	<b>14</b>	<b>25</b>	<b>17</b>	<b>1</b>
<b>Total, miles</b>	<b>15.3</b>													

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Arch/Engr:** CH2MHILL  
**Location:** Waukesha, WI  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton

**Alternate:** No. 8 - Lake Michigan Return Flow Pipeline (36 inch)

Description	Quantity	Unit	Unit Cost Estimate	Total
<b>DIRECT COSTS:</b>				
Return water flow from WWTP to Underwood Creek				
Note: Using aerial map showing pipe routing; 36" pipe size.				
Open Country	4,000	Inft	\$ 200	\$ 798,000
Low Urban	36,000	Inft	\$ 210	\$ 7,560,000
Medium Urban	55,500	Inft	\$ 231	\$ 12,820,500
High Urban Using high urban rate for congested areas along trail	22,500	Inft	\$ 273	\$ 6,142,500
Forest	-	Inft	\$ 242	\$ -
Road Crossing (assume 100 Inft)	45	each	\$ 21,000	\$ 945,000
Creek Crossing (assume 100 Inft)	27	each	\$ 42,000	\$ 1,134,000
Highway Crossing (assume 100 Inft)	13	each	\$ 84,000	\$ 1,092,000
Railroad Crossing (assume 100 Inft)	3	each	\$ 126,000	\$ 378,000
Allowance for Horizontal Boring	10,000	Inft	\$ 500	\$ 5,000,000
Allowance for Road Removal & Replacement (16 ft wide)	352,000	sqft	\$ 6	\$ 2,112,000
Allowance for Groundwater	122,000	Inft	\$ 16	\$ 1,921,500
Allowance for Cost of ROW purchase or use	1	Isum	\$ 500,000	\$ 500,000
Allowance for Lake Michigan Outfall	1	Isum	\$ 5,000,000	\$ 5,000,000
<b>Sub-Total, Pipeline Estimate</b>				<b>\$ 45,403,500</b>
Valves & Appurtenances Allowance	10%			\$ 4,540,350
<b>Total Estimate for Return Flow Pipeline</b>				<b>\$ 49,943,850</b>
Waukesha WWTP Pumping Station (allowance based on Alt 4 + longer)	1	ea		\$ 7,500,000
<b>Sub-Total Construction Costs w/o Markups</b>				<b>\$ 57,443,850</b>
Bonds & Insurance Markup			3.0%	\$ 1,723,316
Mob/Demob Markup			3.0%	\$ 1,723,316
<b>Sub-Total for OH&amp;P Markups</b>				<b>\$ 60,890,481</b>
Contractor Overhead Markup				
Construction Management			2.5%	\$ 1,522,262
General Conditions			7.5%	\$ 4,566,786
Equipment			3.0%	\$ 1,826,714
Contractor Profit Markup			3.0%	\$ 2,064,187
<b>Sub-Total Construction Costs</b>				<b>\$ 70,870,431</b>
Contingency			20.0%	\$ 14,174,086
<b>Total Construction Costs with Markups</b>				<b>\$ 85,044,517</b>
Design & Engineering				
Design & Engineering			12.0%	\$ 10,205,342
Administration of Design during Construction			4.0%	\$ 3,401,781
<b>Sub-Total, Design &amp; Engineering</b>				<b>\$ 98,651,640</b>
Permits, Legal, Administration (allowance)			12.0%	\$ 10,205,342
<b>Total Project Capital Cost Estimate</b>				<b>\$ 108,856,982</b>

Category	Boldt Suggested Unit Pricing			CH2MHill Unit Pricing	
	Construction Difficulty Factor	Production Inft/day	Unit Price - \$/Inft	Construction Difficulty Factor	Segment A & B Unit \$/Inft
Open Country	0.95	500	\$200	0.74	\$320
Low Urban	1.00	400	\$210	1.00	\$432
Medium Urban	1.10	250	\$231	1.19	\$514
High Urban	1.30	125	\$273	1.37	\$592
Groundwater	1.30	125	\$273	1.30	\$562
Forest	1.15	250	\$242	1.15	\$497
Gravel Roads	1.00		\$210	0.85	\$367
Creek Crossing	2.00		\$420	2.00	\$864
HWY Crossing	4.00		\$840	4.00	\$1,728
Unit Cost, \$/dia-in			36-inch diameter	\$12.00	36-inch dia

Location of Pipeline	Distance (Inft)	Comments	Open Country	Low Urban	Medium Urban	High Urban	Ground Water	Forest	Road Replace	Horiz Boring	Road Crossing	Creek Crossing	HWY Crossing	RR Crossing
WWTP to SR59	16,000		4,000	6,000	6,000	-	-	-	12,000	-	12	-	1	1
Corridor: SR59 to Calhoun	19,000		-	18,000	1,000	-	-	-	-	4,000	-	12	3	-
Corridor: Calhoun to 124th	15,000		-	9,000	-	6,000	-	-	-	1,000	-	5	2	-
RR Corridor: 124th to 84th	13,500		-	3,000	-	10,500	-	-	-	-	3	-	1	-
RR Corridor: 84th to Street	48,500		-	-	48,500	-	-	-	5,000	5,000	30	10	6	2
City Street to Lake Michigan	6,000		-	-	-	6,000	-	-	5,000	-	-	-	-	-
Lake Michigan Outfall	4,000		-	-	-	-	-	-	-	-	-	-	-	-
<b>Total, Inft</b>	<b>122,000</b>		<b>4,000</b>	<b>36,000</b>	<b>55,500</b>	<b>22,500</b>	<b>-</b>	<b>-</b>	<b>22,000</b>	<b>10,000</b>	<b>45</b>	<b>27</b>	<b>13</b>	<b>3</b>
<b>Total, miles</b>	<b>23.1</b>													

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton  
**Estimator:** S Ford

**Location:** Waukesha, WI  
**Arch/Engr:** CH2MHILL

**Alternate:** Summary of Alternatives for Supply & Discharge including Present Worth Calculations

Description	Lake Michigan Supply Source Return Flow Discharge	Milwaukee Underwood	Oak Creek Underwood	Racine Underwood	Milwaukee Root River	Oak Creek Root River	Racine Root River	Milwaukee Lake Michigan	Oak Creek Lake Michigan	Racine Lake Michigan
<b>Water Supply Construction Cost</b>										
Supply Pipeline		\$ 32,645,470	\$ 62,682,600	\$ 77,523,429	\$ 32,645,470	\$ 62,682,600	\$ 77,523,429	\$ 32,645,470	\$ 62,682,600	\$ 77,523,429
Booster Pump		\$ 9,152,322	\$ 17,970,000	\$ 17,061,000	\$ 9,152,322	\$ 17,970,000	\$ 17,061,000	\$ 9,152,322	\$ 17,970,000	\$ 17,061,000
<b>Return Flow Construction Cost</b>										
Return Flow Pipeline		\$ 23,624,700	\$ 23,624,700	\$ 23,624,700	\$ 29,884,723	\$ 29,884,723	\$ 29,884,723	\$ 49,943,850	\$ 49,943,850	\$ 49,943,850
Return Flow Pump Station		\$ 3,508,000	\$ 3,508,000	\$ 3,508,000	\$ 4,000,000	\$ 4,000,000	\$ 4,000,000	\$ 5,000,000	\$ 5,000,000	\$ 5,000,000
<b>Distribution System Improvements</b>		\$ 7,222,000	\$ 7,222,000	\$ 7,222,000	\$ 7,222,000	\$ 7,222,000	\$ 7,222,000	\$ 7,222,000	\$ 7,222,000	\$ 7,222,000
<b>Sub-Total Construction Costs w/o Markups</b>		\$ 76,152,492	\$ 115,007,300	\$ 128,939,129	\$ 82,904,515	\$ 121,759,323	\$ 135,691,152	\$ 103,963,642	\$ 142,818,450	\$ 156,750,279
<b>Bonds &amp; Insurance Markup</b>	3.0%	\$ 2,284,575	\$ 3,450,219	\$ 3,868,174	\$ 2,487,135	\$ 3,652,780	\$ 4,070,735	\$ 3,118,909	\$ 4,284,554	\$ 4,702,508
<b>Mob/Demob Markup</b>	3.0%	\$ 2,284,575	\$ 3,450,219	\$ 3,868,174	\$ 2,487,135	\$ 3,652,780	\$ 4,070,735	\$ 3,118,909	\$ 4,284,554	\$ 4,702,508
<b>Sub-Total for OH&amp;P Markups</b>		\$ 80,721,642	\$ 121,907,738	\$ 136,675,477	\$ 87,878,786	\$ 129,064,882	\$ 143,832,621	\$ 110,201,461	\$ 151,387,557	\$ 166,155,296
<b>Contractor Overhead Markup</b>										
Construction Management	2.5%	\$ 2,018,041	\$ 3,047,693	\$ 3,416,887	\$ 2,196,970	\$ 3,226,622	\$ 3,595,816	\$ 2,755,037	\$ 3,784,689	\$ 4,153,882
General Conditions	7.5%	\$ 6,054,123	\$ 9,143,080	\$ 10,250,661	\$ 6,590,909	\$ 9,679,866	\$ 10,787,447	\$ 8,265,110	\$ 11,354,067	\$ 12,461,647
Equipment	3.0%	\$ 2,421,649	\$ 3,657,232	\$ 4,100,264	\$ 2,636,364	\$ 3,871,946	\$ 4,314,979	\$ 3,306,044	\$ 4,541,627	\$ 4,984,659
<b>Contractor Profit Markup</b>	3.0%	\$ 2,736,464	\$ 4,132,672	\$ 4,633,299	\$ 2,979,091	\$ 4,375,300	\$ 4,875,926	\$ 3,735,830	\$ 5,132,038	\$ 5,632,665
<b>Sub-Total Construction Costs</b>		\$ 93,951,919	\$ 141,888,416	\$ 159,076,587	\$ 102,282,119	\$ 150,218,617	\$ 167,406,788	\$ 128,263,480	\$ 176,199,978	\$ 193,388,149
<b>Contingency</b>	20.0%	\$ 18,790,384	\$ 28,377,683	\$ 31,815,317	\$ 20,456,424	\$ 30,043,723	\$ 33,481,358	\$ 25,652,696	\$ 35,239,996	\$ 38,677,630
<b>Total Construction Costs with Markups</b>		\$ 112,742,302	\$ 170,266,100	\$ 190,891,905	\$ 122,738,543	\$ 180,262,340	\$ 200,888,145	\$ 153,916,176	\$ 211,439,973	\$ 232,065,778
<b>Design &amp; Engineering</b>										
Design & Engineering	12.0%	\$ 13,529,076	\$ 20,431,932	\$ 22,907,029	\$ 14,728,625	\$ 21,631,481	\$ 24,106,577	\$ 18,469,941	\$ 25,372,797	\$ 27,847,893
Administration of Design during Construction	4.0%	\$ 4,509,692	\$ 6,810,644	\$ 7,635,676	\$ 4,909,542	\$ 7,210,494	\$ 8,035,526	\$ 6,156,647	\$ 8,457,599	\$ 9,282,631
<b>Sub-Total, Design &amp; Engineering</b>		\$ 130,781,071	\$ 197,508,675	\$ 221,434,610	\$ 142,376,710	\$ 209,104,314	\$ 233,030,249	\$ 178,542,764	\$ 245,270,369	\$ 269,196,303
<b>Permits, Legal, Administration (allowance)</b>	12.0%	\$ 13,529,076	\$ 20,431,932	\$ 22,907,029	\$ 14,728,625	\$ 21,631,481	\$ 24,106,577	\$ 18,469,941	\$ 25,372,797	\$ 27,847,893
<b>Total Project Capital Cost Estimate (Boldt Review)</b>		\$ 144,310,147	\$ 217,940,607	\$ 244,341,638	\$ 157,105,335	\$ 230,735,795	\$ 257,136,826	\$ 197,012,705	\$ 270,643,166	\$ 297,044,196
<b>Annual Operation &amp; Maintenance</b>		\$ 6,200,000	\$ 6,200,000	\$ 6,200,000	\$ 6,230,000	\$ 6,230,000	\$ 6,230,000	\$ 6,230,000	\$ 6,230,000	\$ 6,230,000
<b>50-Year Present Worth (6%)</b>		\$ 242,035,000	\$ 315,666,000	\$ 342,067,000	\$ 255,303,000	\$ 328,934,000	\$ 355,335,000	\$ 295,210,000	\$ 368,841,000	\$ 395,242,000

**Project Information:**

**Project:** Application for Lake Michigan Water Supply  
**Customer:** Wisconsin DNR  
**Type:** Estimate Review of Alternates  
**Area Office:** Boldt / Appleton  
**Estimator:** S Ford

**Location:** Waukesha, WI  
**Arch/Engr:** CH2MHILL

**Alternate:** Present Worth Information

Alternate	Capital Cost (\$ million)	Annual Operation & Maintenance (\$ million)	50-Year Present Worth (6%) (\$ million)
Alternative 1: Continued Use of Deep and Shallow Aquifers	\$199	\$7.200	\$ 312
Alternative 2: Shallow Aquifer and Fox River Alluvium	\$178	\$7.400	\$ 295
Alternative 3: Lake Michigan/Shallow Aquifer with Underwood Creek Return	\$256	\$7.500	\$ 374
Alternative 4: Lake Michigan Milwaukee Supply with Underwood Creek Return	\$145	\$6.200	\$ 243
Alternative 5: Lake Michigan Oak Creek Supply with Underwood Creek Return	\$227	\$6.200	\$ 325
Alternative 6: Lake Michigan Racine Supply with Underwood Creek Return	\$254	\$6.200	\$ 352
Alternative 7: Lake Michigan Milwaukee Supply with Root River Return	\$158	\$6.230	\$ 256
Alternative 8: Lake Michigan Oak Creek Supply with Root River Return	\$231	\$6.230	\$ 329
Alternative 9: Lake Michigan Racine Supply with Root River Return	\$258	\$6.230	\$ 356
Alternative 10: Lake Michigan Milwaukee Supply with Lake Michigan Return	\$197	\$6.240	\$ 295
Alternative 11: Lake Michigan Oak Creek Supply with Lake Michigan Return	\$271	\$6.240	\$ 369
Alternative 12: Lake Michigan Racine Supply with Lake Michigan Return	\$297	\$6.240	\$ 395
Return Flow Option: Underwood Creek	\$52	\$0.119	\$ 54
Return Flow Option: Root River	\$65	\$0.145	\$ 67
Return Flow Option: Lake Michigan Direct	\$109	\$0.159	\$ 112