

Attachment 1

To be inserted into Chapter 4

Waukesha Water Utility's Diversion Application¹

Waukesha Water Utility and its water utility contractor CH2MHill evaluated a series of scenarios to resolve its water supply problems, including different groundwater sources, surface water sources, and combinations of the two sources. Each of the scenarios has different costs associated with the procurement, treatment, and transmission of water. Procurement of Lake Michigan surface water would require not only developing the infrastructure for water conveyance, but also the development of infrastructure to transmit the spent water back to the Lake Michigan basin based on the conditions set forth in the Great Lakes Compact. Under any scenario that would require Waukesha to search for an alternative groundwater supply, the costs are generally tied up in treatment as well as procurement, including the possibility of annexing non-contiguous lands (for example, in areas south of the City near the Vernon Marsh or further west in Waukesha County, beyond the confining aquifer) in order to provide the necessary resources for shallow wells. After eliminating most of the less likely scenarios, CH2MHill and the Waukesha Water Utility focused on evaluating the following four alternatives:

Alternative 1: This proposes continued reliance on groundwater, and continued blending of groundwater from both the deep and shallow aquifers, but with more reliance on the shallow aquifer and reduced withdrawals from the deep aquifer. Specifically, this alternative includes using the existing shallow aquifer wells and the addition of water from 2 wells proposed to be located south of the City near the Vernon Marsh. Under this scenario, approximately 60% of the supply would come from the shallow aquifer while the remaining 40% would come from the deep aquifer. According to CH2MHill, this alternative would likely have negative impacts on the environmentally sensitive marsh and be less cost effective as the continued use of the deep aquifer supply has degraded water quality and would require additional water treatment or processing. Due to the two different source types, this alternative would also require at least two different types of treatment facilities. The cost to treat the ever degrading deep aquifer water would most likely increase through use. Water from this shallow aquifer is hard and would require continued softening costs for the property owner. The estimated capital cost for this alternative is \$189M, with annual operating and maintenance costs around \$7.2M.

Alternative 2: This focuses on continued reliance on groundwater, but proposes to discontinue the use of the deep aquifer in favor of utilizing water strictly from the shallow aquifer, namely from the Fox River alluvium. CH2MHill's analysis indicates that this alternative would have greater negative impacts on the environment than Alternative 1, as it would have a much greater impact on the baseflow to surface waters, specifically in areas along the Fox River including portions of the Vernon Marsh, Vernon Wildlife Area, and Pebble Creek. In comparison to Alternative 1, treatment would be provided by one central treatment facility resulting in a reduction in operation and maintenance costs over Alternative 1. Similar to Alternative 1, water from this shallow aquifer is hard and requires softening costs for the property owner. The estimated capital cost for this alternative is \$184M, with annual operating and maintenance costs around \$7.4M.

Alternative 3: This proposes to discontinue use of the deep aquifer and to purchase treated Lake Michigan water from a Lake Michigan water utility and blend this with water from the

¹ Documents pertaining to the Waukesha Water Utility diversion application can be accessed online at www.ci.waukesha.wi.us/web/guest/futurewatersupplyinfo

shallow aquifer. Approximately 40% of the supply would come from a Lake Michigan supply; under this option, it is assumed that water would be purchased from Milwaukee Water Works, and conveyed through a transmission pipeline and booster pump station to a Waukesha reservoir for distribution. The other 60% of needed supply would come from new and existing shallow aquifer wells. Treated used water would be returned to the Lake Michigan watershed through some form of return flow conveyance. Although Underwood Creek was proposed based on CH2MHill's assessment that it is the best alternative due to the shortest distance and provides the best use of infrastructure, other return flow alternatives exist and would require further evaluation. Water from the shallow aquifer is hard. In some cases, it would be mixed with soft Lake Michigan water, but in others, the groundwater may not be mixed, therefore it would still require continued softening costs for the property owner. The estimated capital cost for this alternative is \$238M, with annual operating and maintenance costs around \$7.5M.

Alternative 4: This alternative proposes to discontinue use of the groundwater supply system and to purchase treated Lake Michigan water from a Lake Michigan water utility (specifically Milwaukee Water Works) and to convey the purchased water through a transmission pipeline and booster pump station to a Waukesha reservoir for distribution. Treated used water would be returned to the Lake Michigan watershed through some form of return flow conveyance. Although Underwood Creek was proposed based on CH2MHill's assessment that it is the best alternative due to the shortest distance and provides the best use of infrastructure, other return flow alternatives exist and would require further evaluation. Alternative 4 is the preferred alternative, as CH2MHill assess it as having the fewest environmental impacts, the longest term sustainability, and the lowest infrastructure costs as it removes the operation and maintenance costs associated with wells, well fields, and water treatment plants. The estimated capital cost for this alternative is \$164M, with annual operating and maintenance costs around \$6.2M.

In addition to the costs associated with water procurement and treatment, costs associated with return to source have also been taken into consideration for Alternatives 3 and 4. Any Great Lakes diversion demands that all water taken out of the basin must be returned to the basin and therefore infrastructure would need to be built to return the spent water. Waukesha evaluated three return flow routes, one through Underwood Creek, one through the Root River, and another as a direct flow to Lake Michigan. Based on the Waukesha Water Utility's diversion application, of the three return flow alternatives evaluated, the return flow through Underwood Creek is considered most preferable with the lowest estimated capital cost of about \$56M with an annual operations and maintenance cost of about \$120,000. The estimated costs for return flow via the Root River are about \$76M with an annual operating and maintenance cost of \$145,000. The estimate for the direct flow return to Lake Michigan is the most expensive with a capital cost of about \$110M and an annual operating and maintenance cost of about \$160,000. The additional costs for the least expensive, preferred return flow through Underwood Creek were added to Alternatives 3 and 4 but may need to be adjusted if this alternative were rejected, adding to the overall costs of Alternatives 3 and 4.

Alternative 4 offers both the lowest estimates in overall capital costs and annual operating and maintenance costs. Its estimated capital cost is lower than the next lowest alternative (Alternative 2 – shallow aquifer only) by \$20M or about 11%. Alternatively, its annual operating and maintenance is about \$1M less than Alternative 1 (shallow and deep aquifer blending), or about 14% less. On a present worth cost basis, the cost differential between Alternative 1 and Alternatives 2 and 4 would be somewhere in the range of 11 to 14%. Alternative 3 is substantially higher than the other alternatives, and therefore not considered a likely scenario.

Although the preferred alternative as set forth under the RWSP promotes the change in supply from groundwater to strictly Lake Michigan water (Alternative 4), questions have arisen regarding whether or not cost differences between the alternatives set forth in the Waukesha Water Utility diversion application would have any differential socio-economic impacts, particularly if either of Waukesha's groundwater alternatives would need to be implemented. It is impossible to answer this question definitively, since existing cost estimates are based on assumptions that may change over time. However, it appears unlikely at this time that the difference in overall cost between the Lake Michigan option and a groundwater option would result in significant socio-economic impacts. Currently, the average Waukesha Water Utility residential user is charged approximately \$67 per quarter for water (based on an average use of 14,300 gallons per quarter) or \$268 per year. Under groundwater-based Alternatives 1 and 2, the average residential water user would be charged about \$151 quarterly or \$604 per year. Under Lake Michigan Alternative 4, the estimated quarterly cost for the average residential water user would be about \$142 (about \$568 per year), or about 6 percent less than the groundwater alternatives. These costs could be somewhat lower if financial assistance is obtained from an outside source.

Additionally, it is unlikely that any of the Waukesha water alternatives would have negative socio-economic impacts on Milwaukee Water Works users based on cost. Current estimates project that future water rates in the Waukesha Water Utility service area will be significantly higher than in the Milwaukee Water Works service area, no matter which alternative is selected. Currently, the estimated quarterly cost for 14,300 gallons for most residential users of Milwaukee Water Works retail supply is about \$42, or roughly \$168 per year. This is \$400 less per year than the rates proposed under Alternative 4 and \$436 less per year than the rates proposed under Alternatives 1 and 2. As such, no matter which alternative is selected, there will be no incentive for a developer, business, or resident to move from Milwaukee to Waukesha based on the cost of water.

There are some unknown cost factors that may need to be addressed if the Waukesha's diversion application is rejected or if portions of the proposal such as the preferred return flow option need to be revised. If the WDNR rejects the preferred return flow route through Underwood Creek in favor of either of the other two routes, the estimated water rates under Alternative 4 would increase. Also, implementation of Alternatives 1 and 2 might trigger the possibility of developing infiltration systems or other protective methods in order to mitigate any impacts to the baseflows of surrounding surface waters. The WDNR has designated all of Waukesha County as a groundwater management area, and therefore implementation of any of the groundwater alternatives would require WDNR approval and would necessitate a groundwater management plan for the area, which could possibly include additional costs associated with recharge area management or groundwater infiltration techniques. Further study of these potential costs may be necessary.