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May 6, 2016
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Ms. Jennifer Bolger Breceda, Executive Director
Milwaukee Riverkeeper
1845 North Farwell Avenue, Suite 100
Milwaukee, Wisconsin 53202

Re: Response to Great Lakes-St. Lawrence River Water Resources Regional Body's May 4, 2016, Preliminary Draft Declaration of Finding
City of Waukesha Water Supply
Waukesha, Wisconsin

Dear Ms. Bolger Breceda:

In accordance with your request, GZA GeoEnvironmental, Inc. (GZA) is providing this letter in an effort to clarify and/or correct potential misconceptions that were illuminated in the Great Lakes-St. Lawrence River Water Resources Regional Body's ("Regional Body") May 4, 2016, Preliminary Draft Declaration of Finding ("Draft Finding"). Below, we provide further elaboration on the following six elements of the Draft Finding:

1. The Regional Body's "Approved Diversion Area";
2. Waukesha's future water service demands;
3. The viability of water treatment for radium;
4. The sustainability of withdrawal from the deep aquifer;
5. Misconception of groundwater withdrawals currently diverting water from Lake Michigan; and
6. The non-diversion solution's manageable impact to streams and wetlands.

BACKGROUND

The City of Waukesha ("City") submitted an Application for Lake Michigan Supply to the Regional Body and the Great Lakes-St. Lawrence River Basin Water Resources Regional Council ("Compact Council") for regional review on January 7, 2016. The Regional Body has reviewed the application and prepared the Draft Finding for further discussion on April 27, 2016, revised May 4, 2016. Based on our review of the Draft Finding, GZA provides the following responses.

Comment 1 - Approved Diversion Area

The Regional Body modified the City's proposed, expanded water supply service area (WSSA), providing an Approved Diversion Area. The Approved Diversion Area consists of the City's existing WSSA (referred to as the "Current Area Served") and several relatively small areas, which are parts of the Town of Waukesha but located within or on the border of the City boundary, or are lands within the City of Pewaukee that are subject to a 1997 agreement to obtain water from the City of Waukesha Water Utility. The majority of the future water demand is from the Current Area Served. The Approved Diversion Area is in general agreement with the position of the Compact Implementation Coalition ("Coalition") that the City's water demand forecast and water supply alternative should be based on the existing WSSA, as stated in our "Non-Diversion Alternative Using

Existing Water Supply with Treatment" (GZA, 2015).[1] Further, as stated in our "Response to Comments on Non-Diversion Alternative," dated February 29, 2016, and as presented below, the deep aquifer is capable of providing a sustainable supply of water to meet the existing and projected water supply demands of the Approved Diversion.

Comment 2 - City's Future Water Demand Is Overestimated

Review of the Draft Findings and AECOM's "Water Demand Projections – Diversion Water Supply Area, Waukesha, Wisconsin" (AECOM, 2016) indicates that future water demand is revised to be 8.4 million gallons per day (MGD), of which 8.2 MGD is based on the population and industrial land acreage in the Current Served Area; 0.2 MGD of which is to serve the relatively small areas under consideration by the Regional Body to be added to the Current Served Area. It is important to note that the 8.2 MGD for the Current Served Area, the same forecast used in the City's Application, is overestimated, as it ignores the decreasing water demand trend from 2003 to 2012, as shown in the following historical GPCD chart (GZA, 2015).

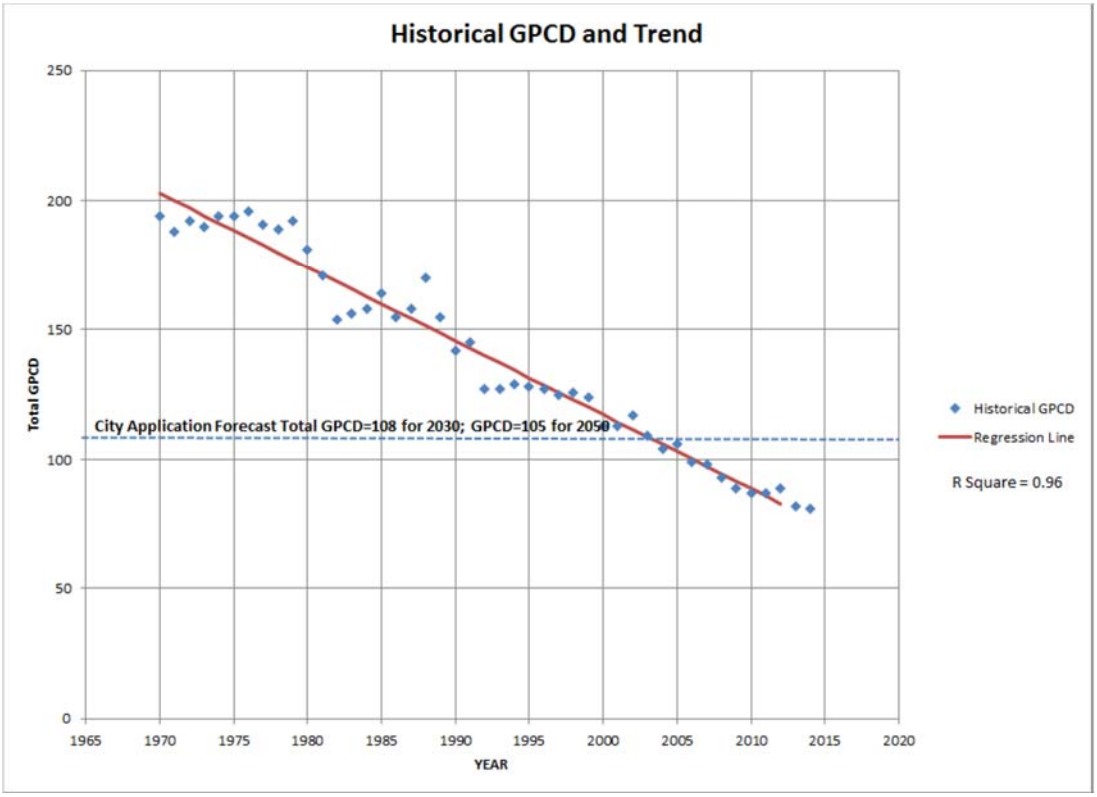

Figure 1: Historical GPCD and Trend

Using the average GPCD from 2008 to 2012, GZA estimated the water demand for the Current Served Area to be 6.7 MGD (GZA, 2015). By adding the difference of 0.2 MGD for the additional area, the average day demand for the Diversion Approved Area is estimated to be 6.9 MGD. This more appropriate projection of water needs is a critical point, as it allows more reasonable estimations of water treatment costs for Waukesha, drives sustainable pumping rates from the deep aquifer and less environmental impact to the Mississippi River Basin under the non-diversion solution.

Comment 3 - Radium Treatment Is Viable and Residuals Can Be Properly Managed

The Draft Finding indicates the various radium treatment options are not sustainable due to concerns that the disposal of radium residual waste presents potential current and future risks to the environment. Our experience with radium treatment options

[1] GZA GeoEnvironmental, Inc., July 2015, Non-Diversion Alternative Using Existing Water Supply with Treatment, City of Waukesha Water Supply.

indicates radium treatment is an established industry standard process and radioactive residuals are routinely managed and disposed under a rigorous permitting process designed to prohibit environmental impacts upon licensed disposal.

As discussed in GZA's February 2016, "Response to Comments on Non-Diversion Alternative" (GZA, 2016),[2] the proposed Non-Diversion Alternative (NDA), using reverse osmosis (RO) treatment with the existing hydrous manganese oxide (HMO), generates reject water; the reject water can be treated in the City's wastewater treatment plant and the radium quantities are expected to be covered under the current approved WPDES permit according to Wisconsin Department of Natural Resources' (WDNR) Preliminary Final Environmental Impact Statement (EIS) (WDNR, 2016).[3]

For the NDA alternative with Water Remediation Technology (WRT) Z-88® process, WRT transports and disposes of the spent media at a United States Environmental Protection Agency (USEPA)-approved licensed facility (USEcology.com) – either at the Washington State Low Level Radioactive Waste Landfill or Grandview Idaho LLRWL, both of which were approved by USEPA for low-level radioactive waste disposal.

As discussed in WDNR's Preliminary Final EIS, several radium treatment technologies are available and have been used routinely in public water systems. The WDNR has regulations in place governing radioactive residual waste disposal (NR 506.12).[4] Federal regulations and USEPA guidance are also available to regulate and guide the proper disposal of radioactive residual wastes (USEPA, 2005).[5]

Comment 4 - Withdrawal From the Deep Aquifer is Sustainable

The City's existing well network, with replacement wells for the abandoned Well No. 2 and the to-be-abandoned Well No. 9, has adequate well capacity to meet the average day demand (ADD) and maximum day demand (MDD) for the Diversion Approved Area (GZA, 2016).

It is important to note that the Southeastern Wisconsin Regional Planning Commission (SEWRPC) defined the deep sandstone aquifer sustainability as:

> "In the specific case of the deep sandstone aquifer, the term sustainability is being interpreted to mean that the potentiometric surface in that aquifer is maintained at current levels or raised based upon use and recharge conditions within Southeastern Wisconsin." (GZA, 2015).

The following multiple lines of evidence, as provided in our previous memoranda (GZA, 2015; GZA, 2016), indicate the deep sandstone aquifer is sustainable:

1. Both the SEWRPC Model[6] and the groundwater elevation data from 2000 to 2012, indicate that the groundwater elevation in the deep sandstone aquifer would be generally stabilized if the 2000 pumping rate is maintained, or raised if the deep aquifer pumping rate is less than the 2000 pumping rate (GZA, 2015), which the groundwater use data established is the case in the SEWRPC Model area.
2. The groundwater use data in Southeastern Wisconsin indicate the total groundwater uses decreased from 2000 to 2011, and fluctuated from 2011 to 2014 (GZA, 2016).
3. Groundwater level data from a United States Geological Survey (USGS) observation well located near the City of Waukesha well field indicated the groundwater level in the deep sandstone aquifer has rebounded approximately 100 feet to an

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[2] GZA, 2016, Response to Comments on Non-Diversion Alternative, City of Waukesha Water Supply.
[3] WDNR, January 2016, City of Waukesha Proposed Great Lakes Diversion, Preliminary Final Environmental Impact Statement.
[4] http://docs.legis.wisconsin.gov/code/admin_code/nr/500/506.pdf.
[5] USEPA, 2005, A Regulators' Guide to the Management of Radioactive Residuals from Drinking Water Treatment Technologies, EPA 816-R-05-004.
[6] Feinstein, D.T. et al, 2005, "Regional Aquifer Model for Southeastern Wisconsin, Report 1: Data Collection, Conceptual Model Development, Numerical Model Construction, and Model Calibration;" "Simulation of Regional Groundwater Flow in Southeastern Wisconsin, Report 2: model Results and Interpretation." (SEWRPC Model).

elevation of approximately 450 feet mean sea level (MSL), which is approximately 250 feet higher than the top of sandstone aquifer (GZA, 2015).

4. A recent groundwater modeling effort (LBG, 2015)[7] commissioned by the City of Waukesha indicated that, assuming pumping rates remain the same as 2014 for the next 50 years, water levels in the sandstone aquifer can be expected to decline less than 10 feet in the western portion of the SEWRPC service area from 2014 to 2064.

Comment 5 - Deep Aquifer Withdrawals Do Not Result in Measurable Diversion From the Lake Michigan Basin

The Draft Finding cited USGS's estimation that as much as 30% of the water pumped by the City is drawn from the Lake Michigan Basin and indicated that 30% of the water pumped by the deep wells is diverted from the Lake Michigan Basin and is discharged into the Mississippi River Basin via the Fox River, causing an unintended diversion of Lake Michigan Basin water into the Mississippi River Basin.

Based on our review of "Regional Hydrogeology and Groundwater Flow Modeling in Southeastern Wisconsin" (WGNHS/USGS, 2006) and the underlying SEWRPC Model, we believe it is important to clarify several key findings from the model documents:

- Water currently discharged from deep wells is derived from areas west of the wells. None of the water discharged from the deep wells is actually Lake Michigan Water.
- Due to deep well pumping in Southeastern Wisconsin, water will flow toward the wells to replenish the pumped water. Approximately 30% of the water flowing toward the pumping wells originates from the Lake Michigan Basin. Approximately 70% of the water flowing toward the deep wells to replenish the discharge originates in the Mississippi River Basin.
- The City discharged approximately 8 MGD from the deep aquifer wells in 2000, of which approximately 2.4 MGD is estimated to be replenished by water from the Lake Michigan Basin. As compared to the recharge inflow to the entire Lake Michigan Basin, which was estimated to be approximately 16,220 MGD in the period of 2001 to 2005 in the Lake Michigan Basin Model (USGS, 2010),[8] the 2.4 MGD is estimated to be approximately 0.015%, a non-detectable amount masked by the dominant factor of recharge changes over the years in the regional water budget.
- As previously noted by GZA in our February 29, 2016 report, groundwater use has continued to decrease in both Southeastern Wisconsin and the City since the completion of previous modeling by SEWRPC. As such, the amount of water diverted from the Lake Michigan Basin by the deep aquifer pumping has likely also decreased. It is recommended, therefore, that an updated modeling analysis be performed to evaluate the effect of changes on groundwater demand, uses, diversions and other factors since 2000.
- The Lake Michigan Diversion alternative with return flow to the Root River requires the return of 8.4 MGD back to Lake Michigan. Due to consumptive use, estimated to be approximately 0.7 MGD by WDNR (Preliminary Final EIS, page 224), the City will return part of the Infiltration and Inflow as make-up water for the return flow, thereby increasing the commingling of the Mississippi River Basin water by 0.7 MGD to the Lake Michigan Basin by way of the root river.

Comment 6 - Non-Diversion Alternative Has Minimal Impact on Streams and Wetlands

The Non-Diversion Alternative utilizes the City of Waukesha's existing shallow aquifer wells and deep aquifer wells (GZA, 2016). As discussed in WDNR's Preliminary EIS, the existing shallow aquifer wells have minimal impact on nearby streams, with less than 2% stream flow reduction on the Fox River and Pebble Creek and approximately zero stream flow reduction on Pebble Brook, Mill Creek and Genesee Creek.[9] In addition, under the current condition, the City's wastewater treatment plant (WWTP) discharges its effluent to the Fox River at an estimated flow rate of 10.2 MGD,[10] including the water pumped by the wells, and

[7] Leggette, Brashears & Graham, Inc. (LBG), November 2015, "Predicting Future Water Levels in the Sandstone Aquifer of Southeastern Wisconsin."
[8] USGS, Feinstein and others, 2010, "Regional Groundwater-Flow Model, Lake Michigan Basin, Great Lakes Water Availability and Use Studies—Scientific Investigations Report 2010–5109," pages 163 and 166.
[9] WDNR's Preliminary Final EIS, Appendix C, page 252.
[10] WDNR's Preliminary Final EIS, Appendix A, page 224.

Infiltration and Inflow rate via the sanitary sewer line, minus consumptive uses. It helps increase streamflow in the Fox River. On the other hand, for the Lake Michigan Diversion alternative with return flow to the Root River, WWTP discharges to the Fox River will be decreased to approximately 3.6 MGD,[11] a reduction of approximately 6.6 MGD, or 10.2 cubic feet per second (cfs). The reduction of WWTP discharge is approximately 11.6% of August Q50 or 17.8% of Q90,[12] which could have a negative impact to aquatic habitat.[13] The reduction of streamflow is also expected to affect wetland immediately next to the Fox River.

WDNR attempted to use the Upper Fox River Model to simulate shallow well pumping impact on nearby wetland, assuming the area of wetland impacted by the shallow well pumping is equal to the extent of 1 foot groundwater drawdown. However, it is important to note that the Upper Fox River Model is not calibrated to simulate water level change in the nearby wetlands because water level, flow data in the wetlands were not available, nor vertical gradient data across the wetland bed media. As such, we believe WDNR's estimated acreages of wetland impacted by groundwater drawdown may be premature, and needs to be further evaluated. In addition, it is worthwhile to note that no field data have been reported related to wetland deterioration since the operation of the City's shallow wells in 2006, and the Non-Diversion Alternative does not need additional shallow aquifer wells.

CLOSING

This memorandum summarizes our previous evaluation and recent review, as presented herein, further confirming that the NDA is a viable and sustainable alternative to meet the existing and future water supply demands for the City. This alternative is protective of both human health and the environment and represents less than 60% of the cost of the diversion alternative, using a combination of commercially available treatment, on a 50-year net present worth basis.

We appreciate the opportunity to provide these clarifying statements and professional opinions. Please feel free to contact the undersigned at (414) 831-2540 with any questions.

Very truly yours,

GZA GeoEnvironmental, Inc.

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[11] WDNR's Preliminary Final EIS, Appendix A, page 224.
[12] According to WDNR's Preliminary Final EIS, Appendix A, August Q50 is 88.1 cfs and Annual Q90 is 57.2 cfs in the Fox River at Pebble Brook (p 225).
[13] WDNR's Preliminary Final EIS, Appendix A, page 171.