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August 6,2014

Mr. Tauren Beggs
Hydrogeologist
Wisconsin Department of Natural Resources
2984 Shawano Avenue
Green Bay WI 54313-6727

Subject: **Expanded Down-gradient Investigation Work Plan**
Former Town of Newton Gravel Pit, 3130 Hecker Road, Manitowoc, Wisconsin
WDNR BRRTS No. 02-36-000268
WDNR FID No. 436104020

Dear Mr. Beggs:

On behalf of the City of Manitowoc (City), AECOM is providing a work plan for expanded investigation down-gradient (east and southeast) of the currently defined groundwater impacts in the vicinity of the Western Source Area at the Former Town of Newton Gravel Pit (Site). The purpose of the investigation is to better quantify groundwater flow and potential groundwater impacts (both vertically and horizontally) between the existing monitoring well WT-16 and the Yindra Property (3518 Hecker Road). This work plan provides the scope of work for the investigation and meets the general requirements of Chapter NR 716 of the Wisconsin Administrative Code (WAC).

Scope of Services

The scope of services for the investigation will expand the groundwater monitoring network to the east and southeast of the Western Source Area with additional wells screened: 1) in the unconsolidated sediments between the water table and the top of bedrock (approximate 80-foot thickness); and 2) in the upper portion of bedrock. Completion of bedrock monitoring wells is dependent on verification of groundwater impacts at the top of bedrock within the unconsolidated sediments.

Groundwater Monitoring Wells Installed in Unconsolidated Sediment

A total of 11 groundwater monitoring wells will be installed in nests at four (4) locations (see attached Figure), including:

- Two piezometers nested with existing wells WT-16 and PZ-16, with target screen elevations at 640 ft MSL and (i.e. between PZ-16 and top of rock) and 600 ft MSL (immediately above top of rock).
- A three-well nest located between WT-16/PZ-16 and Silver Creek. The well nest will include a water table well at approximate elevation of 680 ft MSL, a piezometer at approximate elevation of 640 ft MSL, and a piezometer at approximate elevation of 600 ft MSL.
- A three-well nest located southeast of the newly installed nest described above, between Silver Creek and the Yindra property. The well nest will include a water table well at approximate elevation of 680 ft MSL, a piezometer at approximate elevation of 640 ft MSL, and a piezometer at approximate elevation of 600 ft MSL.
- A three-well nest located west of Hecker Road and south of Gravel Pit Road, on City property. The well nest will be completed consistent with the previously described wells including a water table well at approximate elevation of 680 ft MSL, a piezometer at approximate elevation of 640 ft MSL, and a piezometer at approximate elevation of 600 ft MSL.

At each nested location the deepest boring/well will be completed first. Boreholes will be advanced with 4-1/4 –inch inner diameter (ID) hollow stem augers (HSA). Soil sampling will be completed using a 2-inch diameter by 2-foot long split-spoon sampler advanced by blows from a 140-pound hammer dropped 30 inches. Soil samples will be logged, classified, and geologically interpreted by a geologist

or geotechnical engineer to include consistency or density, matrix color (using a Munsell soil color chart), classification using the Unified Soil Classification System ("USCS"), field moisture, plasticity, cohesiveness, primary sedimentary structure, observed secondary features, weathering zone abbreviation (Hallberg et al., 1978), and depositional interpretation. Boring logs (WDNR Form 4400-122) will be completed for each boring/well.

Each monitoring well will be installed consistent with WAC Chapter NR 141 with PVC riser and factory machined No. 10 slot (0.010-inch) screens, silica sand filter packs, filter pack seals, annular space seals, and protective casings. Water table wells will be installed with 10-foot long screens and piezometers will be installed with 5-foot long screens. Well construction will be documented on WDNR Form 4400-113A.

Each of the newly installed wells will be developed and sampled prior to incorporating into the annual site-wide monitoring event. An estimated 15 water samples (includes quality control samples) will be collected and submitted to a WAC Chapter NR 149 certified laboratory for analyses of volatile organic compounds (VOCs) (EPA Method SW 8260B). The quality control samples will include field duplicate and matrix spike/matrix spike duplicate samples. The quality control samples will be determined by field personnel. Laboratory provided trip blanks will accompany the sample containers to evaluate the potential for analytical artifacts associated with container handling in the field and laboratory.

The location of each newly-installed well will be surveyed (X and Y coordinates), as well as top of casing elevation.

Groundwater Monitoring Wells Installed in Bedrock

Installation of monitoring wells in bedrock is dependent on verification of groundwater impacts at the top of bedrock within the unconsolidated sediments at each respective well nest. Up to four bedrock piezometers will be installed - one at each of the previously described well nests where groundwater samples from the deepest piezometer (immediately above the top of rock) indicate VOC impacts. Anticipated screen elevations will be approximately 580 ft MSL.

The soil borehole for these piezometers will be drilled without sampling to top of rock. Bedrock will be characterized by collecting continuous 2.5-inch diameter HQ wireline, 1.9-inch diameter NQ wireline or NX conventional rock core. Five foot long well screens will be installed so that the effective screen (filter pack and filter pack seal) is below the rock/unconsolidated sediment interface.

Each of the newly installed bedrock piezometers will be developed and sampled prior to incorporating into the annual site-wide monitoring event. A maximum of approximately 6 water samples (includes quality control samples) will be submitted to a WAC Chapter NR 149 certified laboratory for analyses of volatile organic compounds (VOCs) (EPA Method SW 8260B). The quality control samples will include field duplicate and matrix spike/matrix spike duplicate samples. The quality control samples will be determined by field personnel. Laboratory provided trip blanks will accompany the sample containers to evaluate the potential for analytical artifacts associated with container handling in the field and laboratory.

The location of each newly installed well will be surveyed (X and Y coordinates), as well as top of casing elevation.

If you have any questions or require additional detail, please contact Kathleen M. McDaniel, City Attorney, at 920-686-6990 or kmcdaniel@manitowoc.org or Dave Henderson at 414-944-6190 or dave.henderson@aecom.com.

Respectfully Submitted,

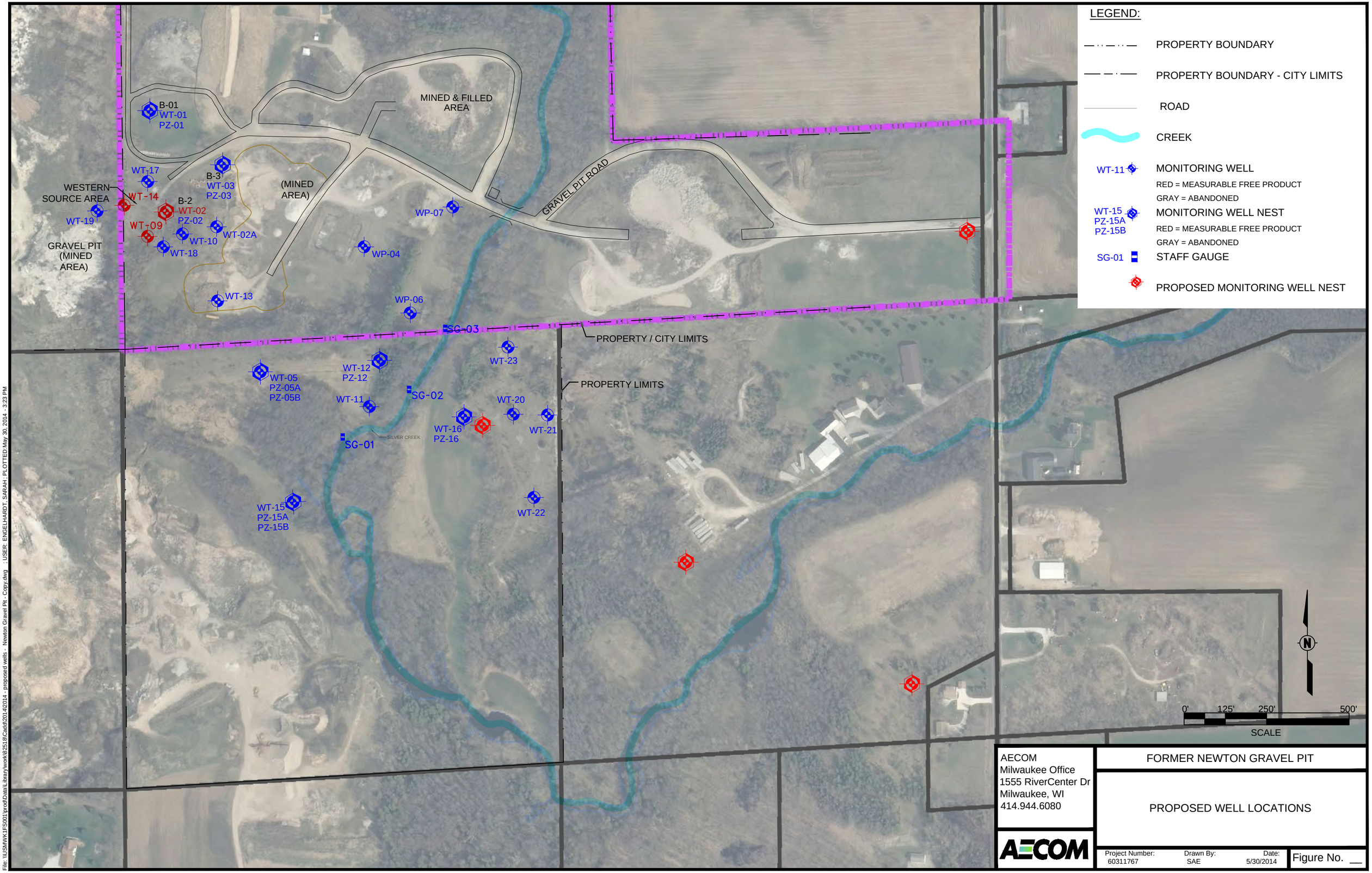
AECOM

D.S. Henderson

David Henderson, P.E.
Senior Project Manager

c: Kathleen M. McDaniel, City Attorney, City of Manitowoc
Dan Koski, Director of Public Infrastructure, City of Manitowoc

Attachments: Figure 1, Proposed Well Locations



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FORMER NEWTON GRAVEL PIT

PROPOSED WELL LOCATIONS

Project Number:	Drawn By:	Date:	Figure No.
60311767	SAE	5/30/2014	

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