WORK PLAN FOR DOWNGRADIENT AND ALLEN DRAIN GSI INVESTIGATIONS

ANN ARBOR WASHTENAW COUNTY, MI

PREPARED FOR GELMAN SCIENCES INC.

FOR SUBMITTAL TO THE MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES AND ENERGY (EGLE)



February 2022 Project No. 806500

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LIST OF ACRONYMS

- EGLE Michigan Department of Environment, Great Lakes, and Energy
- F&V Fleis & VandenBrink Engineering, Inc.
- ppb parts per billion
- QA/QC Quality Assurance/Quality Control
- VOC Volatile Organic Compound
- US EPA United States Environmental Protection Agency
- WCWRC Washtenaw County Water Resources Commissioner



1.0 INTRODUCTION/BACKGOUND

This work plan identifies the next phase of Gelman's Downgradient Investigation of the fate of 1,4-dioxane in the Eastern Area and Gelman's investigation of the Allen Drain Groundwater/Surface Water Interface ("GSI") Pathway. More specifically:

- Downgradient Investigation. Gelman's Downgradient Investigation is an iterative process that began with Gelman's submission of its October 2004 Work Plan for Downgradient Investigations and Potential Underflow of the Huron River (approved by EGLE 2/3/2005). In this phase, Gelman is continuing to evaluate the relationship between the plume and the Allen Drain, including its branches, and the Drain's influence on the flow path of the Eastern Area plume. This evaluation will include installing additional groundwater monitoring wells proximate to the locations where the plume may intersect with the Allen Drain and obtaining flow and contaminant concentration data from within the Drain. These data will be used to identify any locations where the plume discharges to the Allen Drain and the relative volume and concentration of any such discharges, all of which will provide additional insight into the influence, if any, of the Allen Drain on the plume's migration pathway.
- <u>GSI Investigation of Allen Drain Pathway</u>. Gelman will also evaluate whether the GSI pathway via the Allen Drain is relevant and obtain data to confirm Gelman's compliance with the June 1, 2021 Response Activity Order entered in *Attorney General, et al v Gelman Sciences Inc.*, Washtenaw County Circuit Court case no 88-34734-CE, which incorporates by reference the Proposed Fourth Amended and Restated Consent Judgment (collectively, the "Response Activity Order"), including its "Groundwater/Surface Water Interface Objective."
 - o The Response Activity Order's GSI Objective requires Gelman to prevent 1,4-dioxane from venting into the surface waters in the Eastern Area at concentrations above the Generic GSI Cleanup Criterion (which under the Response Activity Order is 280 ppb), except in compliance with Part 201. Part 201 requires evaluation of the GSI pathway if a groundwater contamination plume is entering a sewer that discharges to surface water. Previous investigations of the Allen Drain have revealed the consistent presence of 1,4-dioxane in one of the Drain's branches and periodic trace detections in a second branch. These detections, previous investigations of the Drain's integrity, and the known flow path of the groundwater contaminant plume suggest the possibility that some portion of the plume may intersect and discharge to these Drain branches (although the results of a recent investigation of the shallow groundwater proximate to the Drain performed on behalf of Washtenaw County by Tetra Tech, Inc. suggest otherwise).
 - All available data indicate that the GSI pathway is not relevant with respect to the Allen Drain-even assuming that the 1,4-dioxane detected is related to the Gelman site--because 1,4-dioxane at concentrations above 280 ppb would not be reasonably expected to vent to the Huron River via the Drain. These data include groundwater quality data from MW-82s, the shallow groundwater monitoring well directly upgradient of the West Park area, which shows stable/declining concentrations over the last several years, now below 280 ppb (270 ppb as of July 2021).
 - This GSI Investigation will gather sufficient additional data to make a conclusive determination with regard to the applicability of the GSI pathway as it relates to Allen Drain. The data gathered relevant to this evaluation will include flow measurements and contaminant concentration data from within the Drain, including near the outfall to the Huron River. Ongoing monitoring of the monitoring wells installed upgradient of the points at which the Drain interacts with the plume and future sampling within Allen Drain near the outfall to the Huron River will be relied upon to confirm future compliance with the Response Activity Order's GSI Objective.

To the extent the data obtained by the GSI Investigation confirm Gelman's compliance with Part 201 and the GSI Objective of the Response Activity Order, those data will also confirm Gelman's compliance with Part 31 and



address any related concerns regarding alleged "illicit discharges" raised by the Washtenaw County Resources Commissioner (WCWRC).

The Allen Drain is an underground drain that is located predominantly within the City of Ann Arbor, Washtenaw County, Michigan. The Allen Drain and its branches were historically natural drainage areas. The drainage has been engineered into underground drains to more efficiently convey water, facilitate urbanization, and control flooding. The Allen Drain and its branches are managed under the jurisdiction of the WCWRC.

The main branch of the Allen Drain begins near the University of Michigan Stadium area and drains northward to an outlet on the Huron River just south of Argo Dam. There are three branches that originate west of the main branch and flow generally towards the east that are the focus of this proposed work. These branches are shown on Figure 1 and include:

- West Park-Miller Avenue
- West Park-Fairgrounds
- Murray-Washington

Figure 1 – Allen Drain and its Branches



Hydrogeological investigations conducted by Gelman support the potential hydraulic interaction between 1,4dioxane from the Gelman plume as it reaches the Allen Drain corridor. Water level mapping by Gelman suggests underflow of the Allen Drain corridor is very unlikely. In other words, a groundwater divide is present in the vicinity of the main Branch of the Allen Drain. This is evident from potentiometric surface mapping by F&V and others. A representative map is shown below as Figure 2.



Figure 2 – Generalized Potentiometric Surface

Groundwater moving from west to east toward this area is expected to either: 1) vent into one of the Allen Drain branches, 2) vent into the Allen Drain, 3) migrate along the Allen Drain corridor, or 4) a combination of the above.

In 2019, Gelman Sciences, with the cooperation of the WCWRC office, implemented an EGLE-designed water sampling program that involved the collection of monthly water quality samples from locations along the three branches of the Allen Drain for a period of six months. Results from this sampling program established that 1,4-dioxane is consistently present in the downstream reach of the West Park-Fairgrounds branch and periodically present at trace levels in the Murray-Washington branch. 1,4-Dioxane was determined not to be present in the West Park-Miller Avenue branch. The findings of this work were summarized by EGLE in the report titled: Allen Drain Sampling Investigation, West Park Area of the City of Ann Arbor, November 2019 (https://www.michigan.gov/documents/egle/egle-rrd-GS-AllenCreekDrainSummaryReport-11-20-19_673069_7.pdf).

Years of mapping of the Gelman plume, groundwater flow data, and shallow groundwater investigations that Gelman completed pursuant to a EGLE-designed work plan in 2016 indicate that the West Park-Miller Avenue and Murray-Washington branches are not in a position relative to the Gelman plumes to interact with groundwater containing significant concentrations of 1,4-dioxane related to the Gelman site. This interpretation is consistent with the findings of EGLE's 2019 drain sampling investigation, which did not identify 1,4-dioxane in the West Park-Miller Avenue branch and found only trace concentrations of 1,4-dioxane in the Murray-Washington branch. Over two decades of monitoring the 1,4-dioxane plume in the Eastern Area indicate concentrations of 1,4-dioxane exceeding 280 ppb will not reach the main branch of the Allen Drain in the future. The footprint of higher/plume core concentration in the Eastern Area have been decreasing as a result of groundwater extraction and natural plume dispersion. Ongoing groundwater monitoring in the Eastern Area, including near the branches of the Allen Drain, will be used to assess potential for expansion of 1,4-dioxane concentrations in excess of 280 ppb toward the main branch of the Allen Drain.



2.0 WORK PLAN

2.1 REVIEW RECORDS MADE AVAILABLE BY THE WCWRC

WCWRC has provided F&V with various records of the West Park-Fairgrounds Branch. We anticipate that WCWRC will make other drain information available to F&V upon request. F&V will review such records and include them in our analysis as appropriate.

2.2 FLOW DATA COLLECTION

F&V proposes to collect flow data at multiple selected manhole locations along the three drain branches. The proposed monitoring locations are shown on Figure 3 on the following page.

F&V will first inspect the manhole locations and determine their viability to accommodate flow monitoring equipment. Where the locations are conducive to flow monitoring, F&V will install pressure transducers into the drain channel to measure water level depth in the channels, which can be used along with elevation and other data to measure flow in the drains. Data from the pressure transducers will be augmented with periodic channel velocity measurements collected using a Hach Sigma 910 Portable Area Velocity Flow Meter. If the proposed locations are not suitable for measurements, alternative locations will be proposed.

Data will be collected for a period of three months. Depth data will be recorded at five-minute frequencies. The primary objectives of this work are to establish the contribution of groundwater into the drains and quantify flows.

F&V will also obtain and review United States Geological Survey records for the 04174490 flow station located at the confluence of the Allen Drain and Huron River.



Figure 3 – Proposed Flow Monitoring Locations



2.3 PRECIPITATION DATA COLLECTION

F&V will use a combination of reliable online weather sources for local weather data. These data will be used to determine potential contribution surface water runoff (vs. groundwater infiltration).

2.4 WATER QUALITY DATA COLLECTION

F&V will collect water quality samples from all manhole locations along the West Park-Fairgrounds branch between Wildwood Avenue and the confluence with the West Park-Miller Avenue branch. Additionally, locations previously sampled by EGLE will be resampled. The proposed locations are shown on Figure 4 below.

Figure 4 – Proposed Water Quality Monitoring Locations



The samples will be collected monthly for three months (generally equally spaced in time). The following methods will be used.

All sampling locations will be accessed from existing storm sewer manholes. Grab samples of water from the main flow of the storm water conveyance will be collected. The samples will be collected from the manholes directly using an extension rod fitted with a bottle holder at the end, or a nitrile gloved hand if water is accessible at a shallow depth in the manhole. Entry into the manhole (confined space entry) will not be conducted. The water sample will be collected by dipping a clean plastic 500 ml bottle with the dip-pole or gloved hand. The sample will be dispensed from the 500 ml collection bottle into laboratory provided sample containers. All personnel handling sample bottles will use nitrile gloved hands. The samples will be transported under chain-of-custody to the Gelman Laboratory and analyzed for 1,4-dioxane using US EPA Method 8260 modified. A selected subset of the samples will also be analyzed for volatile organic compounds (VOCs) by Ann Arbor Technical Services using US EPA method 8260/8270. It is anticipated that EGLE will occasionally split samples with Gelman for analysis by EGLE's environmental laboratory.



The following QA/QC samples will be collected for laboratory analysis of 1,4-dioxane and VOCs:

- Equipment Rinsate Blank One rinsate blank per sampling event will be collected from the 500 ml plastic bottle using reagent-grade water provided by the laboratory.
- Duplicates One duplicate sample will be collected per sampling event from a randomly selected location.

2.5 MONITORING WELL INSTALLATION

Gelman has proposed the installation of monitoring well clusters at three locations in the Allen Drain area. These locations, subject to obtaining access, are shown on Figure 5 below as locations F, G and H. Data collected from these wells will provide additional information regarding the influence of the Allen Drain on the Gelman plume. Borings drilled at locations H and F will be drilled to the bedrock surface using Rotosonic drilling methods. Location G is the location of MW-98s/d. In 2006, a boring at this location was advanced to the bedrock surface, and so the Location G boring will not go to bedrock. The goal at this location is to augment this cluster with a shallower well. As such, Vertical Aquifer Sampling (VAS) and continuous coring will focus on the upper 50 foot at this test boring location. Sampling frequencies and well installation procedures we be consistent with those employed during the drilling/installation of other borings/wells installed as part of the Response Activity Order.



Figure 5 – Proposed Monitoring Well Locations

2.6 DATA ANALYSIS/REPORTING

Gelman will prepare a report of its findings. The report will include the data collected from this investigation and interpretations of the data. The report will also include recommendations regarding:

- 1. Long-term monitoring
- 2. Additional investigations that may be beneficial to evaluating the long-term fate of 1,4-dioxane in the downgradient portion of the Eastern Area.



3.0 HEALTH AND SAFETY

3.1 STORMWATER FLOW MONITORING AND WATER SAMPLING

F&V will prepare a project specific health and safety plan for the stormwater flow monitoring and water sampling project. F&V staff do not plan on entering manholes for this project. If there becomes a need to enter a confined space, F&V will follow its protocols for confined space entry.

F&V samplers will wear brightly colored reflective vests, safety glasses, and nitrile gloves (when collecting the water samples) during the sample collection events.

F&V will follow required traffic control in areas where traffic control is necessary. This will include obtaining traffic control permits from the City of Ann Arbor (as required).

3.2 DRILLING

F&V will utilize its existing health and safety plan/procedures in place for drilling related activities.

4.0 SCHEDULE

F&V proposes to implement this investigation within one month of approval by EGLE. F&V will prepare a report of its findings within three months of the completion of field data collection, including the first round of sampling data from the monitoring wells to be installed as a part of this investigation.

