FEDEX: 7732 9550 5820

April 6, 2015

Mr. Christopher Ralston
Maryland Department of the Environment
Remediation Division, Oil Control Program
1800 Washington Blvd, Suite 620
Baltimore, MD 21230-1719

RE: Bioreactor Shutdown Work Plan
Inactive Exxon Facility #28077
14258 Jarrettsville Pike
Phoenix, Maryland
Case Number 2006-0303-BA2
Kleinfelder Project No.: 20153942

Dear Mr. Ralston:

Pursuant to the modification notification requirement of the Corrective Action Plan approval letter,[1] Kleinfelder, on behalf of ExxonMobil, requests permission to deactivate the bioreactor which is currently used to treat a portion of the recovered groundwater at the above referenced site, and transition to liquid phase carbon for primary treatment of all recovered groundwater going forward. This proposed change in treatment technique is based on: (i) the decreasing influent concentration trend; (ii) adequacy of carbon-only treatment for current and anticipated future influent concentrations; (iii) likely microbial colony collapse as influent methyl tertiary butyl ether (MTBE) concentrations continue to decline; (iv) the presence of spare liquid phase granular activated carbon (LGAC) vessels onsite; and, (v) retention of the air stripper equipment onsite, should future needs for additional treatment arise.

BACKGROUND

A groundwater extraction and treatment system is operated onsite to maintain hydraulic control and recover dissolved-phase hydrocarbons. Following extraction, groundwater is directed into one of two onsite equalization tanks (tanks T-102 and T-202) based on dissolved-phase hydrocarbon concentrations. Groundwater from each tank is processed and treated separately.

[1] MDE, June 10, 2009, Corrective Action Plan Approval Letter, Case Number 2006-0303-BA2, former Exxon RAS No. 2-8077, 14258 Jarrettsville Pike, Phoenix, Baltimore County, Maryland, Facility I.D. No. 12342.

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The two treatment streams are referred to as the high concentration stream and the low concentration stream. The low concentration stream is currently treated by four LGAC vessels operated in series.

The high concentration stream currently receives primary treatment via a bioreactor, which can accept a hydraulic loading rate of up to 30 gallons per minute (GPM). A motor-operated valve (MOV) is utilized to maintain flow to the bioreactor at approximately 28 GPM, with any overflow directed into an air stripper located in Treatment Trailer #2 for treatment. The effluent from the bioreactor and the effluent from the air stripper are pumped through two separate trains of three LGACs in series for secondary treatment. A process flow diagram depicting the current treatment operations at the site is provided as **Figure 1**.

PROPOSED TREATMENT SYSTEM CHANGES

No changes to the low concentration stream treatment process are proposed. The proposed hydrocarbon treatment process for the high concentration stream is up to four LGACs operated in series, similar to the low concentration stream treatment process. The compounds of concern that may be present in the high concentration stream are the same as those that may be present in the low concentration stream, so similar hydrocarbon removal efficiencies are expected. Proposed changes to the treatment process are illustrated on **Figure 2**, and include:

- Elimination of the Bioreactor from the treatment process. Treatment of hydrocarbon concentrations in the high concentration stream will mirror the treatment process for the low concentration stream, with up to four LGACs operated in series.

- Permanent shutdown of the Bioreactor. The unit will be permanently decommissioned, including removal and proper disposal of liquids, the sand media, the nutrient tank, chemicals and feed pump, and the pH metering pump, chemicals and caustic tank.

- Permanent shutdown of Treatment Trailer #1. The only equipment currently active in Treatment Trailer #1 are a flow sensor and the MOV limiting flow to the bioreactor and sending overflow to the air stripper in Treatment Trailer #2. All other equipment in Treatment Trailer #1 was previously decommissioned.

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- Temporary shutdown of Treatment Trailer #2. The air stripper in this container is currently maintained and operated to treat any overflow from the high concentration stream that cannot be directed to the bioreactor based on process flow rates. Initially following bioreactor decommissioning, Treatment Trailer #2 will be maintained in operating condition as a back-up only, to be utilized only if warranted based on a change in site conditions or LGAC equipment issues. Treatment Trailer #2 may be converted to permanent shutdown in the future pending evaluation of the LGAC-only treatment operations for both the low concentration and high concentration streams.

- Modification of LGAC configuration. A total of 12 LGACs are in place inside the former station building, each with a capacity of 2,000 pounds. Under the proposed operating scenario, four vessels would be utilized for the low concentration stream, four vessels would be utilized for the high concentration stream, and four vessels would be maintained onsite as spares (**Figure 2**). In the future pending evaluation of the LGAC-only treatment operations for both the low and high concentration streams, the carbon vessel configuration may be streamlined into a single treatment train for processing all recovered water onsite with a spare carbon treatment train maintained onsite.

BASIS FOR PROPOSED TREATMENT SYSTEM CHANGES

Influent dissolved-phase hydrocarbon concentrations have continued to exhibit an overall decreasing trend since groundwater treatment system operations began in 2006. Recent remediation system modifications, including replacement of the DPE Claw system, and the incorporation of onsite well SVE-2, intersection well MW-187B and offsite well MW-82B into the system in 2014 have resulted in additional hydrocarbon recovery; however, the impact on overall system influent concentrations has been minor. Influent to the bioreactor is monitored for benzene, toluene, ethylbenzene and total xylenes (collectively referred to as Total BTEX), MTBE and tertiary butyl alcohol (TBA). Concentrations observed over the previous year of operation are summarized in the following table and influent concentrations since 2007 and over the previous year are presented in the attached **Charts 1** through **4**.

Sample Date	Flow Rate (gpm)	Total BTEX (ug/L)	MTBE (ug/L)	TBA (ug/L)
4/2/2014	18	BRL	41.1	<1.9
4/23/2014	19	0.27	30.6	<1.9
5/7/2014	25	1.58	66.9	<1.9
5/22/2014	26	BRL	41.3	<1.9
6/11/2014	15	BRL	38.8	<4.7
6/24/2014	17	131.9	200	17.4 J
7/9/2014	16	0.24	72.3	<4.7
7/23/2014	17	33.8	75.3	<4.7
8/5/2014	18	7.8	55.7	35.8
8/20/2014	19	2.7	79.6	<4.7
9/2/2014	15	0.73	85.8	<4.7
9/16/2014	14	BRL	127	<4.7
10/2/2014	12	0.22	115	<4.7
10/14/2014	14	5.5	163	<4.7
11/3/2014	17	8.0	106	<4.7
11/18/2014	11	BRL	25.1	<4.7
12/1/2014	12	5.6	41.6	<4.7
12/15/2014	12	BRL	66.5	<4.7
1/5/2015	11	BRL	47	6
1/19/15	14	BRL	44	5 J
2/2/15	12	BRL	26	7
2/16/15	12	BRL	18	3 J
3/2/15	12	BRL	17	7
3/16/15	21	BRL	18	7

ug/L – micrograms per liter
J – estimated value between method detection limit and reporting limit
<1.9 – compound not detected, concentration less than method detection limit shown
BRL – below reporting limits
NA – not analyzed

Based on these concentration trends, the bioreactor is no longer the most appropriate or efficient means of hydrocarbon treatment when compared to other treatment equipment onsite. In addition, a greater risk of microbe colony collapse exists due to low and decreasing hydrocarbon loading rates (critical loading as defined by the manufacturer for current treatment rates is over 175 ug/L of MTBE and TBA).

The carbon vendor for the site, Evoqua Water Technologies, Inc., was provided the average flow and concentrations observed over the previous year to estimate carbon usage based on the isotherms for their carbon. At an average flow of 16 GPM, a high concentration stream exhibiting the average concentrations detected during the previous year would consume carbon in the range of approximately 19 to 46 pounds per day depending on the adsorption efficiency of any TBA that may be present in the influent. This usage rate equates to a change-out of the first vessel in the series approximately once every 43 to 103 days, with breakthrough defined as any detection of a constituent above the laboratory detection limit in the effluent from the first carbon vessel. As influent concentrations continue to decrease over time, the required frequency of change-outs is expected to decrease. The carbon usage estimate provided by Evoqua, with additional comments and calculations added by Kleinfelder, is attached for reference (**Appendix A**).

Influent concentrations of BTEX, MTBE and TBA have been collected from the high concentration stream at a minimum frequency of once per month. Sampling of the high concentration treatment process is proposed to be identical to the sampling procedures currently followed for the low concentration treatment process. Samples shall be collected at a minimum frequency of once per month at the initial LGAC influent, LGAC mid-points (between vessels 1 and 2, 2 and 3, and 3 and 4) and final LGAC effluent. Results from these sampling events shall be maintained and evaluated to determine treatment efficiencies and shall allow for carbon change-out and/or replacement utilizing the spare vessels onsite on a timely basis.

The proposed changes are not expected to affect compliance with the site's treated water discharge permit. The permitted parameters for the discharge permit include individual BTEX compounds, MTBE, naphthalene, gasoline range organics (GRO) and diesel range organics (DRO). These compounds are known to be effectively treated via carbon adsorption.

Please contact the undersigned with any questions or requests for additional information at 410.850.0404.

Sincerely

KLEINFLDER

Leslie D. Steele, P.E.
Senior Engineer

Mark J. Schaaf, C.P.G.
Project Director

Attachments

cc: Mr. John J. Hoban - ExxonMobil Environmental Services Company (Kleinfelder File)
Ms. Ellen Jackson - Maryland Department of the Environment
Mr. Andrew Miller - Maryland Department of the Environment
Mr. Carlos Bollar - Archer & Greiner, P.C.

FIGURES

1 Current Groundwater Recovery and Treatment Process Flow Diagram
2 Proposed Groundwater Recovery and Treatment Process Flow Diagram

CHARTS

1 Influent BTEX Concentrations – January 2007 through March 2015
2 Influent BTEX Concentrations – April 2014 through March 2015
3 Influent MTBE Concentrations – January 2007 through March 2015
4 Influent MTBE Concentrations – April 2014 through March 2015

APPENDIX

A Carbon Usage Estimate

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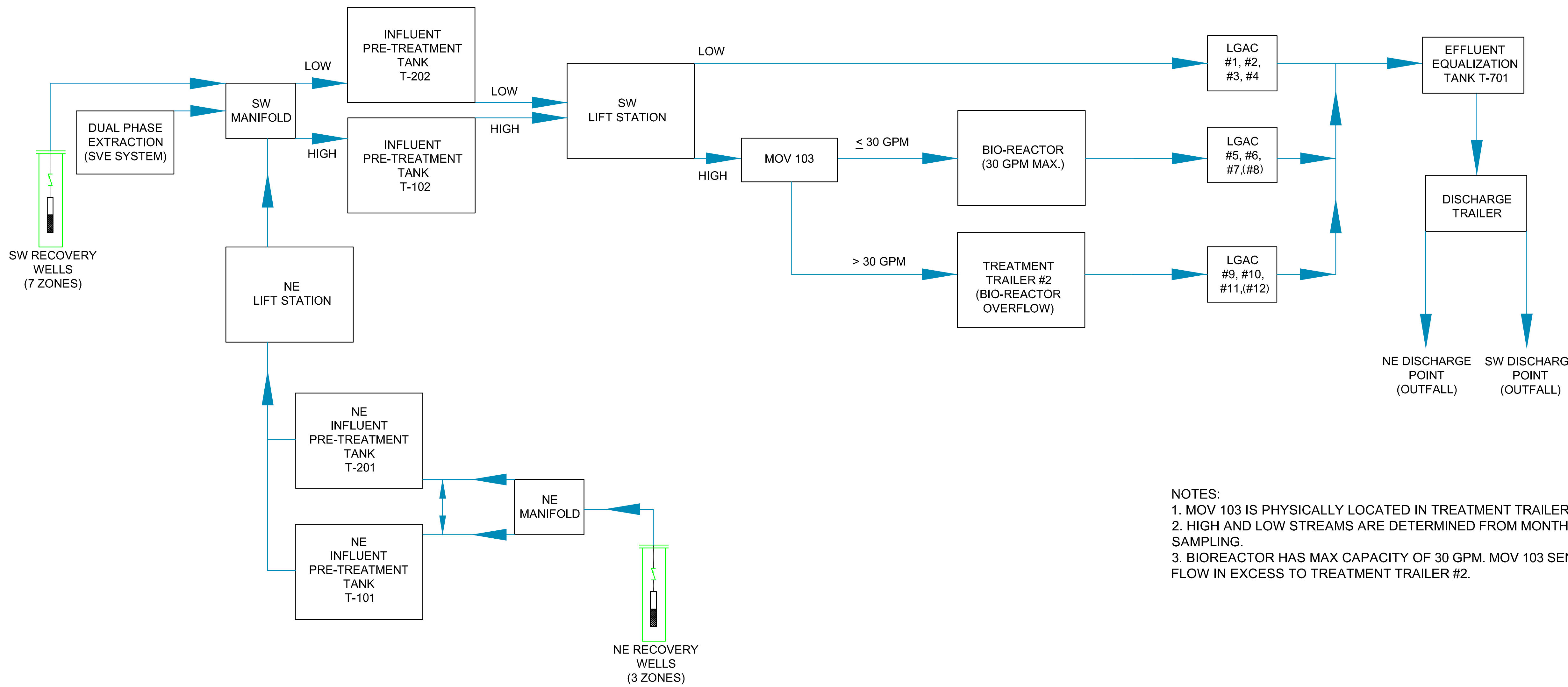
FIGURES



NOTES:
1. MOV 103 IS PHYSICALLY LOCATED IN TREATMENT TRAILER #1.
2. HIGH AND LOW STREAMS ARE DETERMINED FROM MONTHLY SAMPLING.
3. BIOREACTOR HAS MAX CAPACITY OF 30 GPM. MOV 103 SENDS FLOW IN EXCESS TO TREATMENT TRAILER #2.

PLOTTED: 31 Mar 2015, 8:37am, shilburn   LAYOUT: FIG 1 GW PFD   CAD FILE: W:\MARYLAND\28077-XOM-PHOENIX\

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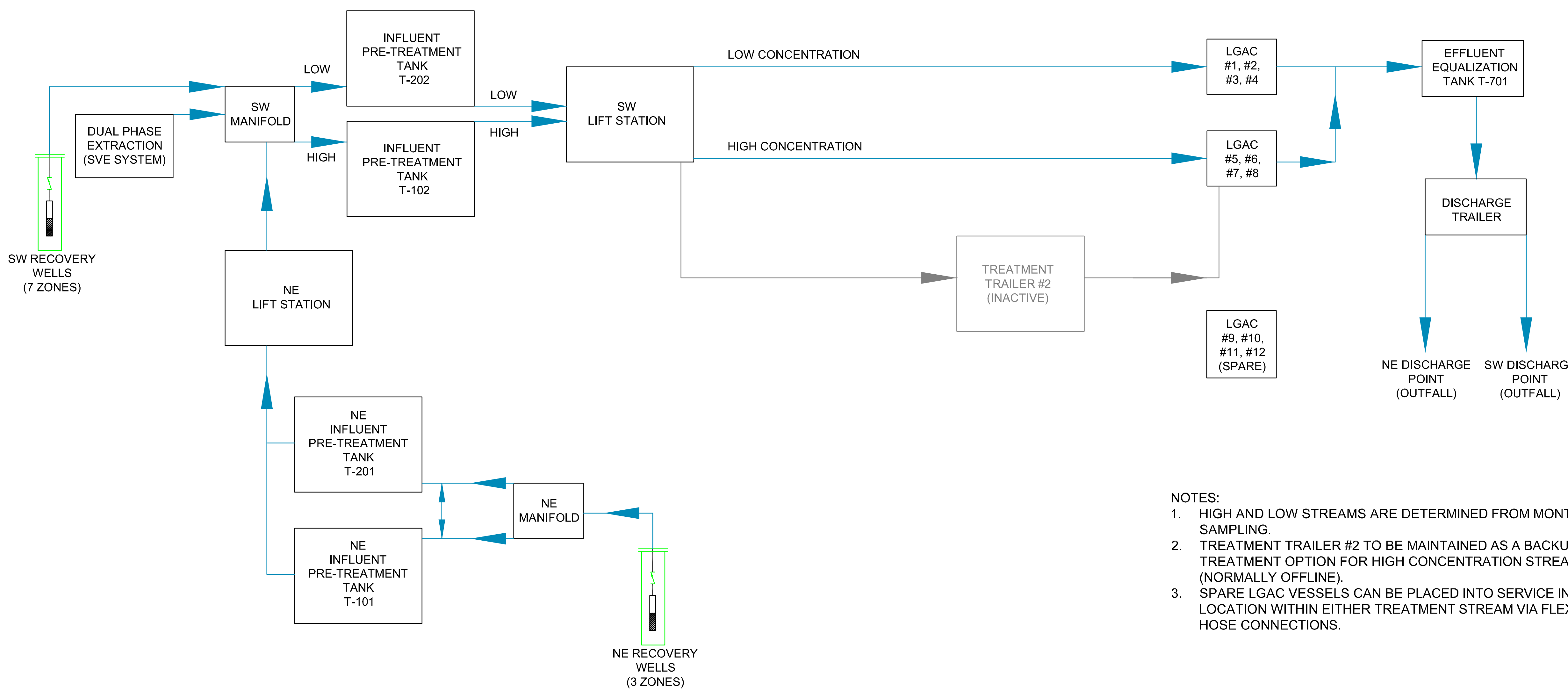
PROJECT NO.	131517
DRAWN:	03/30/15
DRAWN BY:	BNM
CHECKED BY:	LS
FILE NAME:	Final Process Flow Diagram 032515.dwg

CURRENT GROUNDWATER RECOVERY AND TREATMENT PROCESS FLOW DIAGRAM

INACTIVE EXXON FACILITY # 28077
14258 JARRETTSVILLE PIKE
PHOENIX, MARYLAND

FIGURE
1



NOTES:
1. HIGH AND LOW STREAMS ARE DETERMINED FROM MONTHLY SAMPLING.
2. TREATMENT TRAILER #2 TO BE MAINTAINED AS A BACKUP TREATMENT OPTION FOR HIGH CONCENTRATION STREAM (NORMALLY OFFLINE).
3. SPARE LGAC VESSELS CAN BE PLACED INTO SERVICE IN ANY LOCATION WITHIN EITHER TREATMENT STREAM VIA FLEXIBLE HOSE CONNECTIONS.

CAD FILE: W:\MARYLAND\28077-XOM-PHOENIX\ LAYOUT: FIG 2 PROPOSED GW PFD PLOTTED: 31 Mar 2015, 8:40am, shilburn

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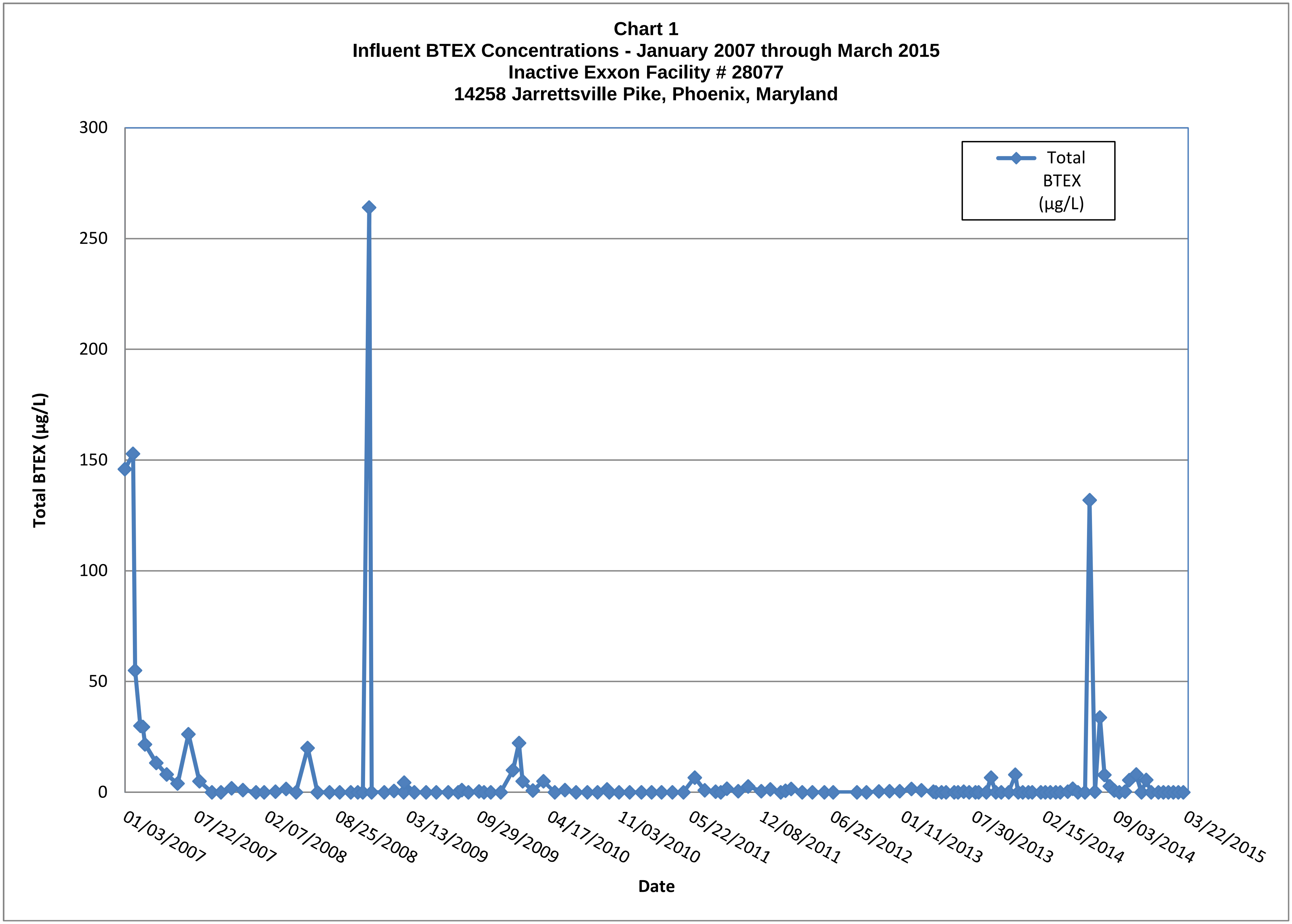
PROJECT NO.	131517
DRAWN:	03/30/15
DRAWN BY:	BNM
CHECKED BY:	LS
FILE NAME:	Final Process Flow Diagram 032515.dwg

PROPOSED GROUNDWATER RECOVERY AND TREATMENT PROCESS FLOW DIAGRAM

INACTIVE EXXON FACILITY # 28077
14258 JARRETTSVILLE PIKE
PHOENIX, MARYLAND

FIGURE
2

CHARTS



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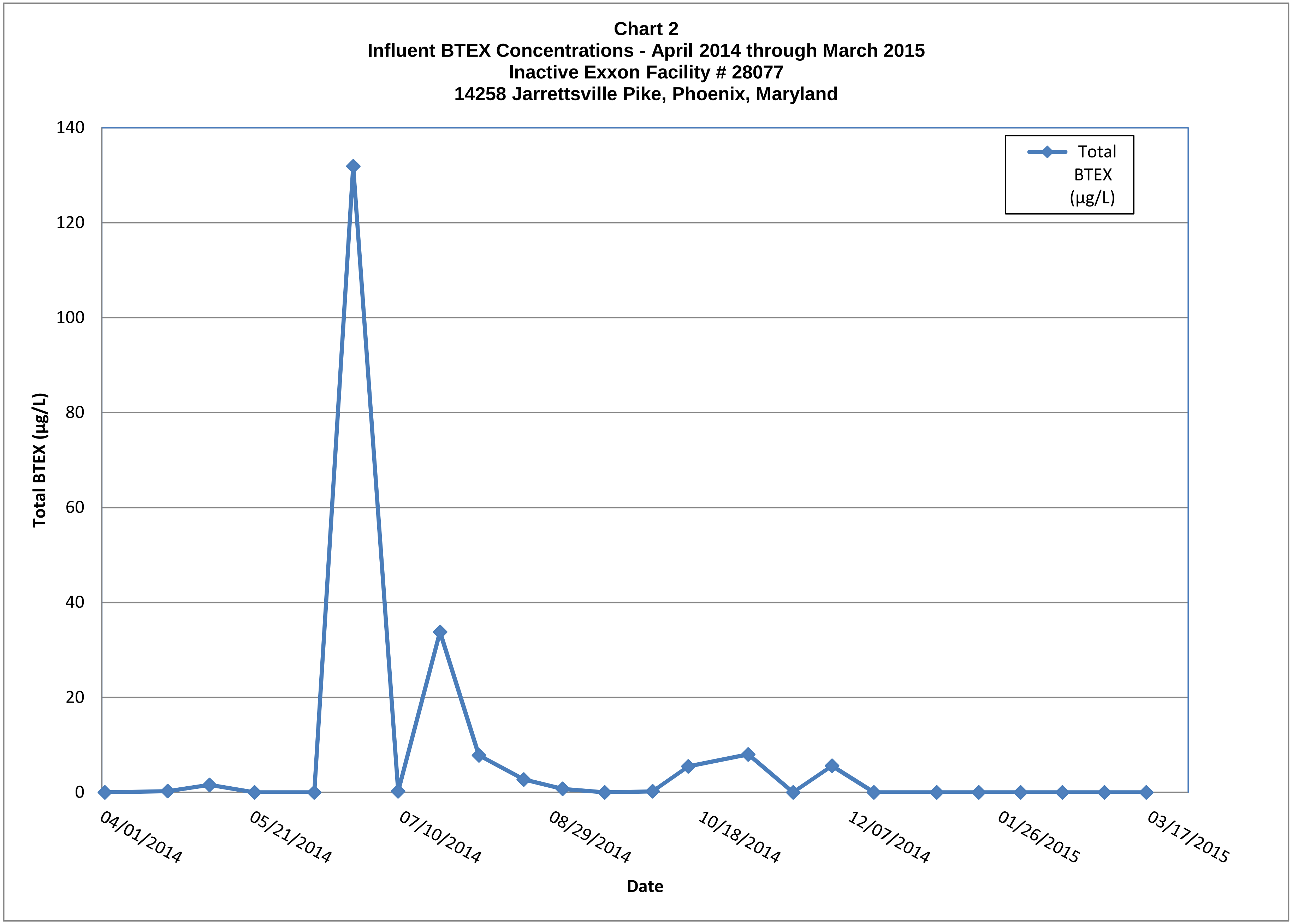

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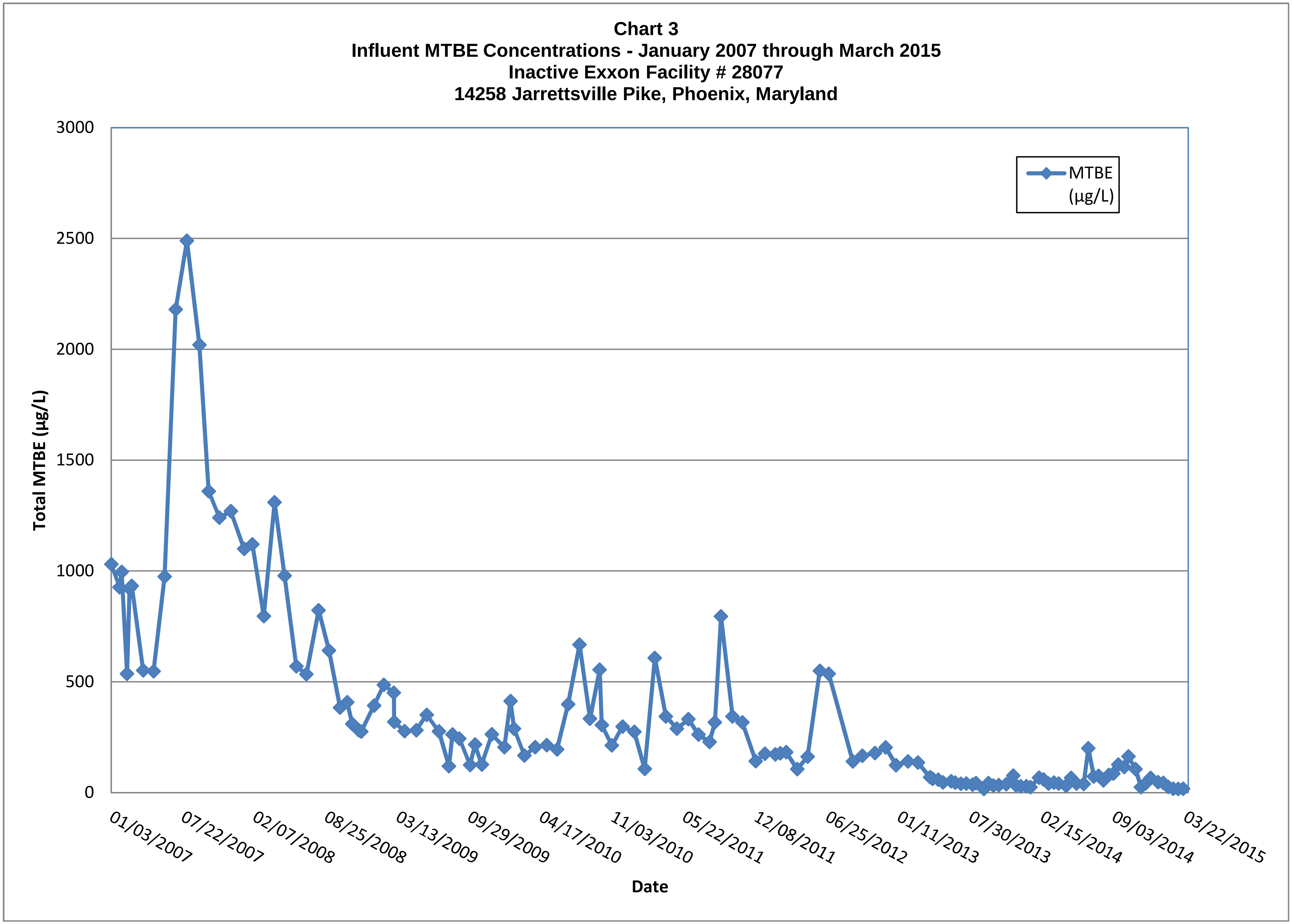

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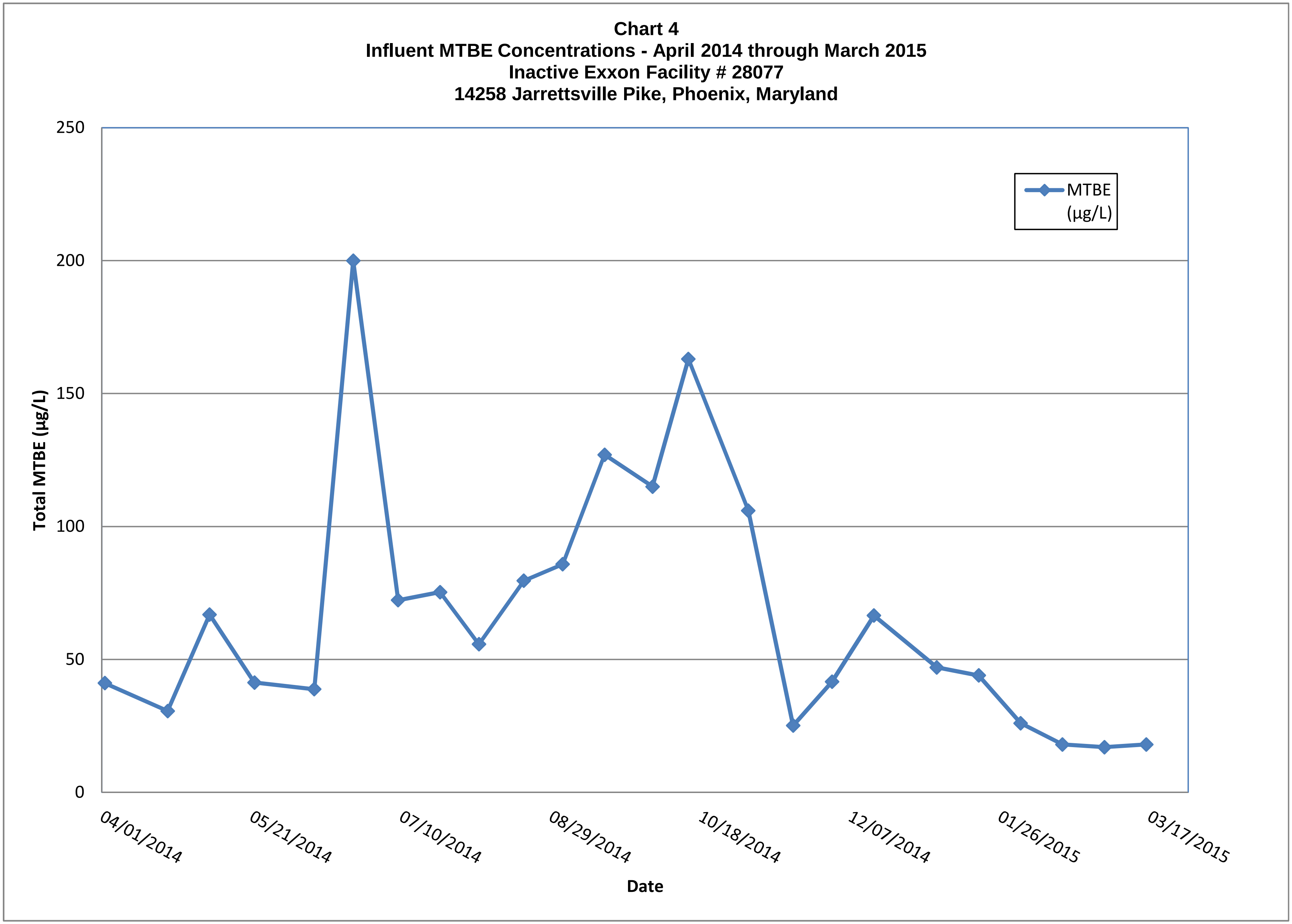

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APPENDIX A

Carbon Usage Estimate

LIQUID PHASE ISOTHERM DESIGN PARAMETERS

Water Flow Rate 16.00000 gpm

LIQUID PHASE DESIGN

Component Name	*Concentration*	*#GAC/1000 gallons of water*
BENZENE	0.8100 ppbw	0.0103
TOLUENE	4.1000 ppbw	0.0066
BENZENE,ETHYL-	0.5800 ppbw	0.0011
XYLENE,m-	66.7000 ppbw	0.0317
MTBE	66.7000 ppbw	0.7932
TBA	5.0000 ppbw	1.1549

Total Carbon Usage Estimated at Breakthrough

46.0263 #GAC/day

1.9977 #GAC/1000 gallons of water

Kleinfelder Notes and Design Considerations:

1. Concentrations and flow rate based on average influent to the Bioreactor (High Concentration Treatment Stream) between April 2, 2014 and March 16, 2015 (24 sampling events).

2. BTEX and TBA concentrations were non-detect during many of the sampling events. For these events, an assumed concentration equal to half of the method detection limit was utilized for calculating average concentrations.

3. TBA is not effectively adsorbed to activated carbon. Per Evoqua, the model output shown above is likely an over-estimate for carbon consumption due to TBA, and actual adsorption efficiencies of less than 5% are often observed. Removal rates observed across carbon beds may also be attributed to biodegradation in some instances, rather than carbon adsorption.

Carbon change-out frequency based on the detection of any compound at a concentration above method detection limits at the effluent of the initial carbon vessel (up to 3 additional vessels would still be in operation downstream of the first vessel):

1. Including Consumption by TBA (As Modeled Above)
    LGAC Capacity = 2000 lbs
    Estimated Breakthrough = 2000 lbs / 46.03 lbs/day = 43 days

2. Excluding Consumption by TBA
    LGAC Capacity = 2000 lbs
    Estimated Breakthrough = 2000 lbs / 19.42 lbs/day = 103 days