TECHNICAL MEMORANDUM

Date: November 14, 2013 **Project No.:** 130-0253

To: Eric Ward, Operations Manager **Company:** Marathon Oil Company

From: Randy March, P.E., P.G.
Eric Kern, Ph.D.

RE: SAMPLING AND ANALYSIS PLAN FOR 596-32C PRODUCED WATER POND, FACILITY #421284, COGCC REM #7734

This Technical Memorandum provides the Sampling and Analysis Plan (SAP) for monitoring of groundwater and surface water near the Marathon Oil Company (MOC) 596-32C produced water pond (the site) through 2014. Subsequent monitoring of groundwater and surface water at the site will be in accordance with Colorado Oil and Gas Conservation Commission (COGCC) Form 28 permitting of the 32C pond as a centralized exploration and production waste facility.

This SAP is issued as a companion document to the following Golder Associates Inc. (Golder) reports:

- *Work Plan for Investigation and Remediation of 596-32C Produced Water Pond*, issued May 31, 2013 (referred to herein as the Work Plan);
- *Report on 32C Soil Remediation Program, Marathon Oil Company 596-32C Pond*, issued August 29, 2013 (referred to herein as the Soil Remediation Report); and
- *Report on 32C Groundwater Monitoring Program, Marathon Oil Company 596-32C Pond*, issued October 31, 2013 (referred to herein as the Groundwater Report).

Several of the conclusions from these reports provide context for the SAP, as described below.

1.0 BACKGROUND INFORMATION

As detailed in the Soil Remediation Report, the 32C contaminant source area has been removed, and there is no longer a source of ongoing groundwater contamination at the site. Based on the investigative findings detailed in the Groundwater Report, it is also noted that: 1) contaminated surface water has not been detected at Little Creek or in a spring located adjacent to Little Creek; 2) potential human receptors are not present within 3 miles of the site; and 3) there is minimal potential for human exposure to groundwater contamination from the 32C pond.

To provide a concise SAP, the reader is referred to the above-listed reports for other pertinent background information and for figures showing groundwater and surface water sampling locations near the site. In addition, Golder technical procedures applicable to the SAP are provided in the Work Plan.

Golder Associates Inc.
44 Union Boulevard, Suite 300
Lakewood, CO 80228 USA
Tel: (303) 980-0540 Fax: (303) 985-2080 www.golder.com

2.0 GROUNDWATER SAMPLING

Groundwater monitoring of site wells MW-1 through MW-4 was performed from July 9 through August 16, 2013, as described in the Groundwater Report. Monitoring of these wells for water quality and water elevations will continue during the fourth quarter of 2013 and will extend through 2014 based on the following.

- Water quality monitoring will be performed on a quarterly basis and water level monitoring will be performed on at least a bimonthly basis. Groundwater levels will be measured using an electronic water level meter.
- Consistent with COGCC Table 910-1 requirements, water quality analyses will include BTEX (benzene, toluene, ethylbenzene, and total xylenes), total dissolved solids (TDS), chloride, and sulfate.
- In support of monitored natural attenuation evaluations: 1) supplemental laboratory analyses will include diesel range total petroleum hydrocarbons (TPH-DRO), gasoline range total petroleum hydrocarbons (TPH-GRO), sulfide, nitrate, alkalinity, total manganese, and total iron; and 2) field analyses will include dissolved oxygen (DO), oxidation-reduction potential (ORP), pH, and other standard field parameters such as temperature and conductivity.
- When feasible, dedicated or disposable sampling equipment will be used to collect samples. To avoid cross contamination, non-dedicated sampling equipment will be thoroughly cleaned prior to initiation of sampling activities, and as otherwise necessary based on Golder Technical Guidance TG-1.2-20 (Collection of Groundwater Quality Samples).
- Samples to be submitted for laboratory testing will be placed in laboratory-supplied containers and stored in a cooler containing ice. Sample chain of custody procedures will be based on TG-1.2-20.
- To allow quality control comparisons for each sampling event, one duplicate groundwater sample will be analyzed from one well for all parameters listed above and one trip blank will be analyzed for BTEX in connection with each sampling event.
- Analytical testing will be performed by Accutest Mountain States, which maintains Colorado and national accreditation programs. EPA SW 846 analytical testing methods will be used in accordance with COGCC requirements.

3.0 SURFACE WATER SAMPLING

Surface water sampling of Little Creek was performed nine times between April 2013 and August 2013. As discussed with the COGCC on August 1, 2013, an additional surface water sampling event will be targeted for the spring 2014 runoff period. It is expected that this supplemental surface water sampling event will be conducted between March and May of 2014. Surface water samples will be collected upstream of 32C, downstream of 32C, and from the spring located approximately 4,000 feet north from the 32C pond.

This surface water sampling program will be performed based on Golder Technical Procedure TP 1.2-26 (Surface Water Sampling Methods). Water quality analyses will be performed by Accutest Mountain

States and will include BTEX, TPH-DRO, TPH-GRO, TDS, chloride, sulfate, total suspended solids, and pH.

4.0 REPORTING

It is anticipated that reporting in connection with these monitoring events will include the following.

- For each of the next four groundwater sampling events, analytical results and groundwater elevation data will be submitted to the COGCC along with a Technical Memorandum. Each Technical Memorandum will briefly summarize the quarterly results, but detailed discussions about groundwater contamination implications will not be included.
- Analytical results for the spring 2014 surface water sampling event will be submitted to the COGCC along with a Technical Memorandum that briefly summarizes these results, but detailed discussions about contamination implications will not be included.
- Following groundwater sampling during the fourth quarter of 2014, a relatively comprehensive report will be submitted to the COGCC that describes: 1) seasonal fluctuations in the groundwater flow regime at the site; 2) groundwater and surface water quality results from the fourth quarter of 2013 through the fourth quarter of 2014; 3) implications concerning groundwater contaminant occurrence and contaminant transport; and 4) recommendations for subsequent water quality monitoring at the site.