



REPORT

Coal Combustion Residuals Landfill Groundwater Monitoring System Certification

Nucla Station Ash Disposal Facility, Nucla, Colorado

Submitted to:

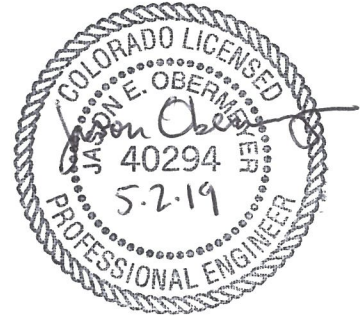
Tri-State Generation and Transmission Association, Inc.

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Submitted by:

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May 2, 2019

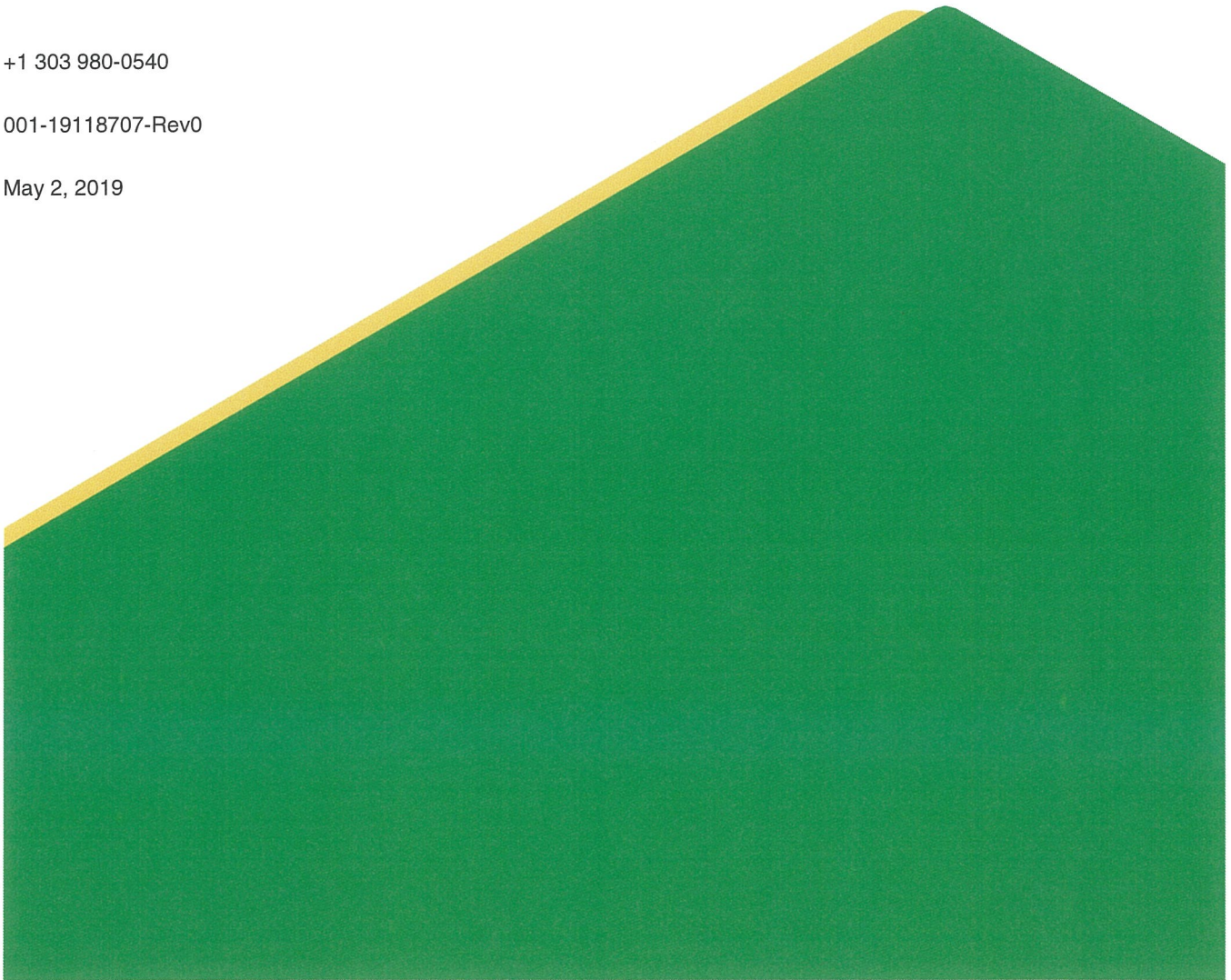


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FIGURES

Figure 1: Monitoring Well Locations

1.0 INTRODUCTION

Golder Associates Inc. (Golder) has prepared this report to certify that the groundwater monitoring system that has been designed and constructed for the Nucla Station Ash Disposal Facility (the Facility), a coal combustion residuals (CCR) landfill that serves the Nucla Generating Station, meets the requirements of 40 CFR 257.91.

This report is an update to the initial CCR landfill groundwater monitoring system certification for the Facility, which was prepared by Golder and dated October 16, 2017. At the time when the initial CCR landfill groundwater monitoring system certification for the Facility was being prepared to meet the required timeframe under 40 CFR Part 257, groundwater levels in some of the monitoring wells that were installed for the groundwater monitoring system at the Facility had not yet stabilized after initial installation in 2016 and were continuing to rise. This was noted in the initial CCR landfill groundwater monitoring system certification for the Facility. Since that time, the groundwater level in one of those monitoring wells, MO-2, has continued to rise such that it was slightly lower than the groundwater level in MO-1, the upgradient monitoring well, in April 2018 and slightly higher than the groundwater level in MO-1 in October 2018 (refer to the 2018 Annual Groundwater Monitoring Report). For this reason, an update to the groundwater monitoring system certification is required to indicate that MO-1 and MO-2 are both upgradient monitoring wells in the groundwater monitoring system for the Facility.

2.0 FACILITY INFORMATION

Tri-State Generation and Transmission Association, Inc. (Tri-State) owns and operates the Nucla Generating Station, a 100-megawatt circulating fluidized bed coal-fired electric generating plant located near the town of Nucla, Colorado. Tri-State disposes of CCRs from the Nucla Generating Station in an existing Tri-State-owned CCR landfill, the Nucla Station Ash Disposal Facility (the Facility), which is located approximately 2.5 miles southeast of the Nucla Generating Station. Within the 81.65-acre property, the CCR disposal footprint comprises approximately 61 acres (see Figure 1).

2.1 Geology and Hydrogeology

Near-surface geology at the Nucla Station Ash Disposal Facility is generally characterized by a thin layer (0 to 15 feet thick) of unconsolidated regolith underlain by 0 to approximately 110 feet of the Dakota Sandstone, approximately 90 to 210 feet of the Burro Canyon Formation, and the Morrison Formation, which is approximately 700 to 800 feet thick regionally. The uppermost aquifer at the site is within the Morrison Formation.

The Morrison aquifer is characterized as highly heterogeneous with zones that are variably transmissive and/or subjected to variable amounts of confining pressure. This characterization is supported by the differences in groundwater levels, water column heights and recovery times observed in the monitoring wells that have been installed to serve as the groundwater monitoring system for the Facility. Sandstone lenses in the Morrison aquifer vary considerably with respect to transmissivity (i.e., thickness and hydraulic conductivity) and horizontal extent due to the alluvial, shoreline, and lacustrine environments that deposited the Salt Wash and Brushy Basin Members of the Morrison Formation, resulting in interbedded siltstone, mudstone, claystone and shale units. Groundwater elevation data suggest a general southerly and westerly groundwater flow direction in the Morrison aquifer in the vicinity of the Nucla Station Ash Disposal Facility. However, the heterogeneity and interbedded nature of the Morrison Formation beneath the Facility, coupled with the observation that groundwater levels in two of the monitoring wells (MO-2 and MO-5) continue to stabilize, confound the ability to precisely discern groundwater flow direction and hydraulic connection.

3.0 GROUNDWATER MONITORING SYSTEM

The groundwater monitoring system for the Facility consists of five monitoring wells, as shown on Figure 1. The monitoring wells are MO-1, MO-2, MO-3, MO-4, and MO-5.

3.1 Information Reviewed

Golder reviewed information from the operating record documenting the design, installation, and development of the monitoring wells and/or describing hydrogeologic conditions at the site to help assess the adequacy of the groundwater monitoring system. The information reviewed included:

GeoTrans, Inc. (2002). Engineering Design and Operations Report, Nucla, Colorado Ash Disposal Facility. Prepared on behalf of Tri-State Generation and Transmission Association, Inc. March 2002.

Golder Associates Inc. (2017). Site Characterization Report, Nucla Station Ash Disposal Facility, Montrose County, Colorado. Report prepared for Tri-State Generation and Transmission Association, Inc. Project 1538934-16B. June 21, 2017.

Golder Associates Inc. (2018). Coal Combustion Residual Landfill, Annual Groundwater Monitoring Report - 2018, Nucla Station Ash Disposal Facility, Nucla, Colorado. Report prepared for Tri-State Generation and Transmission Association, Inc. Project 18104295. January 29, 2019.

Western Colorado Testing, Inc., and J.F.T. Agapito & Associates, Inc. (1987). Final Report – Geological and Geohydrological Evaluation of Dry Storage Site, Nucla CFB Demonstration Project. Report prepared on behalf of Colorado-Ute Electric Association, Inc. July 8, 1987.

3.2 Number, Locations, and Depths of Monitoring Wells

40 CFR 257.91 includes the following requirements for the number, locations, and depths of monitoring wells:

- The groundwater monitoring well system must yield sufficient groundwater samples from the uppermost aquifer to accurately represent background water quality
- The groundwater monitoring system must yield sufficient groundwater samples from the uppermost aquifer to accurately represent the quality of groundwater passing the waste boundary
- The number, spacing, and depths of monitoring wells must be based on characterization of the uppermost aquifer and overlying materials
- The groundwater monitoring system must include at least one upgradient monitoring well and at least three downgradient monitoring wells

On account of the heterogeneity and interbedded nature of the Morrison Formation beneath the Facility, monitoring wells were installed around all four sides of the Facility to help ensure that the groundwater monitoring system would yield sufficient groundwater samples to accurately represent background water quality and the quality of groundwater passing the waste boundary for a wide range of potential groundwater flow directions. The number and spacing of the monitoring wells were selected based on the hydrogeologic conditions at the site and the aerial extent of the active CCR landfill, such that impacts to groundwater quality in the uppermost aquifer can be detected along potential flow pathways if they occur. For the purpose of meeting the requirements of 40 CFR 257.91(c)(1), the monitoring wells having the highest groundwater elevations (MO-1 and MO-2) are considered to be the upgradient monitoring wells and the remaining monitoring wells are considered to be the downgradient

monitoring wells. The depths of the monitoring wells were selected such that the monitoring wells are screened in the Morrison Formation to yield groundwater samples that are representative of water quality in the uppermost aquifer. The number of monitoring wells included in the groundwater monitoring system for the Facility exceeds the minimum number of monitoring wells required under 40 CFR 257(c)(1); correspondingly, the information provided in this report is sufficient to meet the requirements of 40 CFR 257.91.

3.3 Monitoring Well Casing

40 CFR 257.91(e) includes the following requirements for monitoring well construction:

- Monitoring wells must be cased to maintain borehole integrity
- The casing must be screened or perforated and packed with sand or gravel to enable collection of groundwater samples
- The annular space above the sampling depth must be sealed to prevent impacts to groundwater

The monitoring wells at the Facility have polyvinyl chloride (PVC) casings to maintain the integrity of the monitoring well boreholes. The casings are screened within the uppermost aquifer and packed with sand to enable collection of groundwater samples from the uppermost aquifer. The annular space above the screened interval in each monitoring well is sealed with a bentonite seal and a cement-bentonite grout seal.

4.0 CERTIFICATION

Based upon the review described in this report, the undersigned Professional Engineer registered in Colorado certifies that the groundwater monitoring system for the Nucla Station Ash Disposal Facility has been designed and constructed to meet the requirements of 40 CFR 257.91.

Signature Page

Golder Associates Inc.



Sara Harkins
Senior Project Geologist/Geochemist



Jason Obermeyer, PE
Associate and Senior Consultant

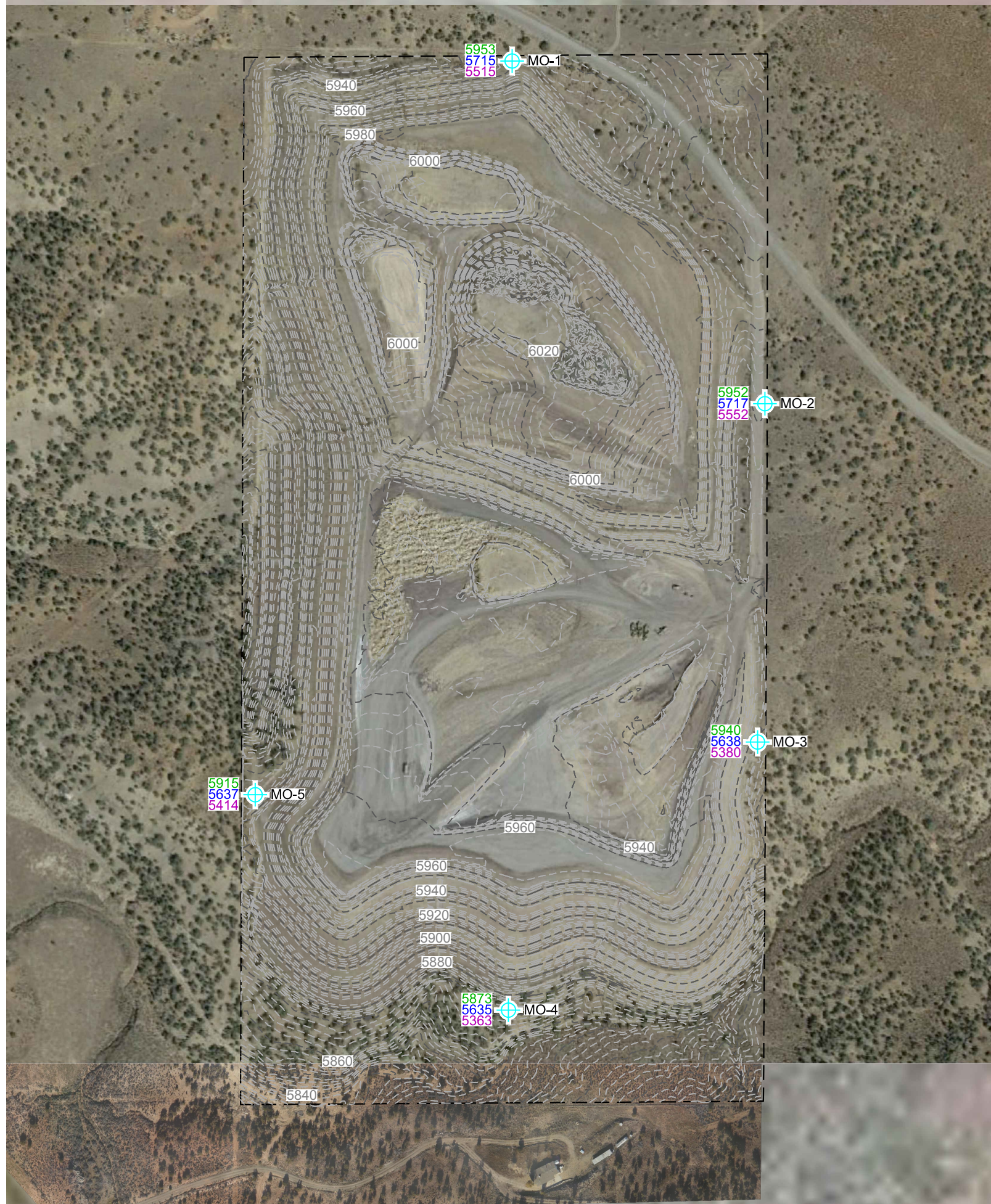
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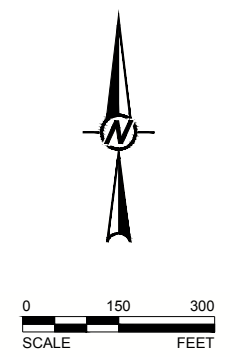
Figure

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LEGEND

	PROPERTY BOUNDARY
	EXISTING GROUND TOPOGRAPHY
	MO-1 MONITORING WELL
5915	GROUND SURFACE ELEVATION
5915	GROUNDWATER ELEVATION (OCTOBER 2018)
5915	BOTTOM OF MONITORING WELL ELEVATION



CLIENT		PROJECT	
TRI-STATE GENERATION AND TRANSMISSION ASSOCIATION		NUCLA STATION ASH DISPOSAL FACILITY	
1100 WEST 116TH AVENUE		COAL COMBUSTION RESIDUALS LANDFILL	
WESTMINSTER, COLORADO 80234		GROUNDWATER MONITORING SYSTEM CERTIFICATION	
CONSULTANT		YYYY-MM-DD	2019-04-25
	GOLDER	DESIGNED	KAC
		PREPARED	KAC
		REVIEWED	SAH
		APPROVED	JEO

TITLE		PROJECT NO.	
MONITORING WELL LOCATIONS		19118707	
		REV.	2
		FIGURE 1	

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