Lorencito Coal Company, LLC

LORENCITO CANYON MINE HYDROLOGY MONITORING PLAN

November 29, 2021

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1 INTRODUCTION

Lorencito Coal Company, LLC (Lorencito) intends to initiate underground coal mining at the Lorencito Canyon Mine (Project) in the Primero Coal Seam. Mining would begin in the P1 and P2 reserves and may extend to the P3 reserves as coal is mined out at P1 and P2 (**Map 1**). To fulfill the requirements of the Regulations of the Colorado Mined Land Reclamation Board, the following information represents the surface and groundwater monitoring program which represents characteristics of water resources in the pre-mine phase of this Project. This Hydrology Monitoring Plan (Plan) has been assembled in compliance with Rule 2.04.7 and the Guidelines for the Collection of Baseline Water Quality and Overburden Geochemistry Data (Colorado Mined Land Reclamation Division [now known as Colorado Division of Reclamation, Mining and Safety; CDRMS] 1982).

Since 1996, analyses have been performed at the Lorencito Canyon Mine Project area to interpret the hydrology of the area. Lorencito will rely on this historic data base as the baseline conditions for the Project area. Field work accomplished during the baseline and surface mining phases of the Project have included the installation and testing of 10 alluvial wells, 16 consolidated aquifer wells, along with the monitoring of springs and seeps, ponds, and windmills in the Project area. From the field data collected, insight has been gained into the recharge and discharge characteristics of aquifers, hydraulic properties, potentiometric and water table surfaces, and water quality for each of the hydrologic units. Based on these previous studies, both conceptual and mathematical hydrologic models have been developed to show the relationships between the various units.

2 PROPOSED MONITORING PROGRAM

Monitoring will only occur in the P1 and P2 reserve areas and monitoring will be implemented in the P3 area as mining progresses in the second permit term. Since the current plan for underground mining will cause limited surface disturbance within the Project area, water resources monitoring will be limited to those areas shown on **Map 1**. **Tables 1, 2, 3**, and **4** presents the monitoring locations, water quality parameters, monitoring frequency and analysis methods for this monitoring program. Locations of all monitoring stations are shown on **Map 1**. Monitoring will begin as soon as the Plan is approved by CDRMS.

Collected data will be summarized and presented to the CDRMS as the Permit Revision Application is submitted for approval anticipated to be completed later this year (2022). All data collected will be presented in future Annual Hydrology Monitoring Reports.

Table 1 Surface and Groundwater Monitoring Stations

Station/Well	Type	Purpose
MW-4 (three wells)	Interburden/Primero/Underburden	Downgradient of P1/P2 Mine Areas
MW-5 (three wells)	Interburden/Primero/Underburden	Upgradient of P1/P2 Mine Areas
MW-6 (three wells)	Interburden/Primero/Underburden	Downgradient of P1/P2 Mine Areas
SPBC-1	Spring/Seep	Bonita Canyon - Downgradient of the P1/P2 Mine Areas
SPBC-2	Spring/Seep	Bonita Canyon - Downgradient of the P1/P2 Mine Areas
SPBC-3	Spring/Seep	Bonita Canyon - Downgradient of the P1/P2 Mine Areas
SPBC-4	Spring/Seep	Bonita Canyon - Downgradient of the P1/P2 Mine Areas
SPBC-5	Spring/Seep	Bonita Canyon - Upgradient of the P1/P2 Mine Areas
SPCC-1	Spring/Seep	Chimney Canyon - Upgradient of the P1/P2 Mine Areas
SPAC-1	Spring/Seep	Alamosa Canyon - Upgradient of the P1/P2 Mine Areas
CC-1	Alluvial/Surface	Chimney Canyon - Upgradient of P1/P2 Mine Areas
BC-1	Alluvial/Surface	Bonita Canyon – Downgradient of P1/P2 Mine Areas
AC-1	Alluvial/Surface	Alamosa Canyon - Upgradient of the P1/P2 Mine Areas
LC-2	Alluvial/Surface	Lorencito Canyon - Upgradient of the P1/P2 Mine Areas
LC-3	Alluvial/Surface	Lorencito Canyon - Upgradient of the P1/P2 Mine Areas
LC-4	Alluvial/Surface	Lorencito Canyon - Downgradient of the P1/P2 Mine Areas
WNBC-1	Windmill	Bonita Canyon – Downgradient of P1/P2 Mine Areas
WNBC-3	Windmill	Bonita Canyon – Upgradient of P1/P2 Mine Areas
WMLPC-1	Windmill	Little Pine Canyon – Upgradient of P1/P2 Mine Areas
WMLPC-2	Windmill	Little Pine Canyon – Upgradient of P1/P2 Mine Areas
WMCC-1	Windmill	Little Pine Canyon – Upgradient of P1/P2 Mine Areas

Table 2 Ground Water Parameters and Monitoring Frequency

A. Water Quality Parameters *	
pH (field)	Nitrate-Nitrite
Conductivity at 25°C (field)	Phosphate (PO_4^{-3} as P)
Temperature (field)	Sodium (Na^+)
Total Dissolved Solids	Sulfate (SO_2^-)
Bicarbonate (HCO_3^-)	Arsenic (As) Cadmium (Cd)
Calcium (Ca^{+2})	Iron (Fe)
Carbonate (CO_3) **	Manganese (Mn)
Chloride ($C1^-$)	Mercury (Hg)
Magnesium (Mg^{+2})	Selenium (Se)
Ammonia (NH_3)	Zinc (Zn)
* Dissolved species concentration only. ** First sampling only.	
B. Monitoring Frequency	
1. Bedrock Aquifers	
a. Measure field water quality parameters monthly (pH, conductivity, and temperature). Record elevation of the water level in the well at time of sampling.	
b. Sample water for complete chemical analysis semi-annually.	
2. Alluvial Aquifers	
a. Measure field water quality parameters monthly (pH, conductivity, and temperature). Record elevation of the water level in the well at time of sampling. Windmills will only be sampled in the fall of the year.	
b. Sample water for complete chemical analysis quarterly. No analyses at windmills.	

Table Source: Guidelines for the Collection of Baseline Water Quality and Overburden Geochemistry Data, CDRMS 1982.

Table 3 Surface Water Parameters and Monitoring Frequency

A. Water Quality Parameters *	
pH (field)	Phosphate (PO_4^{-3} as P)
Conductivity at 25°C (field)	Sodium (Na^+)
Temperature (field)	Sulfate (SO_2^-)
Dissolved Oxygen (field) **	Aluminum (Al)
Total Suspended Solids **	Arsenic (As)
Total Dissolved Solids	Cadmium (Cd)
Oil and Grease **	Copper (cu)
Sodium Adsorption Ratio	Iron (Fe)
Bicarbonate (HCO_3^-)	Lead (Pb)
Calcium (Ca^{+2})	Manganese (Mn)
Chloride ($C1^-$)	Mercury (Hg)
Magnesium (Mg^{+2})	Molybdenum (Mo)
Nitrate-Nitrite	Selenium (Se) Zinc (Zn)
* Total species concentration (dissolved and suspended). ** Not necessary for springs and seeps.	
B. Monitoring Frequency	
1. Streams	
a. Measure field water quality parameters monthly (pH, conductivity, and temperature).	
b. Sample water for complete chemical analysis quarterly, especially during high andlow flow periods. Record flow at time of sampling.	
2. Springs and Seeps	
a. Measure field water quality parameters monthly (pH, conductivity, andtemperature). Record flow at time of sampling.	
b. Sample water for complete chemical analysis quarterly.	

Table Source: Guidelines for the Collection of Baseline Water Quality and Overburden Geochemistry Data, CDRMS 1982.

Table 4 Water Quality Methods of Analysis *

Chemical Parameter	Sampled Units	Medium **	Method of Analysis ***
pH (field)	pH Units	G,S	Field pH meter
Specific Conductance (field)	uhmo/cm @ 25°C	G,S	Wheatstone Bridge (Specific Conductance Meter)
Temperature (field)	°C	S	Field thermometer
Total Dissolved Solids	mg/l	G,S	Filtrate evaporation; calculation
Total Suspended Solids	mg/l	S	Glass fiber filtration 103°-105°
Oil and Grease	mg/l	S	Liquid-liquid extraction with trifluoroethane
Sodium Adsorption Ratio	--	S	Calculation
Dissolved Oxygen (field)	mg/l	S	Membrane electrode
Bicarbonate (HCO_3^-)	mg/l	G,S	Titration; electrometric; manual or automated method -methyl orangeatomic absorption
Calcium (Ca^{+2})	mg/l	G,S	EDTA titration
Carbonate (CO_3^-)	mg/l	G	Titration; electrometric; manual or method -methyl orange
Chloride (Cl^-)	mg/l	G,S	Silver nitrate; mercuric nitrate; automated colorimetric-ferricyanide
Magnesium (Mg^{+2})	mg/l	G,S	Atomic absorption; gravimetric
Ammonia (NH_3)	mg/l	G	Automated colorimetric phenate; distillation
Nitrate-Nitrite	mg/l	G,S	Automated (cadmium reduction); automated (hydrazine reduction)
Phosphate (PO_4^{-3} as P)	mg/l	G,S	Direct single reagent; automated single reagent or stannous chloride
Sodium (Na^+)	mg/l	G,S	Flame photometric; atomic absorption
Sulfate (SO_4^-)	mg/l	G,S	Gravimetric; turbidimetric; automated colorimetric – barium chlorinate
Aluminum (Al)	mg/l	S	Atomic absorption
Arsenic (As)	mg/l	G,S	Atomic absorption
Cadmium (Cd)	mg/l	G,S	Atomic absorption
Copper (Cu)	mg/l	S	Atomic absorption
Iron (Fe)	mg/l	G,S	Atomic absorption
Lead (Pb)	mg/l	S	Atomic absorption
Manganese (Mn)	mg/l	G,S	Atomic absorption
Mercury (Hg)	mg/l	G,S	Flameless atomic absorption
Molybdenum (Mo)	mg/l	S	Atomic absorption
Selenium (Se)	mg/l	G,S	Atomic absorption
Zinc (Zn)	mg/l	G,S	Atomic absorption

Table 4 Water Quality Methods of Analysis *

Chemical Parameter	Sampled Units	Medium **	Method of Analysis ***

Notes:

* Additional methods may be substituted with prior approval from the Division.

** G = groundwater; dissolved species concentration only
S = surface water (includes springs); total species concentration(dissolved and suspended)

*** References which describe these methods:

American Public Health Association; American Water Works Association; and, Water Pollution Control Federation, 1979, Standard methods for the examination of water and wastewater. 14th edition, American Public Health Association, 1015 18th Street, Washington, D.C. 20036, 1193 p.

American Society for Testing and Materials, 1980, Water: Part 31, Annual Book of ASTM Standards, American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania, 19103, 1401 p.

Brown, E.; Skaugstad, M. W.; and Fishman, M. J., 1979, Methods for collection and analysis for water samples for dissolved minerals and gasses: Book 5, Chap. Al, Techniques of Water-Resources Investigations of the United States Geological Survey, U.S.G.S., Publications Sales and Inquiries Office, Federal Office Building, Denver, Colorado.

U.S. Environmental Protection Agency, 1979, Methods for chemical analysis of water and wastes: EPA-600/4-79-020, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268.

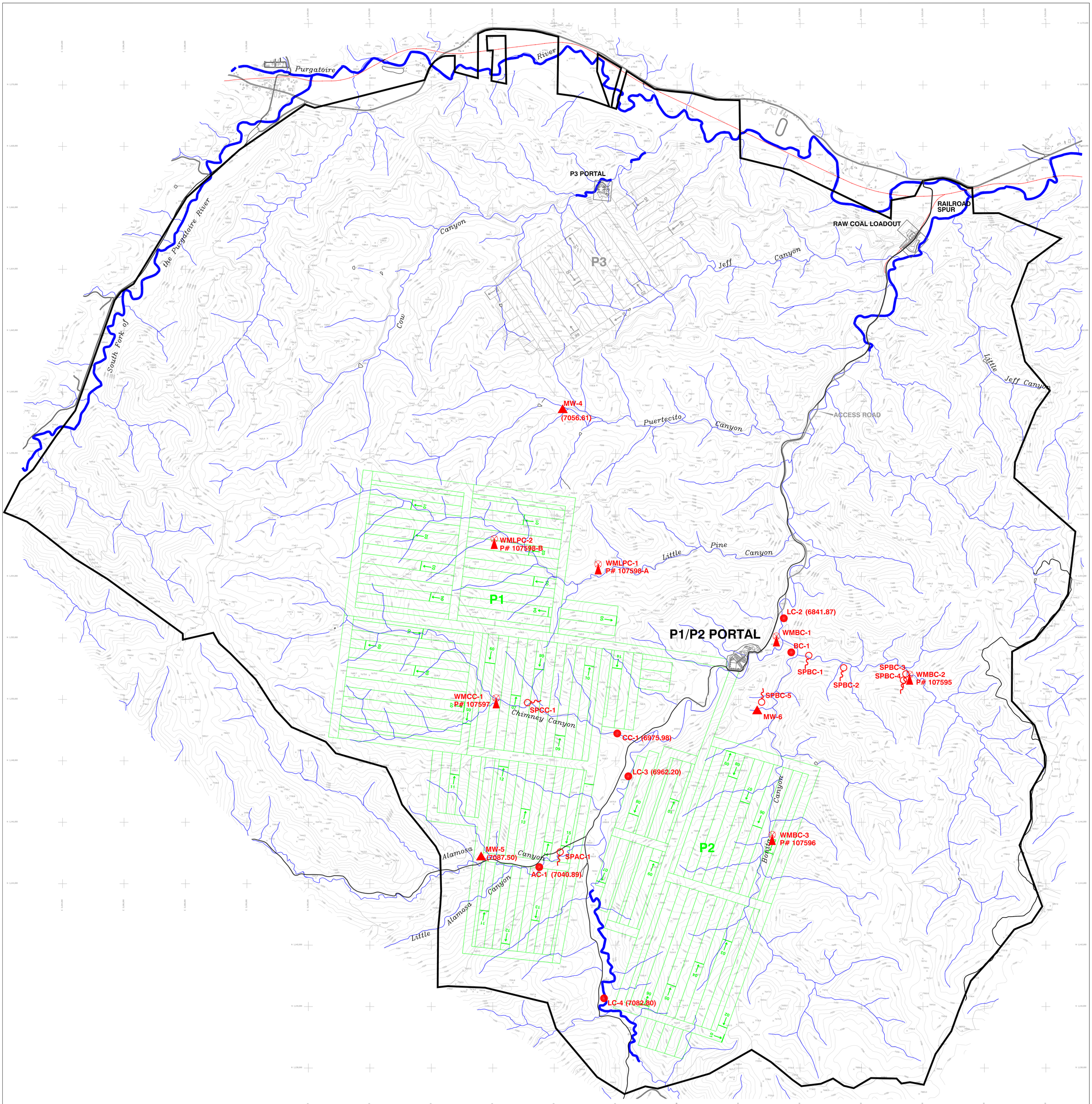
All these references are available for inspection at the Division office: 1313 Sherman Street, Room423, Denver, Colorado 80203.

Table Source: Guidelines for the Collection of Baseline Water Quality and Overburden Geochemistry Data, CDRMS 1982.

3 REFERENCES

Colorado Mined Land Reclamation Division (CDRMS). 1982. Guidelines for the Collection of Baseline Water Quality and Overburden Geochemistry Data. September 16. 18 pages.

Maps



0 1000 2000
Scale (ft)

LEGEND

- ▲ Nest of Bedrock Well Locations
- ● Surface Stations and Alluvial Monitoring Locations
- (7082.80) Alluvial Monitoring Well Elevations
- Windmill
- Springs-Seeps
- Permit Boundary
- Proposed Public Access Road
- Perennial Stream Reach

WMLPC =	Windmill Little Pine Canyon
WMCC =	Windmill Chimney Canyon
SPCC =	Spring-Seeps Chimney Canyon
CC =	Chimney Canyon
LC =	Lorencito Canyon
MW =	Monitoring Well
BC=	Bonita Canyon
SPBC =	Spring-Seeps Bonita Canyon
WMBC =	Windmill Bonita Canyon

#	NAME
P# 107595	ROBERT & BERNARD PARSONS (WMBC-2)
P# 107596	ROBERT & BERNARD PARSONS (WMBC-3)
P# 107597	ROBERT & BERNARD PARSONS (WMCC-1)
P# 107598-A	ROBERT & BERNARD PARSONS (WMPNC-1)
P# 107598-B	ROBERT & BERNARD PARSONS (WMPNC-2)

(NOTE: P#= PERMIT #)

LORENCITO COAL CO., LLC

LORENCITO CANYON MINE
Las Animas County, Colorado

P1/P2 WATER RESOURCES MAP

REV	DESCRIPTION	BY	DATE

FILE: 475WATER_11-26-21

MAP 1

DRAWN BY: ETC | PREPARED BY: JK | DATE: 11/26/21

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