



E-470 Public Highway Authority
22470 E. 6th Parkway, Suite 100
Aurora, CO 80018
303.537.3700 Phone
303.537.3472 Fax

Adams County
Arapahoe County
Aurora, CO
Brighton, CO
Commerce City, CO
Douglas County
Parker, CO
Thornton, CO

June 30, 2021

Department of Natural Resources
Attn: Patrick Lennberg
Colorado Division of Reclamation, Mining & Safety
1313 Sherman Street Room 215
Denver, CO 80203-2243

Re: Sandy Acres Pit, DRMS Permit No. M-1980-110
Hydrologic Balance response

Dear Mr. Lennberg:

This is a follow up to our June 25, 2020 letter regarding water observed at the former Sandy Acres Pit.

Since our last letter we have continued our investigations and it appears that ground water contributes to the water ponding at Sandy Acres Pit. The attached memorandum from BBA Water Consultants summarizes the explorative work and analysis completed to date and mitigation options.

We propose a phased approach to mitigate the ponded water with the next phase being the installation of a sump at the north end of the pond. We will be working with our consultants to develop plans and details for this phase. Once we have those plans completed we will submit them to you for review. We anticipate being able to submit the plans to you on or before December 31, 2021.

If you have any other questions, need more information, or if you would like to meet, please email me at dslack@e-470.com or call me at (303) 537-3710.

Sincerely

A handwritten signature in black ink that reads "Derek Slack".

Derek Slack, P.E.
Roadway Maintenance Manager

MEMORANDUM



To: Derek Slack, P.E. and Neil Thomson, P.E.
E-470 Public Highway Authority (E-470)
From: Austin Malotte, P.E.
Subject: Sandy Acres Ponding – June 2021 Status
Job: 9607.00
Date: June 29, 2021

This memorandum summarizes actions taken by E-470 to-date, information collected, interim conclusions and recommended next steps regarding mitigation of water ponding issues at E-470's Sandy Acres Pit.

Overview and Background Information

The Sandy Acres Pit is a backfilled, inactive, unlined gravel pit located on E-470's property in the Southeast $\frac{1}{4}$ of Section 26, Township 1 South, Range 67 West of the 6th P.M. near Henderson, Colorado. The former pit was permitted under Colorado Division of Reclamation, Mining and Safety (DRMS) as "Henderson Development" in Permit No. M-1980-110. DRMS approved Amendment No. 6, AM-06 on September 3, 2014 and Technical Revision No. 3 on May 12, 2015, permitting E-470 to backfill the Sandy Acres Pit with washed fines from a neighboring gravel pit. The backfilling work was completed by July 1, 2016 in accordance with the conditions of the permit amendment and technical revision.

Since 2014, E-470 has replaced stream depletions associated with historical evaporation of ground water exposed by the former gravel pit pursuant to a series of Substitute Water Supply Plans (SWSPs).¹ Stream depletions associated with Sandy Acres Pit are currently replaced pursuant to an October 25, 2019 letter from the Colorado Division of Water Resources approving SWSP operations through September 30, 2024.

During a 2019 site inspection, DRMS staff noted standing water at the base of the (backfilled) pit at the southern end of the site. Representatives from E-470 and BBA Water Consultants, Inc. (BBA) visited the site and confirmed the presence of ponded water on top of the backfill material at Sandy Acres. E-470, with support from BBA, then proceeded to evaluate available information to attempt to identify the source or sources of the water collecting in Sandy Acres Pit, including review of aerial imagery, topographic and geologic mapping, and configuration of local storm water and drainage systems; field investigations to identify point inflows or evidence of surface water inflows; review of precipitation data and diversion data for an upgradient irrigation ditch; communication with the owner of a raw water transmission line that traverses the Sandy Acres property; review of water level data from nearby water wells; and identification of nearby ground water obstructions like slurry walls and lined reservoirs.

Although these initial activities provided useful information, in early 2020 BBA recommended that E-470 initiate a monitoring well program to gain better understanding of the local ground

¹ SWSP ID 3102 pursuant to §37-90-137(11) C.R.S.

water system including where, when and whether ground water may be expressed at the surface at Sandy Acres Pit. In March 2020, E-470 installed six monitoring wells (monitoring holes) within and around the Sandy Acres property. The locations for the monitoring holes were selected with assistance from BBA and were constructed by Kumar & Associates, Inc. and their subcontractors. Data collected from these monitoring wells are presented later in this memo.

Additional Activities Since June 2020

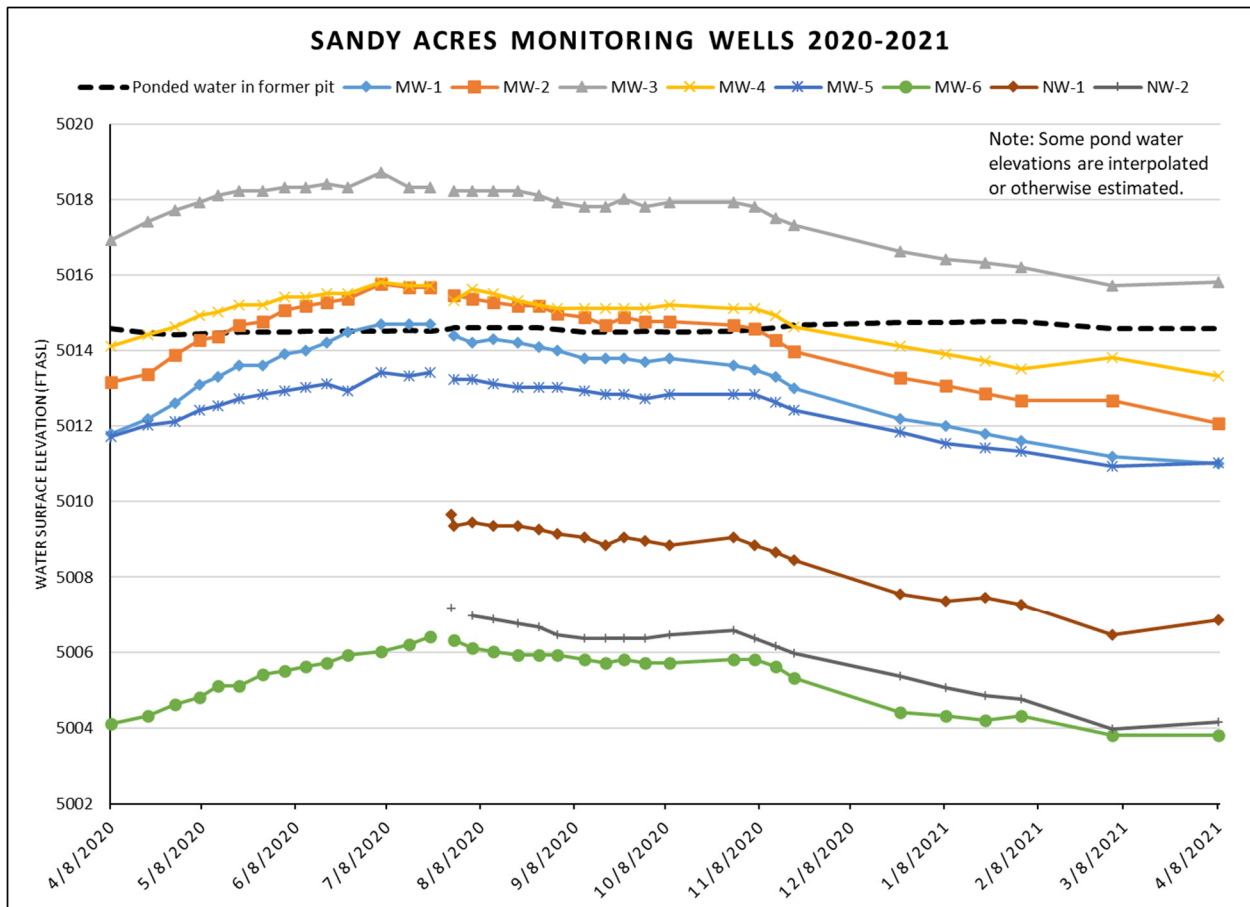
Based on review of the initial data from the six monitoring wells constructed in March 2020, BBA recommended construction of two additional monitoring wells near the north end of the Sandy Acres Pit. These two additional wells were intended to provide additional water level data and to obtain more detailed geophysical logs in that vicinity for potential future mitigation efforts. E-470 and its contractor Kumar & Associates, Inc. constructed the two additional monitoring wells during July 2020. The following table provides basic information regarding the six original monitoring wells (MW-1 through MW-6) and the two new monitoring wells constructed near the north end of the pit in July 2020 (NW-1 and NW-2).

Well Name	Permit No.	Date Constructed	Total Depth (ft)	Top Elevation
MW-1	MH-60550	3/12/2020	43.0	5024.9
MW-2	MH-60550	3/12/2020	49.0	5033.78
MW-3	MH-60550	3/11/2020	44.75	5038.32
MW-4	MH-60550	3/12/2020	49.0	5033.32
MW-5	MH-60550	3/12/2020	45.0	5029.13
MW-6	MH-60554	3/11/2020	35.0	5014.51
NW-1	MH-61010	7/27/2020	40.5	5022.655
NW-2	MH-61010	7/27/2020	40.5	5025.162

The locations of these eight monitoring wells are shown on Figure 1, attached. E-470 regularly collected water level readings from each of the eight monitoring wells after their construction, and from the surface of the ponded water in the pit. Data and initial conclusions from the first year of the Sandy Acres Monitoring Well Program are presented in the following sections.

Sandy Acres Monitoring Well Program

Water levels were collected regularly at each of the monitoring wells and at the ponded surface in the backfilled pit since April 2020. Water level elevations for April 8, 2020 through April 8, 2021 are illustrated graphically below.



The water level data illustrated in the above chart reflect a local ground water gradient from the southeast (Well MW-3) toward the northwest (Wells MW-6, NW-1 and NW-2) across the Sandy Acres property. However, the relatively consistent surface water level in the former Sandy Acres Pit compared with nearby ground water levels that are variable and at times lower than the surface water elevation indicates the ponded water is likely fed in part by ground water but is not necessarily an expression of ground water across the pit. That is, the water in the pit is not in connection with the ground water table throughout the pit; rather, it appears ground water discharges into the pit near its southern end then becomes perched on top of the low-permeability fill material used to backfill the Sandy Acres Pit in 2016.

Although the monitoring well data appear to confirm at least a portion of the ponded water in the former Sandy Acres Pit is the result of ground water discharge to the pit from the south and east, the proportional contributions of such ground water inflows versus surface water inflows remains unclear. Regardless, the presence of ground water inflows to the pit will inform the development of alternatives for mitigation of ponding at Sandy Acres.

Mitigation of Ponding at Sandy Acres

In consultation with BBA, E-470 has developed several conceptual alternatives for mitigation of ponding within the former Sandy Acres Pit. With a full year of data from the monitoring wells, these conceptual alternatives can now be vetted and evaluated as to their ability to address ponding in the pit. The conceptual alternatives under consideration include:

- Perimeter trench drain to intercept ground water that would otherwise discharge to the pit.
- Dewatering well or wells to intercept ground water that would otherwise discharge to the pit.
- Surface or semi-surface channel and drain to collect and convey water in the pit to a ground water sump or other outlet.
- Placement of additional backfill material within pit (unclear if this would resolve the ponding issue or simply displace it to another location).
- No changes to eliminate ponding in pit. Permanent augmentation of evaporative depletions would likely be needed.

The above conceptual alternatives are provided as examples. Some of these may be eliminated from consideration, and other alternatives may be developed in the future.

BBA recommends that E-470 approach this mitigation effort in phases. The first phase, now largely completed, involved identification of the problem and determination as to the likelihood that ground water contributes to the ponding in the former Sandy Acres Pit. In the second phase, BBA will work with E-470 to evaluate conceptual alternatives for mitigation of the ponding, select a preferred alternative, and develop a plan to implement that alternative at Sandy Acres.

Some of the alternatives would likewise be implemented in a phased approach. For example, E-470 may construct a sump at the north end of the former pit to infiltrate ponded water at a location where ground water levels tend to be lower than the existing ground surface (and ponded water surface) in the pit. It would be reasonable to test the functionality and capacity of such a sump prior to construction of a perimeter trench drain, drain channel or other structure that would ultimately rely upon the sump to dispose of intercepted flows.



Figure 1
E-470
Sandy Acres Pit
Monitoring Well Locations

Date: 6/29/2021 | Job No. 9607.00

Legend

- Monitoring Holes (Name, Permit No.)
- Sandy Acres Pit Former High Water Line

Aerial Photo Date: 8/3/2019 NAIP-USA
Data Source: CDSS, CDOT, USGS, BLM

Overview Map

