COLORADO DIVISION OF RECLAMATION, MINING AND SAFETY
1313 Sherman Street, Room 215, Denver, Colorado 80203 ph(303) 866-3567

REQUEST FOR TECHNICAL REVISION (TR) COVER SHEET

File No.: M- 1980-110 Site Name: Henderson Development

County Adams TR# *(DRMS Use only)*

Permittee: E-470 Public Highway Authority

Operator (If Other than Permittee):

Permittee Representative: Derek Slack

Please provide a brief description of the proposed revision:

This technical revision consists of addressing 5 items requested by the Division (as-builts, pit survey data, monitoring data/plan, ground water report from BBA, and potential mitigation measures. These items are presented in the attachments.

As defined by the Minerals Rules, a Technical Revision (TR) is: "a change in the permit or application which does not have more than a minor effect upon the approved or proposed Reclamation or Environmental Protection Plan." The Division is charged with determining if the revision as submitted meets this definition. If the Division determines that the proposed revision is beyond the scope of a TR, the Division may require the submittal of a permit amendment to make the required or desired changes to the permit.

The request for a TR is not considered "filed for review" until the appropriate fee is received by the Division (as listed below by permit type). Please submit the appropriate fee with your request to expedite the review process. After the TR is submitted with the appropriate fee, the Division will determine if it is approvable within 30 days. If the Division requires additional information to approve a TR, you will be notified of specific deficiencies that will need to be addressed. If at the end of the 30 day review period there are still outstanding deficiencies, the Division must deny the TR unless the permittee requests additional time, in writing, to provide the required information.

There is no pre-defined format for the submittal of a TR; however, it is up to the permittee to provide sufficient information to the Division to approve the TR request, including updated mining and reclamation plan maps that accurately depict the changes proposed in the requested TR.

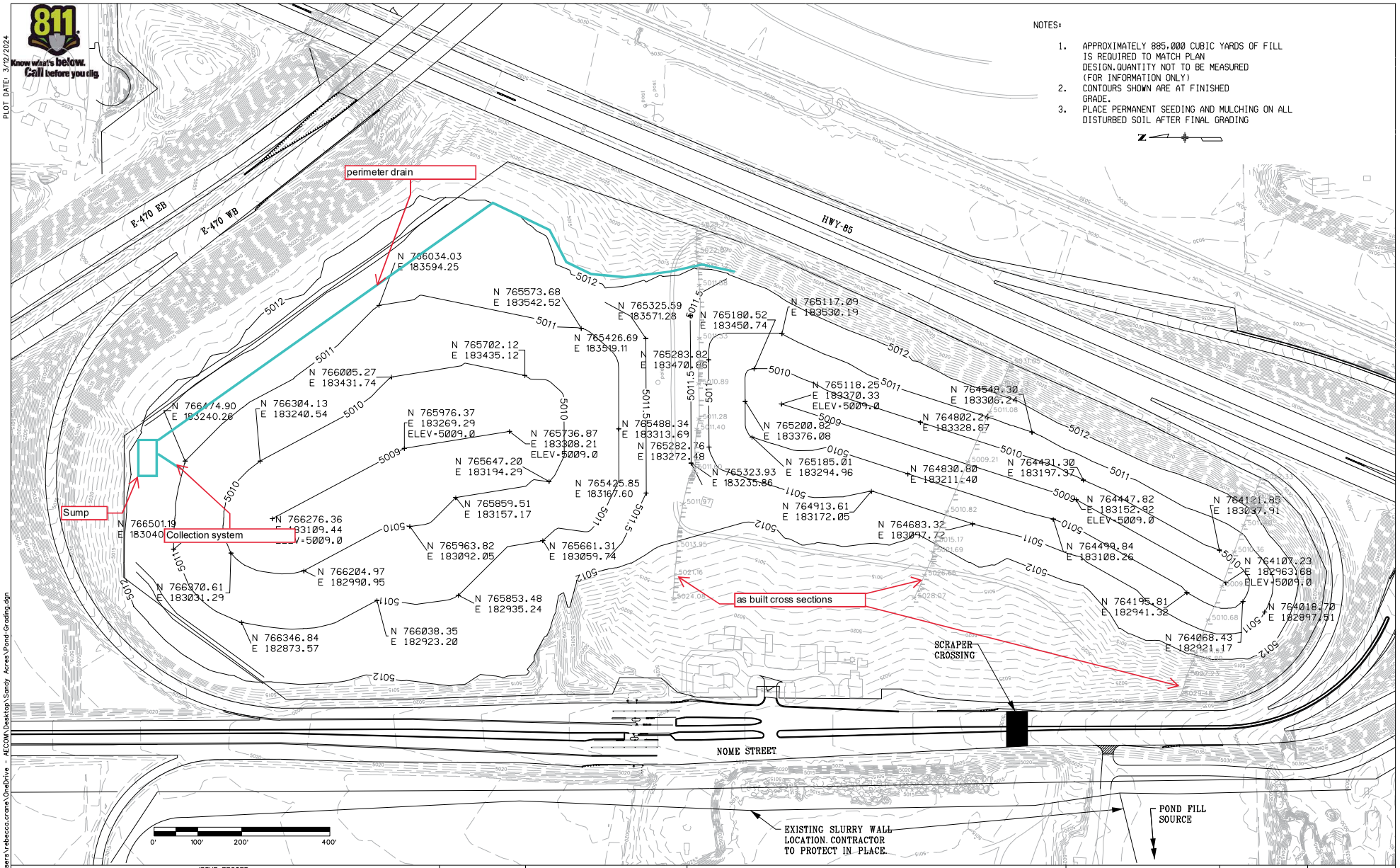
Required Fees for Technical Revision by Permit Type - Please mark the correct fee and submit it with your request for a Technical Revision.

Permit Type	**Required TR Fee**	**Submitted** (mark only one)
110c, 111, 112 construction materials, and 112 quarries	$216	☑
112 hard rock (not DMO)	$175	☐
110d, 112d(1, 2 or 3)	$1006	☐

Technical Revision
M-1980-110
Henderson Development (Sandy Acres)
March 2024

This Technical revision addresses 5 items requested by the Division.

1. As-built drawings for the perimeter passive drain system.
    a. Please see attached drawings and aerial showing the location of the drain as well as the details on the drain.
2. Survey data/elevations for the pit backfill.
    a. Please see two drawings in the pdf. One shows cross section elevations taken which are overlaid onto the design plan sheet. The second sheet is for reference which shows that the water elevation was at 5006.8 prior to backfilling the pond.
3. Groundwater monitoring plan with a map of the existing monitoring wells.
    a. Please see the attached report from BBA Water Consultants, Inc. which includes a map of the monitoring wells, historic data from the wells as well as sampling and frequency going forward. A quarterly reporting frequency of the well sampling is proposed.
4. Groundwater investigation report from BBA Water Consultants, Inc.
    a. Please see attached report.
5. Potential mitigation measures
    a. Potential mitigation measures are listed in the report from BBA Water Consultants, Inc. These include ongoing efforts on the Sandy Acres site as well as working with the owners of Brannan Pit #29 to determine opportunities for a collaborative effort to address high ground water in the area. An initial meeting with Brannan was held March 28, 2024.



NOTES:

1. APPROXIMATELY 885,000 CUBIC YARDS OF FILL IS REQUIRED TO MATCH PLAN DESIGN. QUANTITY NOT TO BE MEASURED (FOR INFORMATION ONLY)
2. CONTOURS SHOWN ARE AT FINISHED GRADE.
3. PLACE PERMANENT SEEDING AND MULCHING ON ALL DISTURBED SOIL AFTER FINAL GRADING

ISSUE RECORD

NO.	BY	PURPOSE	DATE	NO.	BY	PURPOSE	DATE	NO.	BY	PURPOSE	DATE
1	RAC	REVISED CONTOURS	6/22/15								

SANDY ACRES

POND GRADING

ISSUED DATE: MARCH 2015

ISSUED FOR BID

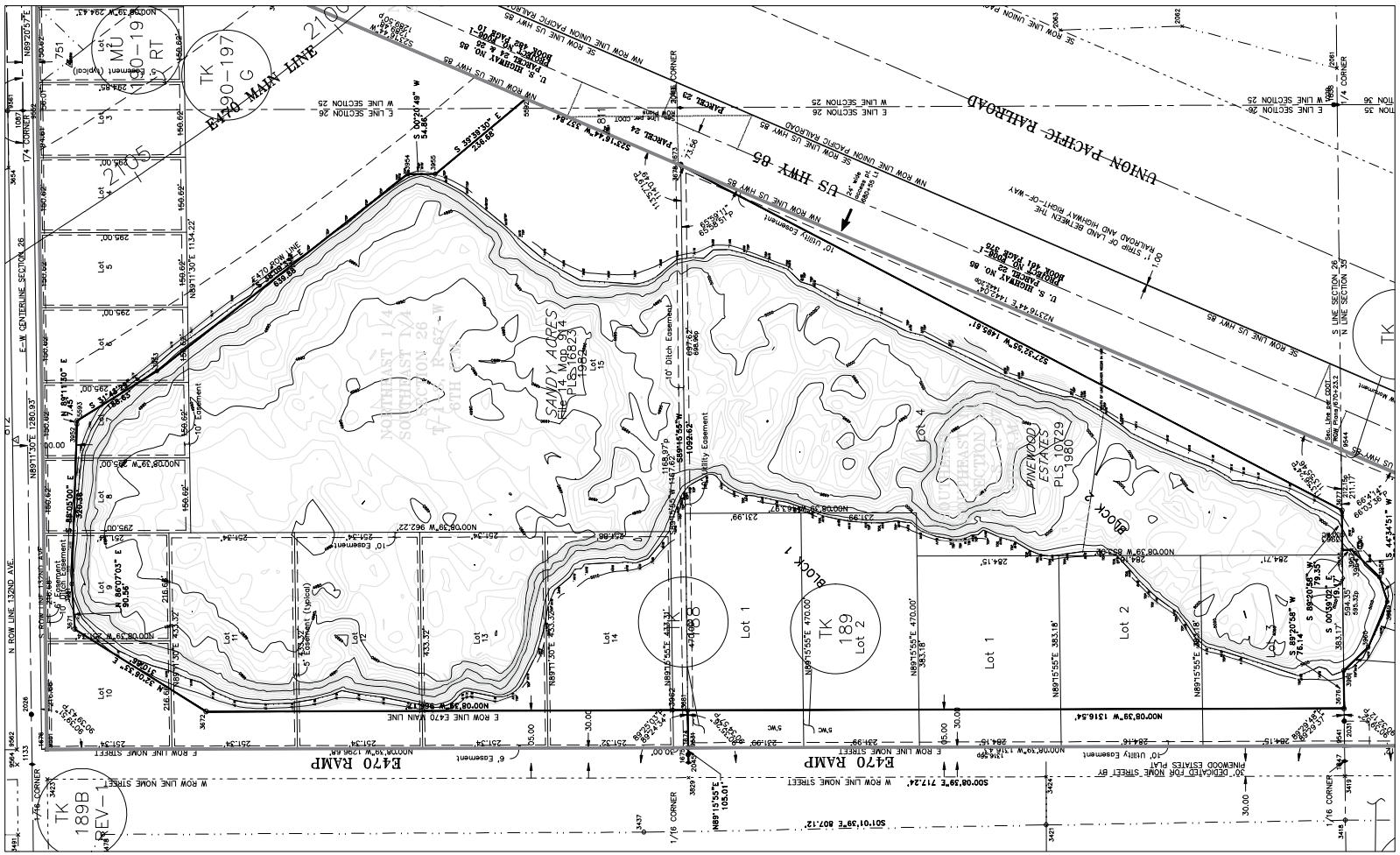
ORIGINAL E-470 CONTRACT NO. 15C401

SHEET NUMBER 5

PLOT DATE: 3/12/2024

FILE NAME: C:\Users\rebecca.crane\OneDrive - AECOM\Desktop\Sandy Acres\Pond-Grading.dgn

TOPOGRAPHIC SURVEY



SECTION: 26
TOWNSHIP: 1 SOUTH
RANGE: 67 WEST

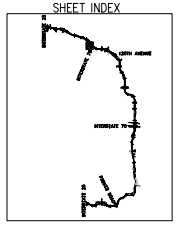
ADAMS COUNTY

SCALE: 1" = 400 FT

SEQ	PARCEL ID	NAME
186	1571260030O5	HENDERSON DEVELOPMENT CO
187	1571260030O6	HENDERSON DEVELOPMENT CO
187A	1571260030O3	HENDERSON DEVELOPMENT CO
187B	1571260030O4	HENDERSON DEVELOPMENT CO
188	1571260030O1	JOYCE K. PLOMMAN
189	1571260030O2	DALE AND CAROL GUMMERSALL
189A	1571260002S	MARIA B. ALLEN & BONNIE M. DURLAND
189B	1571260050O1	BRANNON SAND AND GRAVEL CO, LLC
190	1571260060I3	COLORADO SAND AND GRAVEL CO.
191	1571260060I2	COLORADO SAND AND GRAVEL CO.
192	1571260060I0	COLORADO SAND AND GRAVEL CO.
193	1571260060I1	COLORADO SAND AND GRAVEL CO.
194	1571260060I1	COLORADO SAND AND GRAVEL CO.
195	1571260060I8	COLORADO SAND AND GRAVEL CO.
197A	1571260060O1	COLORADO SAND AND GRAVEL CO.
197B	1571260060I2	COLORADO SAND AND GRAVEL CO.
197C	1571260060O3	COLORADO SAND AND GRAVEL CO.
197D	1571260060O4	COLORADO SAND AND GRAVEL CO.
197E	1571260060O5	COLORADO SAND AND GRAVEL CO.
197F	1571260060O6	COLORADO SAND AND GRAVEL CO.
197G	1571260060O7	COLORADO SAND AND GRAVEL CO.
199	1571260040O1	MOBILE PREMIX CONCRETE, INC.
200	1571260000O4	RICK LYNN WAGNER, et al
201	1571260000O6	JACK WORTHING AND SUSAN A. FLOW
202	1571260020I2	ALBERT R. FREI
203	1571260020O9	HENDERSON AGGREGATES LTD

LEGEND
- PARCEL ID (ORIGINAL PARCEL)
- PARCEL ID (MODIFIED PARCEL)
- E470 PHA
- E470 PHA PERMANENT TRANSFERRED
- E470 PHA TEMPORARY
- FEE TAKE
- RIGHT-OF-WAY
- PERMANENT EASEMENT
- MULTI-USE EASEMENT
- UTILITY EASEMENT
- SLOPE EASEMENT
- DRAINAGE EASEMENT
- DITCH COMMON USE AREA
- COMMON USE AREA
- MISCELLANEOUS EASEMENT
- SECTION LINE
- PROPERTY LINE
- FENCE LINE
- FIBER OPTIC TELL BOOTH LINE
- FIBER OPTIC OTHER UTILITIES
- E470 R.O.W. MONUMENT
- E470 PRIMARY CONTROL MONUMENT
- CONSTRUCTION CONTROL MONUMENT
- BENCHMARK MONUMENT
- E470 MILE POST
- EDGE OF WATER
- AHW APPARENT HIGH WATER

SHEET INDEX



SURVEYOR'S CERTIFICATE

I, Albert V. Valletta, Jr., a Registered Professional Land Surveyor in the State of Colorado, do hereby certify only to E-470 PHA, that on the 13th and 14th of June, 2102, a topographic survey was conducted under my supervision using the normal standard of care of Professional Land Surveyors practicing in Adams County, Colorado and the map hereon accurately represents said survey, to the best of my knowledge. The purpose of this survey was to map the shoreline and bottom of Sandy Acres pond.

This drawing does not represent a Land survey, Land Survey Plat, Improvement Land Survey Plat or Improvement Location Certificate and any monuments or boundary lines shown are for information only and are not to be relied on.

WSSI Job No: 09003:6190p03
Prepared For and on Behalf of
WESTERN STATES SURVEYING, INC.
12753 South Parker Road, Suite 205
Parker Colorado 80134
(303) 841-7436
By: Albert V. Valletta, Jr., P.L.S. 23524

NOTICE: According to Colorado law you must commence any legal action based upon any defect in this survey within three years after you first discover such defect. In no event, may any action based upon any defect in this survey be commenced more than ten years from the date of the certification shown hereon.

CERTIFICATION DEFINED
Pursuant to Rule 6.2-Land Surveyors Certification of the State Board of Registration for Professional Engineers and Land Surveyors, a certification is defined as a signed and sealed statement representing that the surveying services thereon have been performed by or under the responsible charge of the Professional Land Surveyor, in accordance with applicable standards of practice and is not a guaranty or warranty, either expressed or implied.

SURVEYOR'S NOTES:

DATUM & BENCH MARK
This survey is referenced to the E-470 Segment 4 Vertical Datum and originates from the following Bench marks:

POINT	NORTH	EAST	ELEV	DESCRIPTION
811	765523.307	183898.360	5027.54	3 1/2" ALUM. CAP ON 3/4" X 36" ALUM. ROD
Sta. 2097+31.65	OFFSET -505.30		Latitude 39°55'58.25959"N	Longitude 104°50'48.55011"W Height 1515.531m

CONTROL POINTS AND DATUM
This survey is referenced to the E-470 Segment 4 Horizontal Datum and originates from the following Control Monuments:

POINT	NORTH	EAST	ELEV	DESCRIPTION
751	766601.574	184032.091	5026.24	3 1/4" ALUM. CAP ON 3/4" X 72" ALUM. ROD
Sta. 2104+88.56	OFFSET 263.28		Latitude 39°56'08.90296"N	Longitude 104°50'46.73431"W Height 1515.124m
752	761228.281	199457.468	5085.46	3 1/4" ALUM. CAP ON 3/4" X 72" ALUM. ROD
Sta. 1935+18.54	OFFSET 155.09		Latitude 39°55'14.67416"N	Longitude 104°47'29.30396"W Height 1533.071m
810	766104.542	184623.799	5033.25	3 1/2" ALUM. CAP ON 3/4" X 72" ALUM. ROD
Sta. 2096+80.95	OFFSET 422.87		Latitude 39°56'03.95033"N	Longitude 104°50'39.18640"W Height 1517.263m

UTILITIES
1. The utilities were not a part of this survey..

2. No record search was made to determine utility ownership or easements, recorded or unrecorded.

SITE CONDITIONS AT THE TIME OF THE SURVEY: Pond.

SURVEYOR'S NOTES REGARDING POND BOTTOM ELEVATIONS DEPTH FINDER AND TAPE METHODS:
Western States Surveying, Inc. used the following equipment to field survey the pond:
Boat, depth finder, tape, Trimble GPS RTK data collector, base and rover.

GPS RTK topo shots were taken at the limits of the pond at Edge of Water (EOW), Apparent High Water (AHW) and at Top of Bank (TOP). The bottom of the pond was surveyed on the water with the depth finder depths recorded in the data collector. Western States Surveying, Inc. also measured the depths to the bottom of the pond using a weighted tape as a comparison to the depth finder readings. The tape method showed a systematic difference between the depth finder readings and the tape reading of 1.2 feet +/- 0.3 feet on average. Tape readings were taken with the boat stopped and vertical to the bottom at various locations across the pond. The difference of 1.2 feet was subtracted from the depth finder elevations and applied to the computation of the pond bottom elevations.

The field crew was consulted on their observations regarding the difference in the readings and tape measurements. It was noted that the depth finder sends out a signal at an angle from the finder and records an average reading. There was heavy vegetation observed at the south end in the shallower depths (noted on the survey) and vegetation was observed in other areas of the pond.

The water elevation on the date of this survey was 5006.8 feet +/-.

E-470 REFERENCE SHEET:
AER-058-PLAN

Western States Surveying, Inc.
12753 SOUTH PARKER ROAD, SUITE 205
PARKER, CO 80134-3486 (303) 841-7436

TOPOGRAPHIC SURVEY
E470 PHA
SANDY ACRES

REVISIONS	BY	DATE

Scale: 1" = 100'
Field Book: TSC2
Surveyed: SE, JH
Calculated: AW
Drawn: AW
Checked: AW

DATE: 06/20/12
JOB NUMBER: 09903:6190p03

SHEET 1 of 1

C:\Users\Valletavj\OneDrive - Short Elliott Hendrickson Inc\Desktop\E-470 As-Built\Sandy Acres\Sandy Acres using Tape.dwg 2/15/24 3:20pm


April 2023 Aerial
sump location
scar from drain installation
collection system
trenches installed to facilitate draining
Google Earth
Image © 2024 Airbus
400 ft

Sandy Acres Collection System

MEMORANDUM

BBA Water Consultants, Inc.

To: Derek Slack

From: Tim Crawford and Austin Malotte

Subject: E-470 – Sandy Acres Pit – Gravel Pit History, Shallow Alluvial Ground Water and Standing Water Condition Summary

Job: 9607.00

Date: March 28, 2024

This memorandum presents a summary of the history of the E-470 Sandy Acres Pit, shallow ground water conditions surrounding the pit and nearby activities that may influence ground water elevations around the Sandy Acres Pit. This summary specifically addresses conditions and activities that may contribute to pit inflows and standing water conditions in the pit.

Sandy Acres Pit Background

The Sandy Acres Pit, located as presented in Figure 1, was originally approved in September of 1980 and constructed as the Henderson Pit under DRMS Permit No. M-1980-110 by the Henderson Development Company. The pit was constructed to mine sand and gravel material from the South Platte River alluvium. In December of 1985, the permit for the pit was transferred to Colorado Sand and Gravel Co. and expanded by combining an additional permit (M-1981-159) to allow for mining within a 75.75-acre parcel and the creation of the 40.75-acre Sandy Acres Pit. The combined mining operation included both dry and wet pit operations with dry mining to the identified water table of approximately 30 feet and wet mining extending to bedrock at approximately 45 feet in depth.

In 1987, the mining permit was amended to allow the southern portion of the gravel pit (the Pinewood Estates or Henderson Development portion of the pit) to be partially backfilled and partially left as a lake. Under the same amended permit, the northern portion of the gravel pit (the Sandy Acres portion of the pit) would be backfilled. The proposed reclamation for the pit areas considered a residential development with a lake for aesthetic purposes or simply the backfilling of both lakes.

By 1989, the marketable materials from the southern portion of the pit had been mined and processed and the operator installed a berm between the northern and southern pit areas to create a southern lake and facilitate the mining of the northern portions of the site.

Mining of the Sandy Acres Pit was completed in early 2000 and, at the time, standing water (ponding) was present in the bottom of the Sandy Acres Pit.

In November of 2000, the gravel pit permit for the Sandy Acres Pit was transferred to E-470 Public Highway Authority and construction of E-470 began. Approximately 20 percent of the total Sandy Acres Pit lake area was backfilled to accommodate E-470 and its entrance and exit ramps that encircle three sides of the pit.

In 2007, the DRMS required E-470 to address the exposure of ground water in the Sandy Acres Pit. E-470 began to pursue a well permit application and augmentation plan for the exposed ground water and contracted with BBA Water Consultants, Inc. to assist them with the

preparation of an augmentation plan. As an initial step, BBA assisted E-470 with developing a substitute water supply plan (SWSP) for the pit for temporary replacement of stream depletions associated with the pit and the preliminary preparation of an application for an augmentation plan to address long-term depletions.

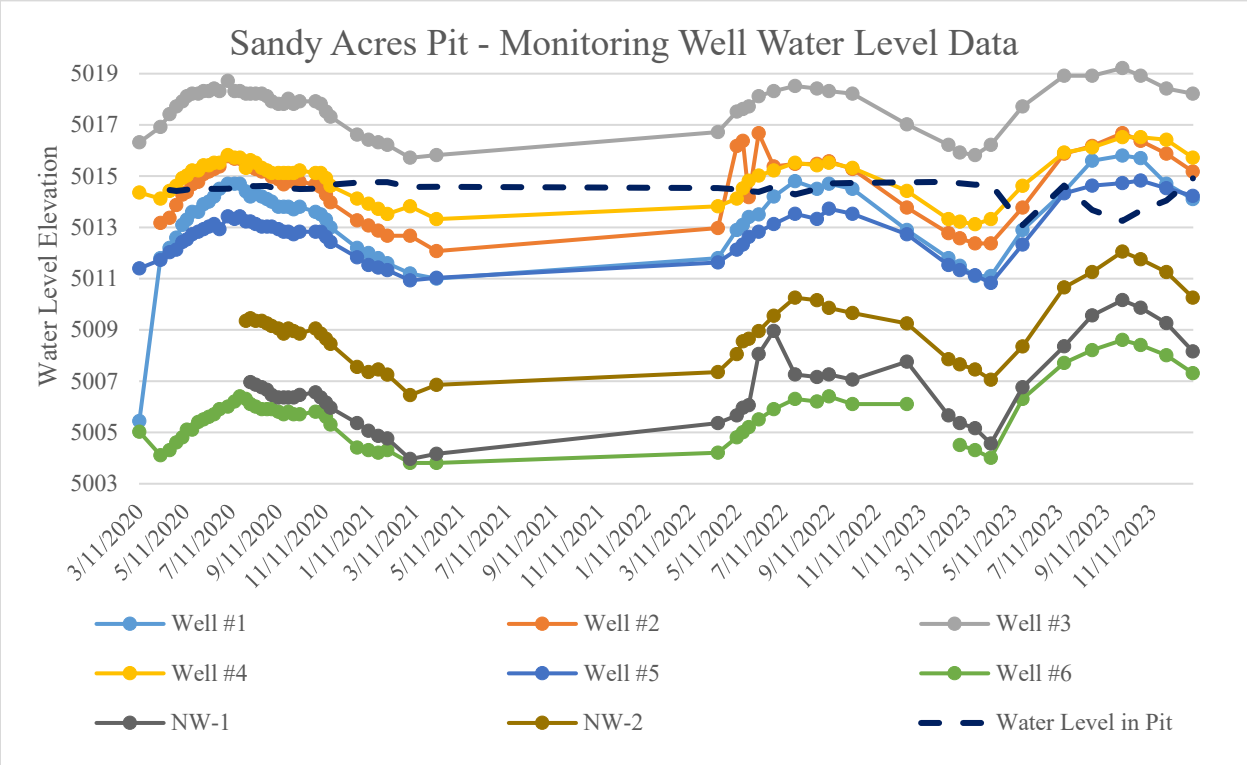
In 2013, E-470 expressed the desire to backfill the Sandy Acres Pit entirely as opposed to maintaining the pit as a lake or storage reservoir and pursuing an augmentation plan. This decision was made because the development of the property as an E-470 interchange precluded the development of the property for residential uses with an aesthetic lake and E-470 did not intend to line and operate a storage reservoir. Based on information in the permit file for the pit, E-470 began backfilling the Sandy Acres Pit with inert material in 2015 and completed the backfilling in July of 2016. The DRMS inspected the backfilled lake in December of 2017, at which time, no water was observed in the backfilled pit. Accordingly, it was confirmed that the backfilling completed in 2016 successfully relieved the standing water issue in the Sandy Acres Pit and no water was observed in the pit for at least a year, as evidenced by the DRMS's 2017 inspection report. In 2016, the SWSP for the pond was updated to identify the cessation of additional consumptive use from the pit resulting from evaporation (because there was no longer standing water in the pit) and to address only the lagged depletions associated with previously exposed ground water.

A July 2019 inspection report for the site identified the presence of water in the pit that did not appear to infiltrate or otherwise discharge within 72 hours. The reclamation of the pit required that no water be exposed and corrective action was requested by the DRMS. This condition and request were communicated to the Division of Water Resources.

In March of 2020, E-470 installed six monitoring wells around the Sandy Acres Pit to monitor ground water level elevations in the South Platte River alluvial aquifer to better understand the standing water in the pit. In July of 2020, two additional monitoring wells were constructed. The locations of the wells are presented in Figure 1 and details regarding the wells are summarized below. Water level data collected from the wells is presented in the attached Table 1.

Well	Permit No.	Completed Depth (ft)
MW-1	323625	43.0
MW-2	323626	49.0
MW-3	323879	44.75
MW-4	323627	49.0
MW-5	323628	35.0
MW-6	323880	35.0
NW-1	323629	40.5
NW-2	323630	40.5

The water level data collected from the monitoring wells have been used to prepare hydrographs of water level elevations surrounding the pit along with the elevation of the water standing in the pit, as presented in the hydrograph below.



The water level data indicate ground water elevations surrounding the pit that range from 5003.8 to 5019.2 feet, a water table that fluctuates annually by up to approximately 5 feet annually and a general ground water gradient from the south/southeast (MW-3) to the north/northwest (MW-6).[1]

The hydrograph indicates that the water table elevations in the areas around MW-1, MW-2, MW-3, MW-4 and MW-5 are higher than the elevation of the water level in the pit during some portions (MW-1, MW-2, MW-4 and MW-5) or all (MW-3) of the year. This indicates that the water table surrounding the pit is higher than the pit in these areas and that South Platte River alluvial aquifer ground water is discharging to the pit in these areas at least at some portions of the year.

In fall / winter of 2021-2022, E-470 constructed a trench along the eastern flank of the Sandy Acres Pit in an attempt, as recommended by BBA Water Consultants, Inc., to intercept ground water on the up ground water gradient side of the pit and transmit and discharge the ground water to the down ground water gradient side of the pit (from the southeast to the northwestern

[1] Note that the ground water elevations referenced in this document are based on a different vertical datum than was used for Sandy Acres backfill and grading project as-built drawings prepared by E-470's surveyor. Thus, the elevations herein would require adjustment for direct comparison to the final grading as-builts.

flanks of the pit). The purpose of these efforts was to effectively reduce the water level elevations and discharge into the pit from the surrounding alluvial aquifer. Along with these efforts, E-470 constructed a sump at the northern end of the pit to collect and discharge transmitted water and trenching in the bottom of the Sandy Acres Pit to direct and discharge water directly from the pit to the sump. Initially, it appeared that these efforts were successful in reducing water level elevations including the elevation of the standing water in the pit.

Aerial photography of the Sandy Acres Pit site generally confirms the history of the pit presented in the permit file. The photography confirms that by 1993, a southern gravel pit cell had been constructed and the mining of a second northern gravel pit cell had begun (Figure 2). Aerial photography confirms that the mining of the Sandy Acres Pit was completed by approximately 2001 (Figure 3). Standing water was observed in the pit in the available photography through this time and continued consistently until 2015 when E-470 began the backfilling project, discussed above (Figure 4). The aerial photography depicts the backfilling of the pond and confirms that no standing water was observed on top of the backfilled material in the pit during 2018 (Figure 5). By the end of the summer of 2019, however, aerial photography indicates standing water was again present in the bottom of the Sandy Acres Pit on top of the backfill material (Figure 6). Aerial photography from April of 2023, after the installation of the trenching and sump collection system, indicates a decrease in the amount of standing water in the pond (Figure 7).

Based on the mining history, monitoring well data and aerial photography, it is conceptualized that the source of the standing water in the Sandy Acres Pit is ground water that discharges into the pit along the southern and eastern flanks of the pit. The monitoring well data suggests this relationship and the ring of green vegetation visible in aerial photography along with field observation of seeps in these areas confirms that shallow ground water is present and discharging into the pit. The ring of green vegetation and the location from which ground water is discharging to the pit is consistent with the contact between the fill that was placed in the pit and the native alluvial material surrounding the pit. The backfilled material in the pit likely causes mounding of ground water around these areas of the pit forcing shallower water levels and ground water discharge into the pit. Due to the fine-grained nature of the fill material (low permeability material), the discharged water cannot readily infiltrate back down into the ground water system and becomes perched on top of the fill in the pit.

Both the 2015 - 2016 backfilling and 2021 - 2022 trench and sump efforts appeared to initially mitigate the standing water conditions in the pit, but in both cases, standing water was ultimately again observed in the pit. Accordingly, the standing water issue in the Sandy Acres Pit continues as solutions are investigated and implemented.

Factors Impacting Ground Water Elevations and Discharge to Pit

Several factors have the potential to impact the elevations of ground water in the South Platte River alluvium around the Sandy Acres Pit, including:

- Sandy Acres Pit Backfilling – As mentioned above, the backfilling of the Sandy Acres Pit itself has the potential to cause mounding and shadowing effects on the upstream and downstream sides of the pit, respectively.

- Adjacent Lined Gravel Pits – Gravel pits (especially lined gravel pits) in close proximity to the Sandy Acres Pit will impact water level elevations, cause ground water mounding and shadowing around the pits and change ground water flow paths. These changes have the potential to influence ground water elevations around the Sandy Acres Pit and result in the discharge of ground water into the pit.

- Adjacent Irrigation Ditch Operation and Nearby Irrigation – The operation of adjacent ditches (specifically the Fulton Ditch) will cause seepage through the bottom of the ditch which will raise water levels beneath and adjacent to the ditch during operation. Similarly, irrigation will result in return flows (a contribution to the ground water system) which will also raise water levels beneath and adjacent to irrigated fields.

- Precipitation and Streamflow – Localized precipitation and streamflow have the potential to directly contribute to the South Platte River alluvial aquifer and impact ground water underflows and water table elevations.

- E-470 Construction – The backfilling of the pit and construction of E-470 may have required the installation of infrastructure that changed ground water flow and impacted water level elevations around the Sandy Acres Pit.

The factors presented generally above are discussed in more detail below.

Sandy Acres Pit Backfilling

The Sandy Acres Pit was backfilled with fine-grained, low permeability material that is less transmissive than the native South Platte River alluvial material. The difference is characteristics restricts ground water flow in the areas surrounding the Sandy Acres Pit, causing water levels to rise on the upgradient side of the pit to force ground water to flow around the pit. This mounding, in part, has resulted in shallower ground water elevations and the discharge of ground water to the Sandy Acres Pit.

Adjacent Gravel Pits

Lined gravel pits, including slurry wall lined pits, have the potential to impact water level elevations and ground water flow paths by causing ground water mounding (higher water level elevations) on the up-ground water gradient side of the liners and ground water shadowing (lower water level elevations) on the down ground water gradient side of the liners. Lined gravel pits adjacent to the Sandy Acres Pit in the South Platte River alluvium have the potential to cause the same impacts locally and to influence how the ground water interacts with the pit.

A gravel pit complex (Brannan Pit #29 – DRMS Permit No. M-1980-183) is located directly to the west and southwest of the Sandy Acres Pit, as presented in Figure 1. This gravel pit complex is the closest gravel pit to the Sandy Acres Pit and, as we know based on information in the permit file for the pit, has affected local ground water elevations and locally increased ground water elevations to the point that corrective action was required, as discussed below.

The Brannan Pit #29 was permitted, constructed and operated at a similar time as the Sandy Acres Pit mining similar South Platte River alluvial material. During the mining of the Brannan

Pit #29, it was decided to slurry wall the pit to allow dewatering and additional mining as well as the use of the pit as a water storage reservoir after reclamation. The slurry wall for the perimeter of the entire pit was completed in 2009. The slurry wall was originally constructed without a perimeter drain.

As evidenced by information in the permit file, the lining of the Brannan Pit #29 impacted ground water flow around the pit. The DRMS first received complaints regarding the loss of surface water and stressed trees and grass areas resulting from the installation of the slurry wall. This was likely due to a shadowing effect from the slurry wall that reduced water levels in certain areas such that local trees and grass had greater difficulty accessing ground water. The DRMS subsequently received complaints of impacts resulting from shallow ground water conditions associated with mounding of ground water likely caused by the slurry wall installation.

In 2010, Brannan was required to monitor alluvial water levels in monitoring wells installed around the pit. Water level data, contained in the permit file for the Brannan Pit #29, is available quarterly from the monitoring wells starting in June of 2010. One of the installed monitoring wells (Brannan Monitoring Well "MW-4 OUT") indicated potential water level mounding of up to approximately 20 feet associated with the slurry wall.

By the end of 2015, Brannan had begun construction of a French drain system to alleviate shallow ground water conditions and flooding of a neighboring property on the western edge of the pit as a result of complaints submitted to the DRMS. The French drain was completed by February of 2016. The installation of the French drain appears to have alleviated the flooded property issues. The observance of shallow ground water and the flooding of a neighboring property confirms that the Brannan slurry walls impacted the hydrologic balance and resulted in mounding of ground water around the pit.

In 2018, a leak in the slurry wall along the east side of the northern Brannan Pit #29 gravel pit was identified. The slurry wall leak was fixed by the spring of 2019. When constructed, the slurry wall was not keyed into bedrock sufficiently and allowed water to leak into the pit. While leaking, the flow of ground water into the pit resulted in localized drawdown (deeper water levels) in the aquifer, but resulted in additional mounding of ground water and shallower ground water level after the leak was repaired.

The timing of the slurry wall liner fix along the east side of the Brannan Pit #29 was similar to the timing of the backfilling of the Sandy Acres Pit. One of the Brannan monitoring wells exhibits a 5-foot rise in elevation at approximately the same time as these activities. The fixing of the Brannan Pit #29 slurry wall and the backfilling of the Sandy Acres Pit likely combined to contribute to the rise in water elevation observed in the Brannan monitoring well. The water level data confirms that water levels in the general area of Brannan Pit #29 and the Sandy Acres Pit are sensitive to these types of mining activities.

Adjacent Irrigation Ditch and Nearby Irrigation

The Fulton Ditch, an existing and active irrigation ditch, is located approximately 600 feet to the east of the Sandy Acres Pit. The Fulton Ditch diverts surface water from the South Platte River

mainly for local irrigation use. Accordingly, the Fulton Ditch operates in the spring and summer months when streamflow is present. Although the ditch diversion records correlate with the seasonal changes in water level elevations, they do not, however, correlate with the magnitude of fluctuations of water level elevations. Accordingly, although Fulton Ditch diversions are an indication that the South Platte River is flowing and diversions are being made for irrigation uses, the ditch flow and potential seepage do not have a significant impact to the magnitude of the water level changes observed around the Sandy Acres Pit. Similarly, the local irrigation, the timing of which is indicated by the Fulton Ditch diversions, also does not correlate with the magnitude of the water level changes observed in the records.

Precipitation and Streamflow

To investigate the potential correlation between precipitation and streamflow on alluvial water level elevations, the reported precipitation and streamflow from the South Platte River at Henderson, CO gage were reviewed and compared to the Sandy Acres Pit water level data. The gage is located within 2.5 miles of the Sandy Acres Pit and is generally representative of conditions in the vicinity of the pit.

The review of precipitation and Sandy Acres Pit water level data indicates that there is little if any correlation between precipitation and the South Platte River alluvial water levels. Localized precipitation may not correlate well with the water level because other factors, including streamflow, influence water levels more strongly on the local scale.

The review of local streamflow and Sandy Acres Pit water level data does indicate a correlation between the reported streamflow and water levels around the pit. Of the four years of data available for comparison (2020 – 2023), 2020 through 2022 exhibited relatively consistent, but lower, streamflow and alluvial water levels. Data from 2023 exhibited higher streamflow in the South Platte River and correspondingly higher alluvial water levels. In addition to the water level data, standing water level conditions in the Sandy Acres Pit were exacerbated in the summer of 2023 as visually observed, consistent with the higher reported streamflow.

The review of precipitation and streamflow indicates that the water levels in the South Platte River are influenced by streamflow in the South Platte River with higher water levels in the spring and summer months during and after runoff.

E-470 Construction

Although there is potential that this construction may have impacted ground water flow around the Sandy Acres Pit, we have not reviewed any construction information or any water level information that would suggest that any changes potentially caused by the construction of E-470 are causing increases in ground water elevations, changes in ground water flows or the discharge of ground water to the pit.

Conclusions / Comments

- Alluvial water level elevations in close proximity to the Sandy Acres Pit are most influenced by 1) streamflow which naturally replenishes the alluvial aquifer underflow each year resulting in seasonal water level fluctuations and 2) gravel pit mining activities,

specifically slurry wall lining, backfilling and slurry wall maintenance, which have caused localized ground water mounding conditions.

- Streamflow is a naturally occurring phenomenon and has always influenced water level elevations in the South Platte River alluvium. When streamflow is higher, more water can be discharged to the alluvial aquifer increasing underflow and water level elevations. When streamflow is lower, less water can be discharged to the alluvial aquifer decreasing underflow and water level elevations.

- Natural water level fluctuations need to be accounted for when designing infrastructure that interacts with ground water, such as the backfilled Sandy Acres Pit.

- Gravel pit activities are a manmade phenomenon, and the impact of those activities also need to be considered when designing infrastructure such as the Sandy Acres Pit.

- Ground water mounding is a change in elevations in certain areas of the alluvial aquifer which, in and of itself, is not a change to the hydrologic balance around a gravel and is an inherent result of lined and backfilled gravel pits.

- The installation of the slurry wall liner around the Brannan Pit #29 was not originally considered as part of the proposed mining and has changed ground water flows and elevations around both the Brannan Pit #29 and Sandy Acres Pit.

- Based on the available information, the standing water condition in the Sandy Acres Pit results from a combination of the backfilling of the Sandy Acres Pit and the installation (and maintenance) of the Brannan Pit #29 slurry wall without proper consideration of the impact of both actions on the local ground water system. The backfilling of the Sandy Acres Pit alone would have resulted in mounding conditions on the up-ground water gradient side of the fill, but the elevated ground water elevation condition caused by the Sandy Acres Pit backfill is exacerbated by the presence of the Brannan Pit #29 slurry wall.

- The Brannan Pit #29 slurry wall was in place prior to the installation of the backfill in the Sandy Acres Pit, but a leak in the slurry wall was fixed approximately two years after the backfilling of the Sandy Acres Pit occurred. Accordingly, the design for the Sandy Acres Pit backfill could not have taken into account the impact of the fully and properly installed slurry wall for the Brannan Pit #29. Once fixed, the Brannan #29 Pit slurry wall caused additional localized ground water changes that were not observed until after the fix and after the installation of the backfill.

- Similar to the west side of the Brannan Pit #29, the ground water mounded by the Brannan Pit #29 slurry wall and Sandy Acres Pit backfill mounds on the upgradient side of the pits to an elevation higher than the fill in the Sandy Acres Pit forcing ground water to discharge to the pit.

- Based on the permit file information, the Sandy Acres Pit had an approved mining permit which included the backfilling that was ultimately performed to reclaim the site. The

Brannan Pit #29 slurry wall was approved after the Sandy Acres Pit permit, but installed before the Sandy Acres Pit backfill and did not adequately consider its impact on the already approved mining activities adjacent to the site. This condition was exacerbated by the leaky Brannan Pit #29 slurry wall which was repaired after Sandy Acres Pit was being backfilled. The Brannan Pit #29 slurry wall did not consider Sandy Acres Pit permitted activities and did not fully install the slurry wall such that E-470 could fully consider its impact.

- Additional French drain structures, similar to the structure that was installed on the west side of the Brannan Pit #29, could be considered for the east side of the Brannan Pit #29 near the southern portions of the Sandy Acres Pit to address the water level concerns in these areas as well. Construction of a drain structure at this location could be performed as a collaborative effort with Brannan, if pursued.

- The continued development of the Sandy Acres Pit perimeter drain and collection sump system could also be pursued to assist with the mitigation of standing water conditions in the Sandy Acres Pit. This system is still being developed and the effectiveness of the system to lower ground water levels and relieve the standing water conditions still needs to be proven.

- Water level data should continue to be collected from the 8 monitoring wells installed by E-470 around the Sandy Acres Pit. Measurements should be collected on a monthly basis, weather permitting, and the measurements should be used to maintain the water level hydrograph of water levels around the pit. The water level data and hydrograph will allow for ongoing monitoring of the elevation of ground water around the pit and the impact of efforts to mitigate the standing water conditions in the Sandy Acres Pit.

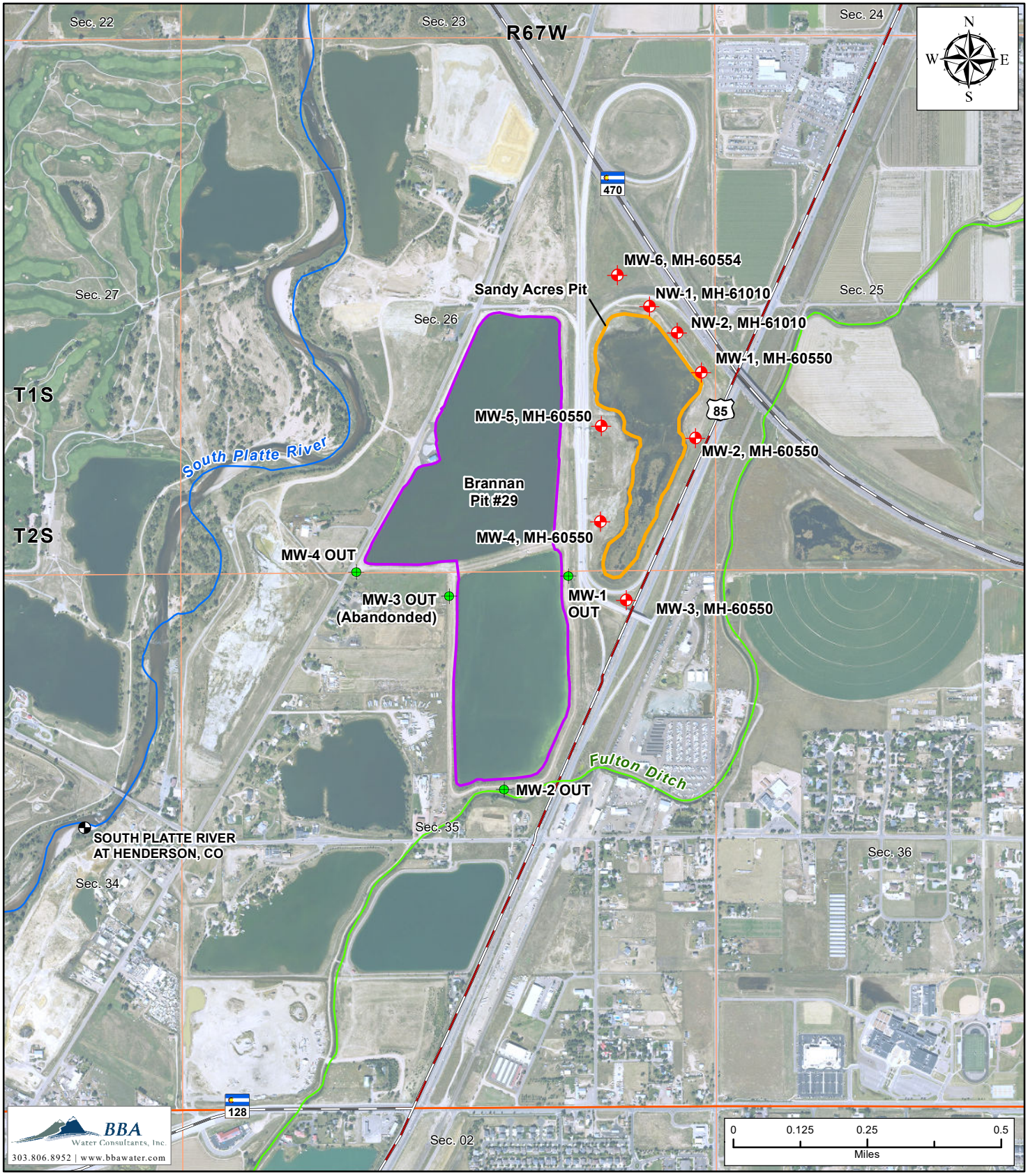


Figure 1
E-470 Sandy Acres Pit
Monitoring Well Locations

Date: 2/8/2024 | Job No. 9607.00
Aerial Photo Date: 8/3/2019 NAIP-USDA
Data Source: CDSS, CDOT, USGS, BLM

Legend

- Stream Flow / Precipitation Gage
- Brannan #29 Pit Monitoring Wells
- Monitoring Holes (Name, Permit No.)
- Brannan Pit #29 Slurry Wall Liner
- Sandy Acres Pit Former High Water Line

Overview Map

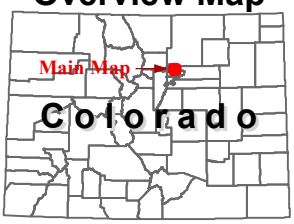


Table 1

E-470 - Sandy Acres Pit

Monitoring Well Levels and Elevations

	Well #1		Well #2		Well #3		Well #4		Well #5		Well #6		Pond Elevation		NW-1		NW-2	
TOC Elevation		5024.901		5033.775		5038.318		5033.32		5029.13		5014.509		5013.086		5025.162		5022.655
Date	Reading	Elevation	Reading	Elevation	Reading	Elevation	Reading	Elevation	Reading	Elevation	Reading	Elevation	Reading	Elevation	Reading	Elevation	Reading	Elevation
3/11/2020	16.0	5005.445			19.0	5016.32	16.0	5014.357	15.0	5011.402	5.5	5005.026						
4/8/2020	13.1	5011.80	20.6	5013.18	21.4	5016.92	19.2	5014.12	17.4	5011.73	10.4	5004.11						
4/20/2020	12.7	5012.20	20.4	5013.38	20.9	5017.42	18.9	5014.42	17.1	5012.03	10.2	5004.31	1.38	5014.46				
4/29/2020	12.3	5012.60	19.9	5013.88	20.6	5017.72	18.7	5014.62	17.0	5012.13	9.9	5004.61	1.33	5014.42				
5/7/2020	11.8	5013.10	19.5	5014.28	20.4	5017.92	18.4	5014.92	16.7	5012.43	9.7	5004.81						
5/13/2020	11.6	5013.30	19.4	5014.38	20.2	5018.12	18.3	5015.02	16.6	5012.53	9.4	5005.11						
5/20/2020	11.3	5013.60	19.1	5014.68	20.1	5018.22	18.1	5015.22	16.4	5012.73	9.4	5005.11	1.40	5014.49				
5/28/2020	11.3	5013.60	19.0	5014.78	20.1	5018.22	18.1	5015.22	16.3	5012.83	9.1	5005.41						
6/4/2020	11.0	5013.90	18.7	5015.08	20.0	5018.32	17.9	5015.42	16.2	5012.93	9.0	5005.51	1.40	5014.49				
6/11/2020	10.9	5014.00	18.6	5015.18	20.0	5018.32	17.9	5015.42	16.1	5013.03	8.9	5005.61	1.42	5014.51				
6/18/2020	10.7	5014.20	18.5	5015.28	19.9	5018.42	17.8	5015.52	16.0	5013.13	8.8	5005.71	1.42	5014.50				
6/25/2020	10.4	5014.50	18.4	5015.38	20.0	5018.32	17.8	5015.52	16.2	5012.93	8.6	5005.91						
7/6/2020	10.2	5014.70	18.0	5015.78	19.6	5018.72	17.5	5015.82	15.7	5013.43	8.5	5006.01	1.42	5014.51				
7/15/2020	10.2	5014.70	18.1	5015.68	20.0	5018.32	17.6	5015.72	15.8	5013.33	8.3	5006.21	1.45	5014.54				
7/22/2020	10.2	5014.70	18.1	5015.68	20.0	5018.32	17.6	5015.72	15.7	5013.43	8.1	5006.41	1.42	5014.51				
7/30/2020	10.5	5014.40	18.3	5015.48	20.1	5018.22	18.0	5015.32	15.9	5013.23	8.2	5006.31	1.51	5014.60			13.30	5009.36
8/5/2020	10.7	5014.20	18.4	5015.38	20.1	5018.22	17.7	5015.62	15.9	5013.23	8.4	5006.11	1.53	5014.62	18.20	5006.96	13.20	5009.46
8/12/2020	10.6	5014.30	18.5	5015.28	20.1	5018.22	17.8	5015.52	16.0	5013.13	8.5	5006.01	1.52	5014.61	18.30	5006.86	13.30	5009.36
8/20/2020	10.7	5014.20	18.6	5015.18	20.1	5018.22	18.0	5015.32	16.1	5013.03	8.6	5005.91	1.53	5014.62	18.40	5006.76	13.30	5009.36
8/27/2020	10.8	5014.10	18.6	5015.18	20.2	5018.12	18.1	5015.22	16.1	5013.03	8.6	5005.91	1.53	5014.62	18.50	5006.66	13.40	5009.26
9/2/2020	10.9	5014.00	18.8	5014.98	20.4	5017.92	18.2	5015.12	16.1	5013.03	8.6	5005.91			18.70	5006.46	13.50	5009.16
9/11/2020	11.1	5013.80	18.9	5014.88	20.5	5017.82	18.2	5015.12	16.2	5012.93	8.7	5005.81	1.41	5014.50	18.80	5006.36	13.60	5009.06
9/18/2020	11.1	5013.80	19.1	5014.68	20.5	5017.82	18.2	5015.12	16.3	5012.83	8.8	5005.71	1.41	5014.50	18.80	5006.36	13.80	5008.86
9/24/2020	11.1	5013.80	18.9	5014.88	20.3	5018.02	18.2	5015.12	16.3	5012.83	8.7	5005.81	1.41	5014.50	18.80	5006.36	13.60	5009.06
10/1/2020	11.2	5013.70	19.0	5014.78	20.5	5017.82	18.2	5015.12	16.4	5012.73	8.8	5005.71	1.43	5014.52	18.80	5006.36	13.70	5008.96
10/9/2020	11.1	5013.80	19.0	5014.78	20.4	5017.92	18.1	5015.22	16.3	5012.83	8.8	5005.71	1.41	5014.50	18.70	5006.46	13.80	5008.86
10/30/2020	11.3	5013.60	19.1	5014.68	20.4	5017.92	18.2	5015.12	16.3	5012.83	8.7	5005.81	1.42	5014.51	18.60	5006.56	13.60	5009.06
11/6/2020	11.4	5013.50	19.2	5014.58	20.5	5017.82	18.2	5015.12	16.3	5012.83	8.7	5005.81	1.47	5014.56	18.80	5006.36	13.80	5008.86
11/13/2020	11.6	5013.30	19.5	5014.28	20.8	5017.52	18.4	5014.92	16.5	5012.63	8.9	5005.61	1.52	5014.61	19.00	5006.16	14.00	5008.66
11/19/2020	11.9	5013.00	19.8	5013.98	21.0	5017.32	18.7	5014.62	16.7	5012.43	9.2	5005.31	1.58	5014.67	19.20	5005.96	14.20	5008.46
12/24/2020	12.7	5012.20	20.5	5013.28	21.7	5016.62	19.2	5014.12	17.3	5011.83	10.1	5004.41	1.66	5014.75	19.80	5005.36	15.10	5007.56
1/8/2021	12.9	5012.00	20.7	5013.08	21.9	5016.42	19.4	5013.92	17.6	5011.53	10.2	5004.31	1.67	5014.76	20.10	5005.06	15.30	5007.36
1/21/2021	13.1	5011.80	20.9	5012.88	22.0	5016.32	19.6	5013.72	17.7	5011.43	10.3	5004.21	1.68	5014.77	20.30	5004.86	15.20	5007.46
2/2/2021	13.3	5011.60	21.1	5012.68	22.1	5016.22	19.8	5013.52	17.8	5011.33	10.2	5004.31	1.68	5014.77	20.40	5004.76	15.40	5007.26
3/4/2021	13.7	5011.20	21.1	5012.68	22.6	5015.72	19.5	5013.82	18.2	5010.93	10.7	5003.81	1.49	5014.58	21.20	5003.96	16.20	5006.46
4/8/2021	13.9	5011.00	21.7	5012.08	22.5	5015.82	20.0	5013.32	18.1	5011.03	10.7	5003.81	1.50	5014.59	21.00	5004.16	15.80	5006.86
4/15/2022	13.1	5011.80	20.8	5012.98	21.6	5016.72	19.5	5013.82	17.5	5011.63	10.3	5004.21	1.40	5014.49	19.80	5005.36	15.30	5007.36
4/27/2022	12.9	5012.00	20.5	5013.28	21.0	5017.32	19.6	5013.72	17.7	5011.43	10.1	5004.41	1.21	5014.30	19.90	5005.26	15.00	5007.66
5/10/2022	12.0	5012.90	17.6	5016.18	20.8	5017.52	19.2	5014.12	17.0	5012.13	9.7	5004.81	1.33	5014.42	19.50	5005.66	14.60	5008.06
5/18/2022	11.8	5013.10	17.4	5016.38	20.7	5017.62	18.8	5014.52	16.8	5012.33	9.5	5005.01	1.30	5014.39	19.20	5005.96	14.10	5008.56
5/26/2022	11.5	5013.40	19.6	5014.18	20.6	5017.72	18.5	5014.82	16.5	5012.63	9.3	5005.21	1.50	5014.59	19.10	5006.06	14.00	5008.66
6/8/2022	11.4	5013.50	17.1	5016.68	20.2	5018.12	18.3	5015.02	16.3	5012.83	9.0	5005.51	1.20	5014.29	17.10	5008.06	13.70	5008.96
6/28/2022	10.7	5014.20	18.4	5015.38	20.0	5018.32	18.1	5015.22	16.0	5013.13	8.6	5005.91			16.20	5008.96	13.10	5009.56
7/26/2022	10.1	5014.80	18.3	5015.48	19.8	5018.52	17.8	5015.52	15.6	5013.53	8.2	5006.31	1.63	5014.72	17.90	5007.26	12.40	5010.26
8/24/2022	10.4	5014.50	18.3	5015.48	19.9	5018.42	17.9	5015.42	15.8	5013.33	8.3	5006.21	1.65	5014.74	18.00	5007.16	12.50	5010.16
9/9/2022	10.2	5014.70	18.2	5015.58	20.0	5018.32	17.8	5015.52	15.4	5013.73	8.1	5006.41			17.90	5007.26	12.80	5009.86
9/30/2022	10.3	5014.60		5033.78		5038.32		5033.32		5029.13		5014.51	1.69	5014.78	17.60	5007.56	12.40	5010.26
10/10/2022	10.4	5014.50	18.5	5015.28	20.1	5018.22	18.0	5015.32	15.6	5013.53	8.4	5006.11			18.10	5007.06	13.00	5009.66
12/21/2022	12.0	5012.90	20.0	5013.78	21.3	5017.02	18.9	5014.42	16.4	5012.73	8.4	5006.11	1.58	5014.67	17.40	5007.76	13.40	5009.26
2/7/2023	12.8	5012.15	20.7	5013.08									1.60	5014.69	19.00	5006.16	14.70	5007.96
2/14/2023	13.1	5011.80	21.0	5012.78	22.1	5016.22	20.0	5013.32	17.6	5011.53					19.50	5005.66	14.80	5007.86
3/1/2023	13.4	5011.50	21.2	5012.58	22.4	5015.92	20.1	5013.22	17.8	5011.33	10.0	5004.51	1.55	5014.64	19.80	5005.36	15.00	5007.66
3/21/2023	13.8	5011.10	21.4	5012.38	22.5	5015.82	20.2	5013.12	18.0	5011.13	10.2	5004.31	0.59	5013.68	20.00	5005.16	15.20	5007.46
4/11/2023	13.8	5011.10	21.4	5012.38	22.1	5016.22	20.0	5013.32	18.3	5010.83	10.5	5004.01	0.17	5013.26	20.60	5004.56	15.60	5007.06
5/23/2023	12.0	5012.90	20.0	5013.78	20.6	5017.72	18.7	5014.62	16.8	5012.33	8.2	5006.31			18.40	5006.76	14.30	5008.36
7/17/2023	10.5	5014.40	17.9	5015.88	19.4	5018.92	17.4	5015.92	14.8	5014.33	6.8	5007.71	0.96	5014.05	16.80	5008.36	12.00	5010.66
8/23/2023	9.3	5015.60	17.6	5016.18	19.4	5018.92	17.2	5016.12	14.5	5014.63	6.3	5008.21	1.83	5014.92	15.60	5009.56	11.40	5011.26
10/2/2023	9.1	5015.80	17.1	5016.68	19.1	5019.22	16.8	5016.52	14.4	5014.73	5.9	5008.61	2.60	5015.69	15.00	5010.16	10.60	5012.06
10/26/2023	9.2	5015.70	17.4	5016.38	19.4	5018.92	16.8	5016.52	14.3	5014.83	6.1	5008.41			15.30	5009.86	10.90	5011.76
11/29/2023	10.2	5014.70	17.9	5015.88	19.9	5018.42	16.9	5016.42	14.6	5014.53	6.5	5008.01			15.90	5009.26	11.40	5011.26
1/3/2024	10.8	5014.10	18.6	5015.18	20.1	5018.22	17.6	5015.72	14.9	5014.23	7.2	5007.31			17.00	5008.16	12.40	5010.26

Notes:
Levels and elevations measured and presented by E-470.

Figure 2
E-470 Sandy Acres Pit
Aerial Photography 1993

Date: 3/23/2024 | Job No. 9607.00

Legend

Sandy Acres Pit Former High Water Line

Aerial Photo Date: 6/26/1993 USGS
Data Source: CDSS, CDOT, USGS, BLM

Overview Map

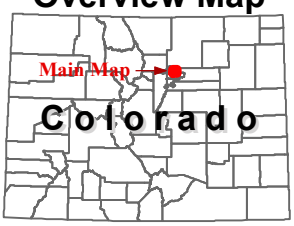


Figure 3
E-470 Sandy Acres Pit
Aerial Photography 2001

Date: 3/23/2024 | Job No. 9607.00

Legend

Sandy Acres Pit Former High Water Line

Aerial Photo Date: 12/31/2001 Google Earth
Data Source: CDSS, CDOT, USGS, BLM

Overview Map

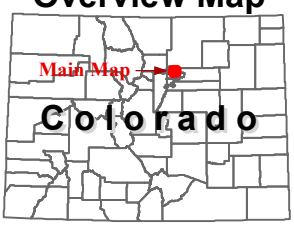


Figure 4
E-470 Sandy Acres Pit
Aerial Photography 2015

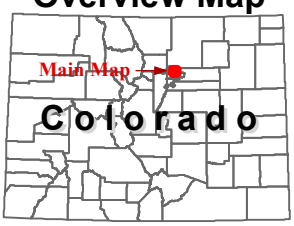
Date: 3/23/2024 | Job No. 9607.00

Legend

Sandy Acres Pit Former High Water Line

Aerial Photo Date: 10/9/2015 Google Earth
Data Source: CDSS, CDOT, USGS, BLM

Overview Map



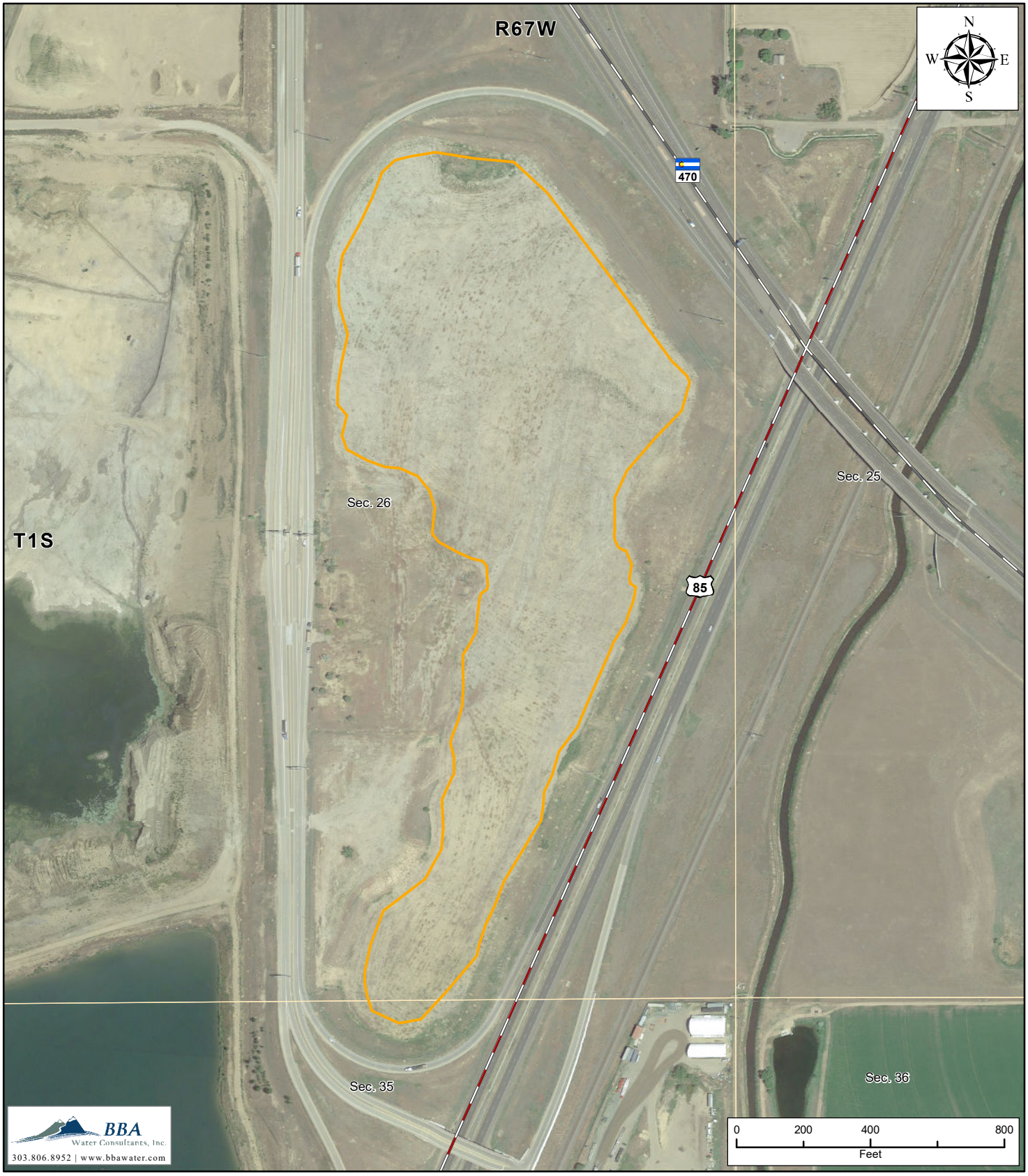


Figure 5
E-470 Sandy Acres Pit
Aerial Photography 2018

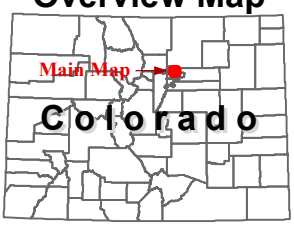
Date: 3/23/2024 | Job No. 9607.00

Legend

Sandy Acres Pit Former High Water Line

Aerial Photo Date: 5/31/2018 Google Earth
Data Source: CDSS, CDOT, USGS, BLM

Overview Map



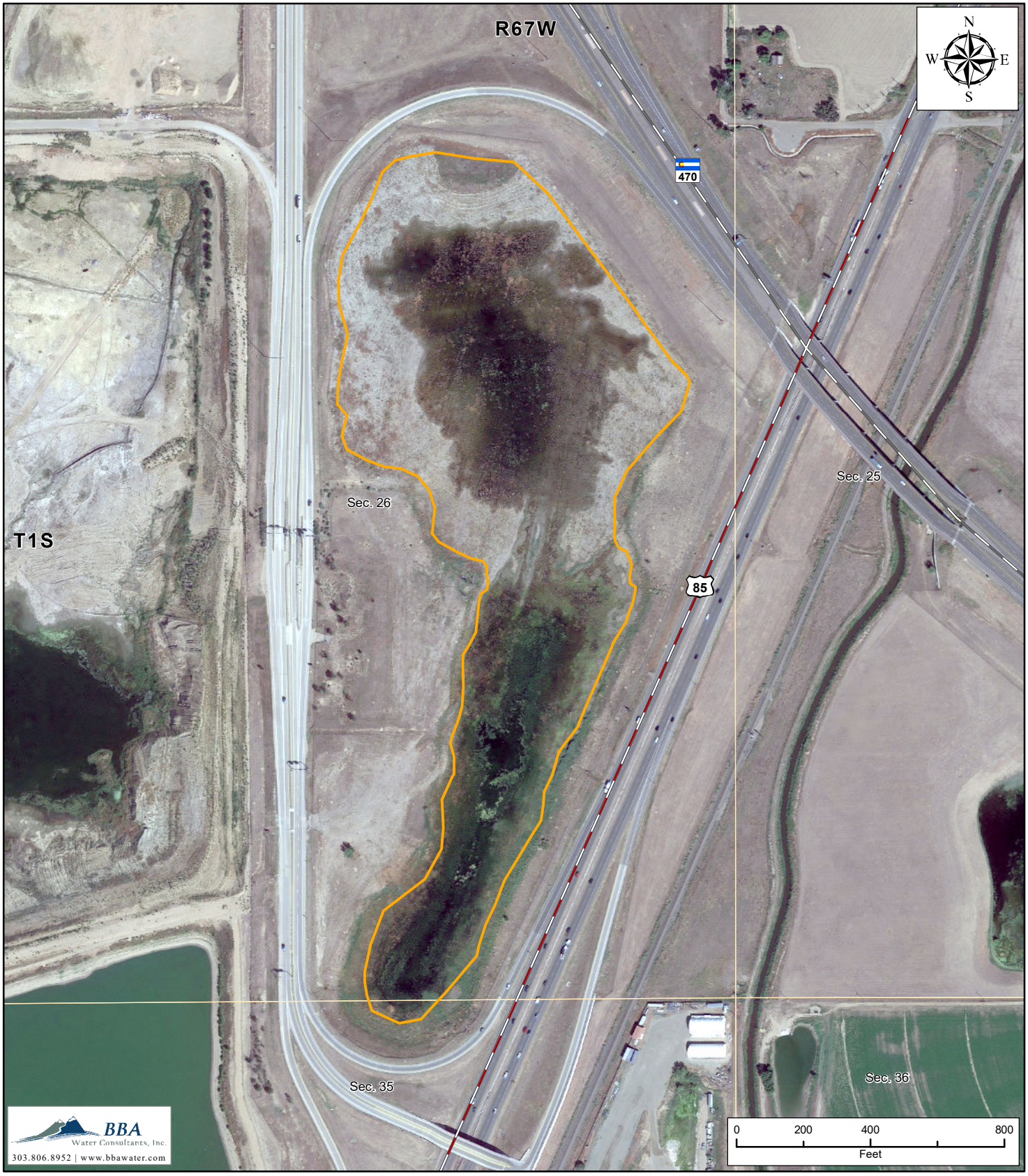


Figure 6
E-470 Sandy Acres Pit
Aerial Photography 2019

Date: 3/23/2024 | Job No. 9607.00

Legend

Sandy Acres Pit Former High Water Line

Aerial Photo Date: 9/12/2019 Google Earth
Data Source: CDSS, CDOT, USGS, BLM

Overview Map

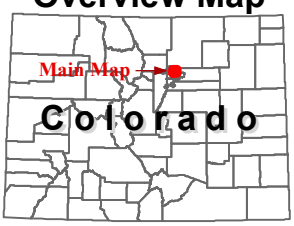


Figure 7
E-470 Sandy Acres Pit
Aerial Photography 2023

Date: 3/23/2024 | Job No. 9607.00

Legend

Sandy Acres Pit Former High Water Line

Aerial Photo Date: 4/26/2023 Google Earth
Data Source: CDSS, CDOT, USGS, BLM

Overview Map