Ewing Gravel Pit

112c Colorado Division of Reclamation, Mining, and Safety Construction Material Regular Operation Application

August 2023

By:

BURNCO Colorado, LLC

Represented by:

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INTRODUCTION

The proposed Ewing Gravel Pit is located just east U.S. Highway 85 and directly north of the city limits of Fort Lupton in Weld County, CO. The property is bound by the South Platte river to west. BURNCO Colorado, LLC is both the permittee and operator of the proposed aggregate mining operation. The site is currently a group of agricultural fields with a few oil producing well areas, residences, and agriculture related building dispersed throughout the property. The site contains two terraces divided by the Platteville ditch: the lower terrace to the west near the South Platte River, and the upper terrace to the east near the highway. Access to the site will be via the existing connection to US-85 in the northeast corner of the site.

BURNCO is proposing that the site be converted to a gravel pit to produce aggregate products for the use in construction materials. The permit and affected area of this operation will be 156.7 acres. Approximately 116.0 acres of new disturbance will be created for mining. Mining will occur on both terraces across three pods. Reclamation will convert the site to water storage ponds surrounded by rangeland, which will serve as open space and public recreation for Fort Lupton.

The proposed operation at the Ewing Gravel Pit will consist of mining and processing sand and gravel for the production of construction materials. Processing of the extracted materials will include crushing, screening, washing, and the use of concrete and asphalt plants.

EXHIBIT A LEGAL DESCRIPTION

The site is located directly north of the City of Fort Lupton in Weld County, Colorado. A legal description is shown on Map C-1 which is included in Exhibit C. A general location map is shown in Exhibit B which indicates the mine entrance coordinates.

1. Legal Description

The Ewing Gravel Pit is located directly north of Fort Lupton in Weld County, CO in part of the Southeast ¼ (SE ¼) of Section 30, Township 2 North, Range 66 West, of the 6th Principal Meridian (PM) and part of the East ½ (E ½) of the Southwest ¼ (SW ¼) of Section 30, Township 2 North, Range 66 West, of the 6th Principal Meridian (PM). The legal description is as follows:

A PLAT OF A PARCEL OF LAND IN THE CITY OF FORT LUPTON, COLORADO, LOCATED IN THE SOUTH HALF OF SECTION 30, TOWNSHIP 2 NORTH, RANGE 66 WEST OF THE 6TH P.M., MORE PARTICULARLY DESCRIBED AS FOLLOWS:

PARCEL A:

THE SOUTHEAST QUARTER (SE 1/4) OF SECTION THIRTY (30), TOWNSHIP 2 NORTH, RANGE 66 WEST OF THE 6TH P.M.,

EXCEPT THE TRACT OF LAND CONVEYED IN QUIT CLAIM DEED RECORDED MARCH 13, 1967 UNDER RECEPTION NO. 1501076, DESCRIBED AS FOLLOWS:

A PARCEL OF LAND IN THE SOUTHEAST QUARTER (SE1/4) OF SECTION 30, TOWNSHIP 2 NORTH, RANGE 66 WEST OF THE 6TH P.M., WELD COUNTY COLORADO, DESCRIBED AS:

BEGINNING AT THE SOUTHEAST CORNER OF SAID SE1/4; THENCE NORTH ALONG THE EAST LINE OF SAID SE1/4, A DISTANCE OF 1082.00 FEET; THENCE S60°45'W, A DISTANCE OF 135.41 FEET TO A POINT ON THE WESTERLY R.O.W. LINE OF U.S. HIGHWAY NO. 85, SAID POINT BEING THE TRUE POINT OF BEGINNING;

THENCE S58° 45'W, A DISTANCE OF 211.18 FEET; THENCE S55°03'W A DISTANCE OF 454.35 FEET; THENCE NORTH 89°19'30"W, A DISTANCE OF 405.42 FEET TO A POINT ON THE CENTERLINE OF THE PLATTEVILLE DITCH; THENCE ALONG SAID CENTERLINE BY THE FOLLOWING COURSES AND DISTANCES;

S32°57'W, 57.98 FEET;

S46°21'W, 200.00 FEET;

S59°36'W, 115.00 FEET;

S84°25'45”W, 145.00 FEET TO THE BEGINNING OF A CURVE TO THE LEFT; THENCE ALONG THE ARC OF SAID CURVE, A DISTANCE OF 72.62 FEET (THE RADIUS OF SAID CURVE IS 48.64 FEET AND THE DELTA IS 85°32'45");

THENCE S01 ° 07'E, 304.28 FEET;

S49°40'30”E, 65.07 FEET MORE OR LESS TO A POINT ON THE SOUTH LINE OF THE SE1/4 SECTION 30; THENCE N89° 51'E ALONG SAID SOUTH LINE, A DISTANCE OF

1366.39 FEET TO A POINT ON THE WESTERLY R.O.W. OF U.S. HIGHWAY NO. 85; THENCE NORTH ALONG SAID R.O.W. LINE, A DISTANCE OF 1015. 84 FEET TO THE TRUE POINT OF BEGINNING.

AND ALSO EXCEPTING A TRACT OF LAND SITUATED IN SE1/4 OF SAID SECTION 30, MORE PARTICULARLY DESCRIBED AS FOLLOWS, TO-WIT:

BEGINNING AT THE SOUTHWEST CORNER OF SAID SE1/4; THENCE DUE EAST 720 FEET; THENCE NORTH 66° 24' WEST 810 FEET; THENCE SOUTH 320 FEET TO THE PLACE OF BEGINNING;

AND ALSO EXCEPTING A TRACT OF LAND MORE PARTICULARLY DESCRIBED AS FOLLOWS, TO-WIT: BEGINNING AT A POINT ON THE NORTH LINE OF THE SE 1/4 FROM WHICH POINT THE NORTHEAST CORNER OF SECTION 30 BEARS NORTH 2°26' EAST, A DISTANCE OF 2640.6 FEET; THENCE SOUTH 0°05' EAST, 1619.0 FEET TO A POINT ON THE SOUTH PROPERTY LINE; THENCE NORTH 60° 40' EAST, A DISTANCE OF 137.5 FEET TO A POINT ON THE EAST LINE OF SECTION 30; THENCE ALONG THE EAST LINE OF SECTION 30, NORTH 0°05' WEST, A DISTANCE OF 1551.8 FEET TO THE NORTHEAST CORNER OF THE SE 1/4 OF SAID SECTION 30; THENCE ALONG THE NORTH LINE OF THE SOUTHEAST 1/4 SOUTH 89°55'30" WEST, A DISTANCE OF 120.0 FEET, MORE OR LESS, TO THE POINT OF BEGINNING,

AND ALSO EXCEPTING THAT TRACT OF LAND CONVEYED BY WARRANTY DEED RECORDED JULY 11, 2001 UNDER RECEPTION NO. 2865029, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

THAT PARCEL OF LAND LOCATED IN THE SOUTHEAST QUARTER OF SECTION THIRTY, TOWNSHIP TWO NORTH, RANGE SIXTY-SIX WEST OF THE SIXTH PRINCIPAL MERIDIAN, COUNTY OF WELD, STATE OF COLORADO BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHWEST CORNER OF THE SOUTHEAST QUARTER OF SECTION THIRTY, TOWNSHIP 2 NORTH, RANGE SIXTY-SIX WEST OF THE SIXTH PRINCIPAL MERIDIAN, FROM WHENCE THE SOUTHWEST CORNER OF SAID SOUTHEAST QUARTER OF SAID SECTION THIRTY BEARS S00° 20'40"W, AND WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG THE NORTH LINE OF THE SOUTHEAST QUARTER OF SAID SECTION THIRTY, N89° 43'26"E A DISTANCE OF 385.26 FEET; THENCE SOUTH 59°17'18"W A DISTANCE OF 180.22 FEET; THENCE S54° 56'22"W A DISTANCE OF 94.45 FEET; THENCE S63 34'06W A DISTANCE OF 172.35 FEET TO THE WEST LINE OF THE SOUTHEAST QUARTER OF SAID SECTION 30; THENCE ALONG SAID WEST LINE N00° 20'40"E A DISTANCE OF 221.16 FEET MORE OR LESS TO THE POINT OF BEGINNING.

AND ALSO EXCEPTING THAT PARCEL CONVEYED TO THE STATE HIGHWAY COMMISSION OF COLORADO IN DEED RECORDED FEBRUARY 3, 1964 UNDER RECEPTION NO. 1428041, COUNTY OF WELD, STATE OF COLORADO.

PARCEL B:

A TRACT OF LAND LOCATED IN THE SOUTHWEST (SW 1/4) OF SECTION THIRTY (30), TOWNSHIP 2 NORTH, RANGE 66 WEST OF THE 6TH P.M., MORE PARTICULARLY DESCRIBED AS FOLLOWS, TO-WIT: BEGINNING AT A POINT 350 FEET SOUTH OF THE NORTHWEST CORNER OF THE SOUTHEAST 1/4 OF SAID SECTION 30; THENCE SOUTH 69° WEST 416 FEET; THENCE SOUTH 28° 45' WEST 550 FEET; THENCE SOUTH 11°

WEST 992 FEET; THENCE SOUTH 66° 24' EAST 920 FEET; THENCE DUE NORTH 1970 FEET TO THE PLACE OF BEGINNING, COUNTY OF WELD, STATE OF COLORADO.

EXHIBIT B INDEX MAP

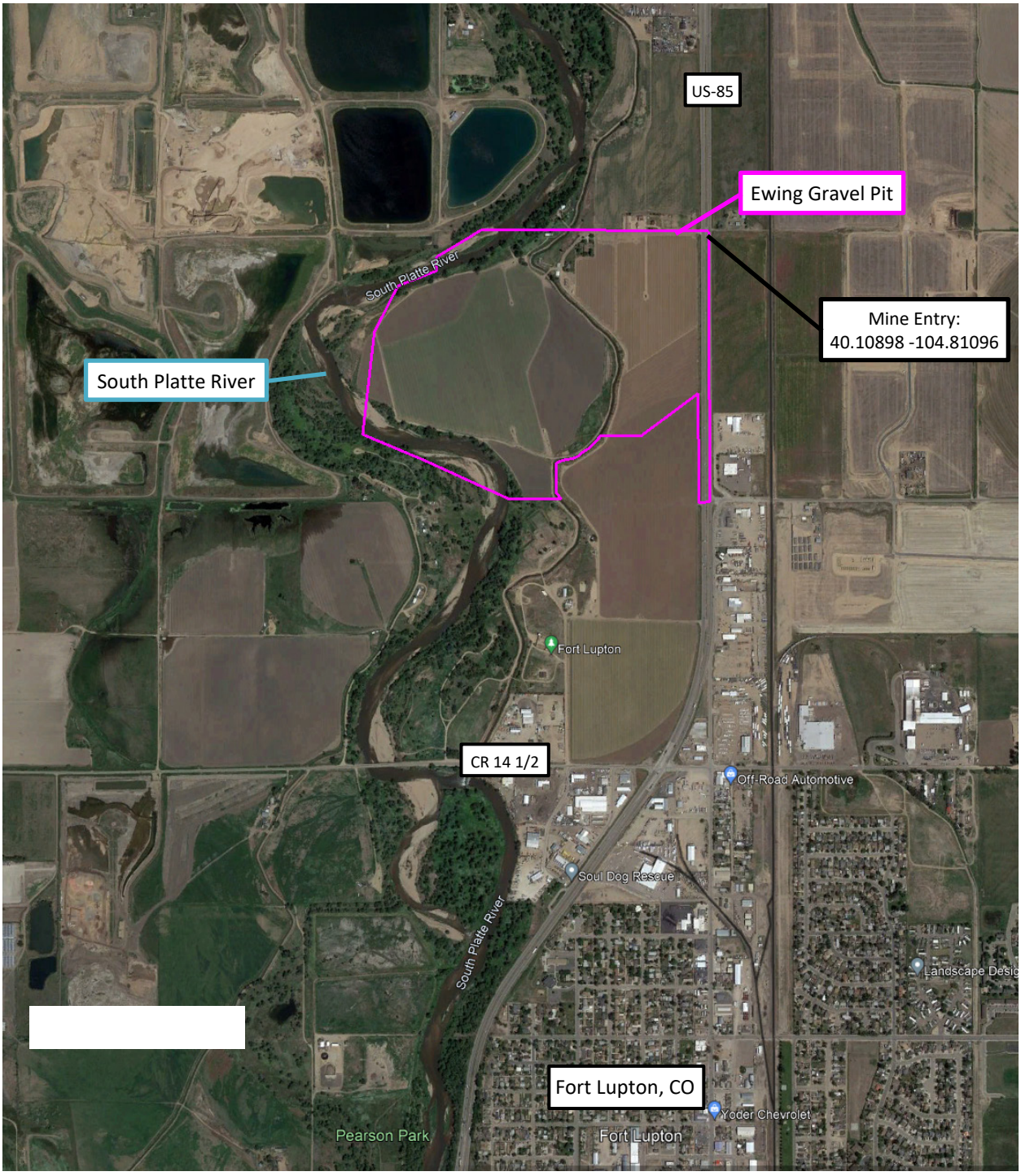


EXHIBIT C PREMINE AND MINE PLAN MAPS

Map C-1 Current Conditions

Map C-2 Mining Plan

Map C-3 Cross Sections

EXHIBIT D MINING PLAN

1. General Mining Plan

The property boundary has been surveyed on site and the permit area will be surveyed prior to any additional acreage to the site disturbance. Map C-2 shows the mining plan. The mine will include 116 acres of disturbance. The primary commodity to be mined will be sand and gravel for use in construction materials. These construction materials may include crushed rock, sand, washed rock, concrete, and asphalt. Fill dirt may incidentally be produced as well. The mine will be accessed from the existing connection to US-85. This access road will require improvements to be able to support mine traffic. All earthwork required to improve the road will be completed prior to mining. Slurry walls will be installed surrounding Pod 1 and 2, and another surrounding Pod 3. These walls will stop groundwater from infiltrating into the pits, and facilitate water storage in the reclaimed pits. Slurry wall construction will be completed prior to mining in any given pod.

The sand and gravel deposit is an average 25 to 45-foot thickness within the alluvial deposit surrounding the South Platte. The deposit is overlain by an average of two feet of topsoil and two feet of overburden. It is split into two terraces: a lower terrace adjacent to the Platte River and an upper terrace along US-85. The lower terrace is made up of the primary sand and gravel layer overlain with topsoil and overburden. An additional sand layer overlies the gravel deposit, starting midway through the lower terrace and increasing in depth to the southeast. It reaches an average thickness of 28 feet in the easternmost mining area, Pod 3, on the upper terrace. The bedrock is an olive-gray claystone and siltstone that exists approximately 30 to 40 feet below the surface.

Mining will occur in three separate pods, starting on the lower terrace and proceeding east: Pod 1, Pod 2, then Pod 3. The processing area in the northern part of Pod 3 will be mined last. Mining and reclamation will occur concurrently as mining progresses in order to minimize the total disturbance. There is sufficient topsoil and overburden on site to successfully reclaim the site to its final condition as water storage ponds surrounded by rangeland. Reclamation will include backfilling and regrading of the site, topsoiling, and revegetation. The slurry walls installed prior to mining will be retained.

All mining will continue to the bottom of the gravel deposit with 1.5H:1V final mining slopes along the perimeter. The active highwall will be at a near vertical slope, and will progress to the halfway point of the final mining slope. This allows for the remaining highwall to be knocked down via dozer to create the completed mining slope. Slopes will then be backfilled with sand or overburden to the reclaimed 3H:1V slopes. Refer to the cross sections on Map C-3 for the various slope details throughout mining.

Dozers and scrapers will be used to strip topsoil and overburden from the areas to be mined to be stored in the designated stockpiles. Any stockpile to be in place longer than 90 days will be

seeded to prevent erosion. While pre-mine stripping is occurring, all existing buildings, except for the oil wells and their related structures, will be demolished. All debris will be removed from the site. Sand and gravel will be extracted using loaders, excavators, dozers, and trucks. Excavated material will be conveyed to the center of the site for processing. Processing of material will include screening, washing, crushing, and the production of concrete and asphalt.

No blasting will take place at the Ewing Gravel Pit. No refuse, acid, or toxic producing material are expected to be encountered in this operation. If these materials are encountered, at least two feet of inert material will be placed over the area and mining will move to a different area.

2. Mining Timetable

Mining operations at the Ewing Gravel Pit are expected to take approximately 10.5 years to complete, based on an annual average production of 700,000 tons. Actual production rates will fluctuate based on market conditions. An approximate mining timetable based on this production and the phased mining plan is shown in Table D-1.

Table D-1 Mining Timetable

Description	Time Required
Construction of access road and slurry wall.	2 months
Initial stripping of processing area and Pod 1 (west portion on lower terrace)	1 month
Mine and reclaim Pod 1 according to approved plans. Reclamation occurs as mining has reached its maximum extents in an area.	4 years
Initial stripping of new mining area for Pod 2 (center portion on lower terrace)	1 month
Mine and reclaim Pod 2 according to approved plans. Reclamation occurs as mining has reached its maximum extents in an area.	2 years
Initial stripping of new mining area for Pod 3 (east portion on upper terrace)	1 month
Mine and reclaim Pod 3 according to approved plans. Reclamation occurs as mining has reached its maximum extents in an area.	4 years
Total	10.5 years

3. Mine Facilities and Operation

The site will contain the following facilities and equipment:

Facilities:

- Portable hot mix asphalt (HMA) plant
- Concrete batch plant
- Portable wash plant
- Portable crushing & screening unit

- Gradation screen/conveyor (portable)
- Portable toilet
- Mine office (portable)
- Scale
- Portable fuel storage

Equipment:

- Front-end loaders
- Bulldozers
- Scrapers
- Haul trucks (off highway)
- Water trucks
- Graders
- Excavators
- Conveyors

Only a loader and scale will be located on the site full time, as most of the year the mine will not need to be running at full production. No permanent structures will be built within the mining area. All production facilities and equipment will be portable. BURNCO will provide portable toilets and bottled water to employees on site during operations. These will be located in the processing area. Any fuel stored on site will have full secondary containment that can carry 110% of the fuel tank volume. All facilities will be removed during reclamation. Explosives will not be used at the site.

4. Topsoil and Overburden Handling

Topsoil averages two feet overlying two feet of overburden. Topsoil and overburden will be stripped with appropriate earthmoving equipment as deemed suitable for the operation such as front-end loaders, dozers, excavators, and water trucks. Topsoil and overburden will be stockpiled separately onsite in either designated stockpiles, berms, or directly placed to create final reclamation slopes. These materials will be directly placed in the designated stockpile areas or berms which can be seen on Map C-2. Stockpiles to be in place longer than 90 days will be seeded with the permanent seed mix to prevent erosion (see Exhibit E for seed mix). Screening berms will be constructed immediately with overburden, topsoil, and/or sand extracted from Pod 1. These berms will be vegetated to prevent erosion and provide noise and visual screening. An average of two feet of topsoil and two feet of overburden were assumed to determine the overall material balance shown in Table D-2.

Table D-2 Topsoil and Overburden Material Generated During Mining

Material Generated (CY)	
Topsoil	271,360
Overburden	271,360

Due to the reclaimed land use as water storage ponds, there will be an excess of topsoil than what is needed for reclamation. This is because the lakes make up the majority of the reclaimed land and do not need to be topsoiled entirely. There is not enough overburden to meet

reclamation needs by itself. Excess topsoil and sand will be used to augment the overburden in achieving the final grading shown in the reclamation map in Exhibit F. Overburden, topsoil, and sand will be used to backfill mining slopes to their final reclaimed state. Topsoil will be replaced on all disturbances outside of the ponds and on the pond slopes. It will not be replaced on the pond floor. Topsoil will be replaced in an average two-foot layer to restore the existing soil conditions. Details pertaining to reclamation can be found in Exhibit E and the maps in Exhibit F.

5. Site Access and Internal Road Improvements

The Ewing Gravel Pit will be accessed via the existing northeast access connecting to U.S. Highway 85. All improvements will be covered by appropriate CDOT permits. Improvements to this road will be completed prior to the start of the mining operation.

The remainder of the site will be accessed internally. The ditch separating the upper and lower terraces has an existing crossing which is currently 15 feet wide. BURNCO plans to widen this crossing to facilitate access from the lower mining areas to the processing area. The crossing will be widened to 30 feet, and a box culvert will be inserted below to maintain flow through the ditch. Details of the crossing improvements are shown on Map C-2. This will be completed prior to the start of mining.

The location and details of these items are all shown on Map C-2 in Exhibit C.

6. Water Information, Rights, and Augmentation

All water rights issues such as availability of water for this operation, consumption rates, dust control, etc. is presented in Exhibit G – Water Information.

7. Schedule of Operations

Mining operations will occur as dictated by demand with an average annual production of 700,000 tons. Mining, screening, and processing will be conducted on site with portable equipment throughout the year. Asphalt and concrete production will occur onsite at various times of the year. Product will be sold from these activities throughout the year. The operator will not have night gravel mining operations, although minor truck activity and repairs may occur after hours.

8. Fort Lupton Impacts and Environmental Impacts

All potential county impacts and concerns are addressed in the Fort Lupton Special Use Permit and Fort Lupton Annexation Application.

EXHIBIT E RECLAMATION PLAN

1. General Reclamation Plan

The total disturbed area to be reclaimed under this permit is 116.0 acres out of the 156.7-acre permit area. Reclamation of the Ewing Gravel Pit will convert the site to a final land use of water storage ponds and rangeland. The land will be annexed into Fort Lupton and will be used as public open space. Reclamation will occur concurrently with mining. Final reclamation will be completed after mining has finished. The pre-mine land use is predominantly agriculture with some oil production areas and one residence. Rangeland exists along the South Platte River corridor. Surroundings land uses include agriculture, open space, and mining. Pursuant to Rule 6.4.5.2(b), the applicant evaluated the post-mine land use in regard to adopted state and local land use plans for this area and adjacent land uses. The proposed post-mine land use of water storage ponds and rangeland is compatible with the general agricultural character of the area.

The permit and affected area of the site are 156.7 acres and 128 acres respectively, not all of which will be disturbed and require reclamation. Approximately 116.0 acres will be disturbed. There will be 78.1 acres of water storage while the remaining area will be open space with roads and trails. Table E-1 below summarize the final land uses within the affected area upon completion of reclamation.

Table E-1 Reclamation Areas

Description	Area (Acres)
Rangeland	37.9
Water Storage Ponds	78.1
Disturbed Area Total	116.0
Undisturbed Area	40.7
Total Affected (Permit) Area	**156.7**

Reclamation will occur concurrently as mining progresses through each pod. No more than 500 feet of highwall will be unreclaimed at a time. Mining slopes will be backfilled and graded to a maximum 3H:1V slope. The slopes will then be compacted for stabilization and to prevent erosion. All portable facilities and equipment will be removed from the area. All berms will be flattened. The slurry wall will remain during and after reclamation. The pond slopes and any other surrounding disturbances will be topsoiled and seeded for revegetation. Topsoil will be replaced in a two-foot layer to restore the current soil profile. Revegetation will be completed using a native seed mix recommended by the Natural Resource Conservation Service. Revegetation efforts will be monitored following reclamation. The pits will be used for freshwater storage after they have been fully reclaimed and revegetated. The ponds must have a minimum of three feet of freeboard at all times. Wildlife fencing may need to be installed surrounding the reservoirs for reclamation. These will be installed by BURNCO at the request of Colorado Parks and Wildlife (CPW) or the City of Fort Lupton.

There will be more than enough material stockpiled from on-site materials to fulfill reclamation needs as the groundwater lakes take up the majority of the reclamation area. Table E-2 shows the volumes of topsoil and overburden required for reclamation and the material volumes that will be stripped and stockpiled. As shown, there is an excess of topsoil that is stripped versus what is required for reclamation. The stripped overburden does not meet the amount required for backfilling the pits. However, there will be an excess of topsoil and sand that will be more than enough to meet these requirements. These calculations were made assuming that the site has a uniform two feet of topsoil and two feet of overburden across all areas. Topsoil will be replaced in an average two foot layer across all non-pond disturbances, while overburden will be used to backfill the pit slopes from 1.5H:1V to 3H:1V.

Table E-2 Reclamation Volumes

		Material Available on Site		Requirements for Reclamation	
Pod	Area (acres)	Topsoil Stripped (CY)	Overburden Stripped (CY)	Topsoil Required (CY)	Overburden Backfill Required (CY)
1	39.2	126,340	126,340	22,510	253,330
2	14.9	48,050	48,050	13,870	141,330
3	30.0	96,930	96,930	10,030	301,730
Screening Berm Area	3.1	10,030	--	10,030	--
Totals	84.1	271,360	271,360	87,870	696,400*

* Overburden reclamation requirements not met by the stripped overburden. There is an excess of topsoil (183,490 CY) and sand (>2M CY) present at the site that can be used to augment the backfill requirements.

Overburden reclamation requirements will not met by the stripped overburden alone. Approximately 425,000 CY of excess topsoil and/or sand will be used to augment this shortage. There is an excess of topsoil and sand present at the site that can be used to augment the backfill requirements. The excess volume of topsoil and sand required for backfill are shown in Table E-3. While most of the sand that is excavated will likely be sold, BURNCO will keep at least the minimum required amount per pod for reclamation backfilling stockpiled on site.

Table E-3 Additional Backfill Material Requirements

Minimum Requirements for Augmented Backfill Material				
	Pod 1 Volume (CY)	**Pod 2 Volume (CY)**	**Pod 3 Volume (CY)**	**Total Volume (CY)**
Existing Overburden (from Table E-2)	126,340	48,050	96,930	271,320
Excess Topsoil (calculated from Table E-2)	103,830	34,180	86,900	224,910
Min. Sand Requirement	**23,160**	**59,100**	**117,900**	**200,160**
Total (CY)	253,330	141,330	301,730	696,390

2. Topsoil Replacement

An average of two feet of topsoil will be stripped and stockpiled prior to mining. After backfilling and grading has been completed during reclamation, topsoil will be replaced at an average depth of feet in a manner that is similar to the pre-mine soil profile. Topsoil will only be placed on the pond slopes and other surrounding disturbances. Topsoil will not be replaced on the pond floors. Replaced topsoil will be directly placed by loaders and haul trucks. All topsoiled areas will be disced to aid in root penetration.

3. Haul Roads and Access

All internal haul roads will remain following reclamation so sustain access to the various water and oil wells throughout the site. They will also be useful for the reclaimed land use as open space. The main access will be via US-85. The ditch crossing and secondary property access will also remain in place. Some internal roads may be left in place as trails for the final land use as a public open space.

4. Reclamation Timetable and Sequence

The sequence and timing of reclamation can be seen in Table E-4 below. The reclamation schedule is dependent on the rate of mining and fluctuating market demands. The operator will reclaim the site concurrently with the progression of mining to limit the total disturbance.

Table E-4 Reclamation Timetable

Description	Time Required
Develop and mine pod 1	4 years
Develop and mine pod 2 while reclaiming previous phases	2 years
Develop and mine pod 3 while reclaiming previous phases	4 years
Backfill, topsoil, and revegetate remaining disturbances	1 year
Vegetation monitoring	2 years
Total	13 years

5. Revegetation Plans

Seed will be placed in all areas to be vegetated following grading, topsoiling, and discing of the soil. All disturbances that are retopsoiled will be seeded with a Rangeland Seed Mix. The Weld County recommended mix to be used is as follows:

5.1. Rangeland Seed Mix

Species	Pounds of pure live seed per acre (drilled)
Sand Bluestem	1.0
Sand Lovegrass	2.5
Indian Ricegrass	3.0
Prairie Sandreed	0.75
Green Needlegrass	1.5
Little Bluestem	0.75
Yellow Indiangrass	0.5
Switchgrass	1.5
Sand Dropseed	0.5
Total	**12.0**

Broadcast seeding will be done at double the drill rate. Mulch will be placed at roughly 4000 pounds per acre.

6. Post Reclamation Site Drainage

The site will drain internally following reclamation. All water that enters the site will drain to the water storage ponds across the site. Refer to map F-1 for the post reclamation drainage of the site.

7. Revegetation Success Criteria

Revegetation will be deemed adequate when erosion is controlled, the vegetation cover matches neighboring wildlife habitat areas, and when it is considered satisfactory according to Division standards. This will be monitored in the two years following the completion of reclamation.

8. Monitoring Reclamation Success

Measures will be employed for the control of any noxious weed species. The objective of this weed management plan is to control undesirable plants on the Ewing property. Plants identified through the Colorado Noxious Weed Act (C.R.S 35-5.5) and the Weld County Noxious Weed List as undesirable and designated for management within the county will be removed. Any weeds identified as List A species will be eradicated. Other lower listed plants identified as noxious weeds will be managed by control measures. A Weed Control Plan will be utilized as follows:

1) Each April, a weed survey will be taken of the permit area.

2) If any patches or plants have been identified, they will be sprayed by backpack sprayer or 4-wheeler using chemicals approved for use by the weed control staff of Weld County.
3) After reclamation, weed surveys and spraying will continue until the perennial cover and production of the site have met DRMS requirements and bond release has been obtained.

The Division and Weld County staff will be consulted regarding any weed infestation areas and any control measures prior to their initiation. The plan does not contemplate total weed removal on the property. Rather, the goal is to prevent the spread of weeds into uninfected areas as is the primary goal of the Weld County Weed Management Plan.

Each year during the mining operation, the permit area will be monitored closely, through which the operator may determine if any additional weeds have grown. If any new species of weeds are found, Weld County and the Division will be consulted in order to formulate the best plan for the new infestation.

EXHIBIT F RECLAMATION MAPS

Map F-1 Reclamation Plan

EXHIBIT G WATER INFORMATION

1. General

The Ewing Gravel Pit is within the floodplain and floodway of the South Platte River. The Platteville Ditch traverses the site from south to north roughly halfway across it. Mining pods 1 and 2 are located on the lower, western terrace which is within the floodplain. Mining pod 3 is located on the upper, eastern terrace along US-85, outside of the floodplain. Mining within the floodway/floodplain will be conducted with no filling or stockpiling above the natural ground grade. Groundwater is located roughly five feet below the natural grade in mining pods 1 and 2; 25-feet below grade in mining pod 3. All groundwater onsite is part of the South Platte River alluvial aquifer. Prior to mining any pod a slurry wall will be installed around the perimeter of each terrace of gravel, as shown on Map C-2. These slurry walls will be for the development of water storage reservoirs following reclamation.

Xcel Energy maintains a system of groundwater wells on the property for the purpose of supplying water to their power plant to the east, in Keensburg. These wells will be protected from groundwater impacts by their proximity to the South Platte River. Analysis conducted by BURNCO and shown in Appendix G-3 demonstrates this protection.

BURNCO is committed to protecting the hydrological balance and water quality at the site.

2. Water Quality Protection

The primary concerns surrounding water quality protection at the Ewing Gravel Pit site are the potential impacts to the surface and groundwater from sediment, hydraulic fluids, and diesel fuel. Sediment will be controlled through the use of stormwater retention within the disturbance area through the life of the mine. The site will be graded in a manner that maintains all surficial flows within the disturbed area, in turn containing all sediment and unwanted discharges from leaving the site. Hydraulic fluids and diesel fuels will be contained within vehicles or with adequate storage methods that follow best practices of maintenance; these practices including regular inspections of vehicles, hydraulic lines, and any other potential spill sources. Diesel fuel will be stored on-site in double walled tanks with secondary containment. Fuel storage will be stored away from exposed groundwater and other waterways. Spill kits will be located near all fueling areas to clean up inadvertent spills as soon as possible. An SPCC plan will be in place to prevent oil discharges and establish a response procedure in the event of spills.

Any surface water discharges from the site will be sampled in accordance with the NPDES discharge permit. All discharge will be via the approved Outfall, the proposed location of which is shown on Map C-2.

Table G-1. Surface Water Discharge Monitoring Requirements in NPDES Discharge Permit

Parameter	Monitoring Frequency	Sample Type
Flow	Instantaneous, Monthly	In-situ
pH	2x/month	Grab
Total Suspended Solids	2x/month	Grab
Oil and Grease Visual	2x/month	Visual
Oil and Grease	Contingent on visibility of oil and grease	Grab
Total Flow	Instantaneous, Monthly	Calculated
Selenium, Potentially Dissolved	2x/month	Grab
Total Dissolved Solids	Quarterly	Grab

Note: these are the anticipated analytes based on operator experience at similar sites. CDPHE may issue different sampling requirements with the permit.

3. Floodplain

The majority of the site is within the 100-year floodplain and floodway as reported by the Federal Emergency Management Agency. These boundaries are shown in the Exhibit C and F maps. The minimum distance maintained from the South Platte River to excavation activities is 100 feet. Additionally, no stockpiling or filling above the natural grade will occur in the floodway or floodplain. All topsoil and overburden stockpiles will be placed on the upper terrace. Overall, the downstream flood impacts should remain the same or be reduced from activity at the site as the removal of material results in more storage space for flood water below the existing grade. A no-rise certification has been provided to the City of Fort Lupton as part of its floodplain development permit.

In accordance with the Mile High Flood Control District technical guidelines, inflow/outflow structures will be installed along the river bank where mining pod 1 reaches its closest point to the South Platte River. Details of these designs can be seen on the Map G-1 – Drainage Map.

In the event of flooding at the site, equipment from the active mining floor will be removed and the pit will be allowed to fill with water. The flooded pit will be pumped only after the flood has subsided. All fuel will be stored at least one foot above the base flood elevation and in sufficient secondary containment with 110% carrying capacity.

4. Wetlands

The National Wetlands Inventory aerial-based mapping indicates the presence of wetlands within the permit area. These wetlands are mostly associated with the vegetated banks along with South Platte River. BURNCO commits to conducting a wetlands survey prior to disturbing any potential wetlands. Exhibit C and F maps show the NWI mapped wetlands.

5. Aquifers

The only identified aquifer located at the site is the shallow alluvial aquifer of the South Platte River. The depth to this aquifer varies throughout the year but is typically five feet below surface for the lower terrace (Pods 1 and 2) and 25 feet below the upper terrace (Pod 3). According to the U.S. Geological Survey's Ground Water Atlas of the United States[1], the underlying bedrock aquifer is the Laramie Fox Hills Aquifer of the Denver Basin system. The entirety of the Ewing Gravel Pit mining operation will take place in the overlaying alluvium above a shale/siltstone layer; the Laramie Fox Hills Aquifer will not be mined.

6. Surface Water

The mining operation will impact surface water in the area through the stormwater runoff that enters the site. Map G-1 – Drainage Map show the drainage patterns and how they are affected throughout the life of the mine. The maps include information on the drainage basins currently, during mining, and post reclamation as well as the drainage directions throughout these stages. The primary concern for surface water protection at the site is preventing the discharge of sediment, oil, and/or hydraulic fluids from the operation areas. Oils and hydraulic fluids are stored on site following the standard best management practices. These practices include the use of secondary containment at fluid storage and transfer points, spill kits, and employee training regarding safe handling practices. Sediment is trapped onsite using controls and best management practices by directing and controlling surface water runoff that enters the disturbed areas. More information on sediment and surface water control is provided below.

6.1. Surface Water Handling

There are three drainage basins that collect all stormwater runoff on and around the Ewing site. These are shown on the Drainage Map. The first two consist of the lower terrace and cover Pods 1 and 2 respectively, as well as undisturbed portions to the south. Runoff from this drainage basin will be collected in the mining pods during mining and in the water reservoirs following reclamation.

The second drainage basin exists on the upper terrace and consists of mining pod 3 and undisturbed upland to the south. Runoff from this drainage basin will be collected to the mining pod and processing area during mining and the water storage reservoir following reclamation.

[1] https://pubs.usgs.gov/ha/ha730/ch_c/

All drainage basins are shown on the Drainage Map.

6.1.1. Mining

During all phases of mining, and for each drainage basin, surface water runoff will drain to the active mining pod, reclaimed reservoir, or the processing area. Water collected in the active mining pod will be allowed to evaporate or will be discharge via the approved CDPHE outfall once sediment has settled out. Water collected within the processing area will be allowed to evaporate or discharged via the approved CDPHE outfall once sediment has settled out.

6.1.2. Post Reclamation

The drainage patterns during mining will be retained following reclamation of the site. Any surface water runoff will collect in the reclaimed reservoirs. There is enough storage capacity above the anticipated reservoir levels and the top of the shore to store the 100-year storm events. More on those calculations is provided below.

6.1.3. Flood Protection

Mining Pod 1 will extend to within 150 feet from the South Platte River in two locations as shown on the Drainage Map. Due to this proximity to the river, measures will be taken to protect the riverbank from erosion during a flood event. An inflow and outflow structure will be constructed between the River and the mining pod once mining is within 300 feet of the river. These structures will allow for the safe exchange of flood waters between the pit and river which prevents erosion of the riverbank and pitside slope during flood events. These structures are of a design approved for use by the Mile High Flood District. Details of the inflow/outflow structure are shown on the Drainage Map.

6.2. Disturbed Area Runoff

During all stages of mining, there is enough water storage capacity to contain the 5-year and 100-year 24-hour storm events and prevent erosion from surface water discharge. The expected rainfall from these events at the Ewing Site is provided in Table G-2 below.

Table G-2. Area Storm Events (from NOAA[2])

Event Probability	Event Rainfall (inches)
5-YR 24-HR	2.28
100-YR 24-HR	4.64

The peak runoff was generated from these values for the three drainage basins during all stages of mining. Pre-mine, mining, and reclamation conditions are delineated on the Drainage Map. The discharge volumes from these storm events are calculated in Appendix G-1 at the end of this exhibit. Table G-3 summarizes the runoff volumes and storage volumes for each

[2] National Oceanic and Atmospheric Administration

drainage. All drainage calculations were made using the Rational Method identified in the Mile High Flood Control District.

Table G-3. Drainage Calculations

Drainage Basin 1					
Site Condition	Area (ac)	Runoff Coefficient	100-Yr 24-Hr Runoff (ac-ft)	Discharge Flow Rate (gpm)*	Detention Capacity (ac-ft)***
Base	60.8	0.5	10.8	15,450	N/A
Mine	60.8	0.9	11.0	1000-3000**	191.5
Reclamation	60.8	0.9	11.0	0	191.5
Drainage Basin 2					
Site Condition	Area (ac)	Runoff Coefficient	100-Yr 24-Hr Runoff (ac-ft)	Discharge Flow Rate (gpm)*	Lake Storage Capacity (ac-ft)***
Base	22.4	0.5	2.3	5,300	N/A
Mine	22.4	0.9	4.2	1000-3000**	71.6
Reclamation	22.4	0.9	4.2	0	71.6
Drainage Basin 3					
Site Condition	Area (ac)	Runoff Coefficient	100-Yr 24-Hr Runoff (ac-ft)	Discharge Flow Rate (gpm)*	Lake Storage Capacity (ac-ft)***
Base	107.8	0.5	6.1	27,400	N/A
Mine	107.8	0.9	19.4	1000-3000**	146.8
Reclamation	107.8	0.9	19.4	0	146.8

* The discharge flow rate is calculated from the peak discharge of the 100-Yr 24-Hr storm event.

**Discharge flow rate is variable and controlled during mining as all discharges are pumped from the settling pond.
***Detention Capacity calculated in CAD.

7. Groundwater

Groundwater is located approximately five feet below the surface of the lower terrace and approximately 25 feet below the upper terrace at the Ewing site. This was determined from wells installed onsite. 12 wells are located onsite for different uses. Table G-4 outlines all wells within 600' of the permit area. These well locations are shown in Map C-1.

Table G-4. Wells Within 600' of Permit Area

Applicant/Well ID	Permit ID	Total Depth (feet)	Purpose	Distance from nearest mining area (ft)
L G EVERIST INC	53518-MH	39	Monitoring/Sampling	29
MARTINEZ, HUMBERTO C.	215110--A	53	Domestic	106
DITIRRO JOHN JR	11082-F-R	45	Irrigation	606
TRICYCLE LANE TEXASS LLC (HAHNE, CLIFFORD)	151399--A	55	Domestic	31
EWING, DALE	151398-		Domestic	0
ROCKY MOUNTAIN ENERGY CENTER LLC	58545-F	50	Industrial	375
BACHOFER, ROSS	310554-		Stock	365
ROCKY MOUNTAIN ENERGY CENTER LLC	58543-F	52	Industrial	88
TRICYCLE LANE TEXASS LLC (HAHNE, CLIFFORD)	146-R	55	Irrigation	0
ROCKY MOUNTAIN ENERGY CENTER LLC	58540-F	50	Industrial	472
L G EVERIST INC	53509-MH	55	Monitoring/Sampling	0
L G EVERIST INC	297890-	51	Monitoring/Sampling	0
ROCKY MOUNTAIN ENERGY CENTER LLC	58541-F	54	Industrial	319
L G EVERIST INC	53510-MH	60	Monitoring/Sampling	84
L G EVERIST INC	57957-F	45	Industrial	590
L G EVERIST INC	57958-F	0	Other	528
FORMBY, ERNEST	98266-VE	53	Domestic	159
TRICYCLE LANE TEXASS LLC (HAHNE, CLIFFORD)	6912-F	54	Irrigation	47
L G EVERIST INC	297892-	27	Monitoring/Sampling	10
GAYTAN, ROCIO	215110--A	53	Domestic	159
ROCKY MOUNTAIN ENERGY CENTER LLC	58544-F	46	Industrial	65
EWING, DALE	151399-	40	Domestic	27
TRICYCLE LANE TEXASS LLC (HAHNE, CLIFFORD)	151398--A	55	Domestic	30
L G EVERIST INC	297891-	58	Monitoring/Sampling	84
L G EVERIST INC	77371-F		Industrial	590
OTTESENS INC	22612-F-R	52	Irrigation	270
FORMBY, EMMETT	215110-		Domestic	156
ROCKY MOUNTAIN ENERGY CENTER LLC	58542-F	58	Industrial	52
DITIRRO JOHN JR	11082-F	45	Irrigation	600

*Ewing, Tricycle Lane, and LG Everist listed wells on the property are under the applicant's control.

The Rocky Mountain Energy Center listed wells are the Xcel wells for powerplant water. They are listed separately in Table G-5. The landowner has recently installed piezometers onsite for groundwater level monitoring. These are listed in Table G-6. The piezometers will be used to track groundwater changes before and during mining. They will remain following reclamation for the benefit of the landowner.

Table G-5. Xcel Supply Wells Within 600' of Permit Area

Applicant/Well ID	Permit ID	Total Depth (feet)	Purpose	Distance from nearest mining area (ft)
ROCKY MOUNTAIN ENERGY CENTER LLC	58545-F	50	Industrial	375
ROCKY MOUNTAIN ENERGY CENTER LLC	58543-F	52	Industrial	88
ROCKY MOUNTAIN ENERGY CENTER LLC	58540-F	50	Industrial	472
ROCKY MOUNTAIN ENERGY CENTER LLC	58541-F	54	Industrial	319
ROCKY MOUNTAIN ENERGY CENTER LLC	58544-F	46	Industrial	65
ROCKY MOUNTAIN ENERGY CENTER LLC	58542-F	58	Industrial	52

Table G-6. Piezometers

Applicant/Well ID	Total Depth (feet)	Purpose	Distance from nearest mining area (ft)
Piez-1	50	Industrial	208
Piez-2	50	Industrial	50
Piez-3	50	Industrial	97
Piez-4	50	Industrial	450

Groundwater quality data was gathered in advance of mining. This data and discussion of it can be seen in the Groundwater Monitoring Plan in Appendix G-2.

7.1. Groundwater – Mining

Prior to mining of a pod a slurry wall will be installed around the perimeter of the pod to prevent groundwater flow into the mining area. Following slurry wall installation, the operator will mine out the pod by dewatering it via the approved CDPHE discharge point. Pumping to conduct this dewatering will take place during the initial mining of each pod and then pumping will cease. Stormwater runoff that is collected in an active pod may be pumped out to protect local water rights, once sediment has settled. For this reason, the CDPHE discharge point will be maintained over the life of the mine. The pump will be located at least two feet below the active mining floor at the lowest point of the pit. It will be surrounded by a gravel filter. This configuration minimizes the risk sediment being pumped out of the pit.

The typical pit pump location can be seen on Map C-2.

7.2. Groundwater – Reclamation

Permanent water storage reservoirs will be left behind within each pod, as can be seen on Map F-1. There will be no groundwater consumptive use in reclamation.

7.3. Groundwater – Slurry Wall Impact

The installation of several slurry walls within the alluvial aquifer of the South Platte River creates two main potential impacts to the aquifer: the creation of local groundwater shadows or mounding that damage neighboring structures or property and the potential exacerbation of regional groundwater impacts. For these reasons, the applicant has had a groundwater model developed by GSI. The groundwater model looks at the potential impacts of the slurry wall installation on neighboring property and structures, particularly the Xcel supply wells.

7.3.1. Xcel Supply Wells

A set of five groundwater wells run along the west side of the mining pod 1 (Map C-1). Xcel energy pumps from these wells to supply their operations near Keenesburg, CO. The wells feed a pump house on the northwest corner of the property, from there the water is pumped east to Keenesburg. The wells are located both upstream and downstream of a proposed slurry wall. GSI analyzed the impact of the slurry wall on the Xcel wells to determine if the wall would prevent the wells from producing as Xcel required. The GSI report is in Appendix G-3.

Monitoring of the groundwater level along the South Platte River and the slurry wall will take place as outlined in the groundwater monitoring plan in Appendix G-2.

8. Water Related Permits

The operator is applying for all necessary permits that have not already been acquired for water handling at the Ewing Gravel Pit. This includes a discharge permit with the Colorado Department of Public Health and Environment and a gravel well permit for initial dewatering of each pod with the Colorado Division of Water Resources.

9. Water Consumption and Source

Water for dust control will be the primary consumptive use at the Ewing Gravel Pit site. Water will also be used for aggregate washing, dust control, and concrete/asphalt production. Water will be purchased from the local water conservancy district during operations. No ongoing water consumptive use exists in reclamation, since the water storage pods are lined. This water will be sourced from a freshwater pond in the processing area. This pond will be covered by a gravel well permit. Table G-7 summarizes the estimated water consumption for the operation throughout the year.

Table G-7. Water Consumption

Month	Aggregate Washing (ac-ft)	Concrete/Asphalt Production (ac-ft)	Dust Control (ac-ft)	Evaporative Depletions (ac-ft)	Water Removed from Mining (ac-ft)	Total (ac-ft)
Jan	0	0	0.11	0.00	0.00	0.1
Feb	0	0	0.12	0.00	0.00	0.1
Mar	0	0	0.19	0.00	0.00	0.2
Apr	2.88	3.00	0.32	1.62	0.00	7.8
May	2.99	3.12	0.42	1.68	0.00	8.2
Jun	2.88	3.00	0.51	1.62	0.00	8.0
Jul	2.99	3.12	0.53	1.68	0.00	8.3
Aug	2.99	3.12	0.47	1.68	0.00	8.3
Sep	2.88	3.00	0.35	1.62	0.00	7.9
Oct	2.99	3.12	0.25	1.68	0.00	8.0
Nov	0	0	0.14	0.00	0.00	0.1
Dec	0	0	0.11	0.00	0.00	0.1
Total	**20.62**	**21.48**	**3.50**	**11.56**	**0**	**57.2**

The Ewing Gravel Pit sources water for operations via water contract. Any groundwater exposure will be covered by a gravel well permit with the Colorado Division of Water Resources.

Appendix G-1 Hydrology Calculations

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

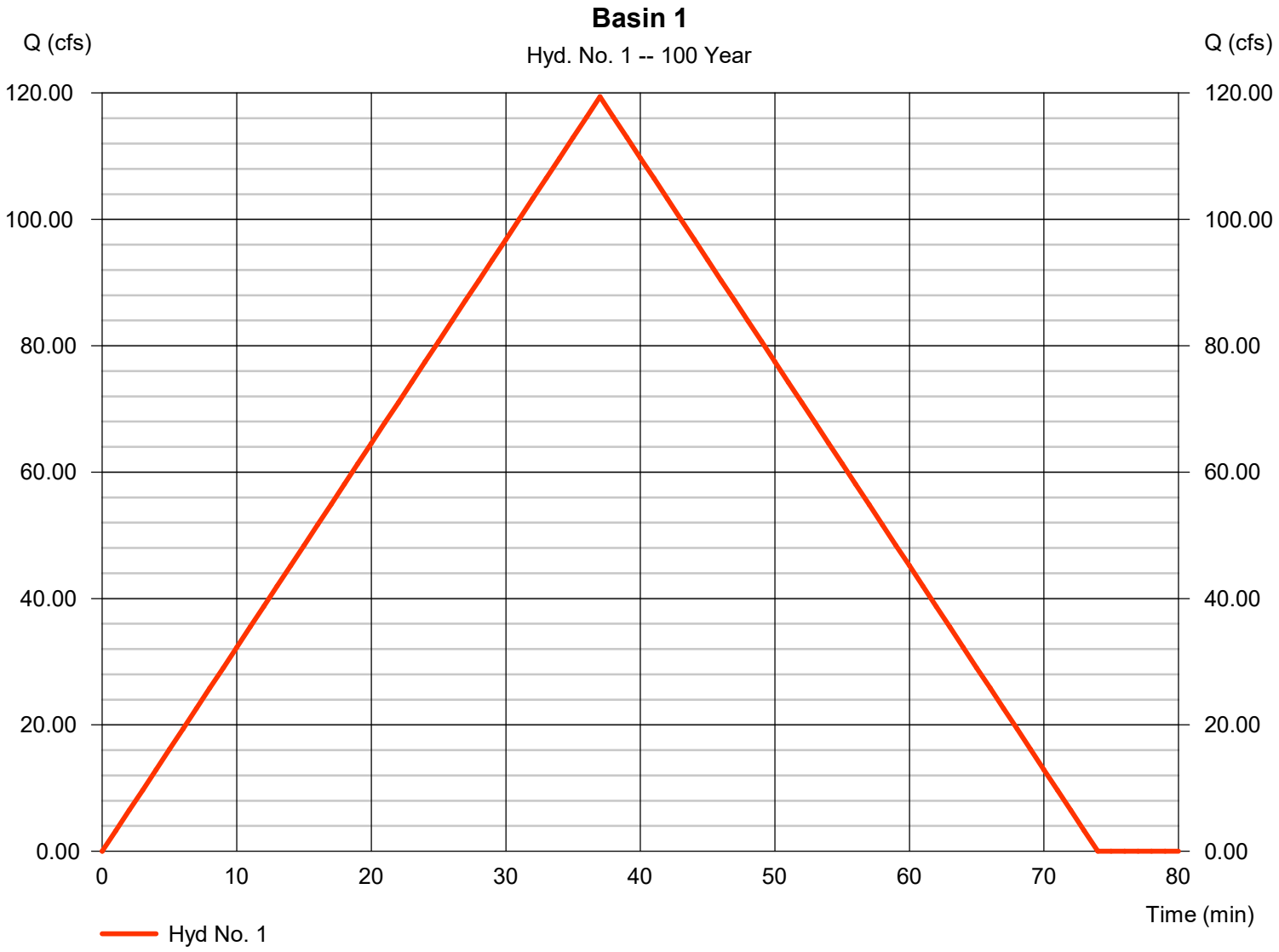
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	Rational	119.42	1	37	6.086	------	------	------	Basin 1
2	Rational	41.16	1	41	2.324	------	------	------	Basin 2
3	Rational	211.73	1	37	10.791	------	------	------	Basin 3
4	Rational	214.95	1	37	10.955	------	------	------	Basin 1-Mining
5	Rational	74.08	1	41	4.184	------	------	------	Basin 2-Mining
6	Rational	381.11	1	37	19.423	------	------	------	Basin 3-Mining

Hydrograph Report

Hyd. No. 1

Basin 1

Hydrograph type	=	Rational	Peak discharge	=	119.42 cfs
Storm frequency	=	100 yrs	Time to peak	=	37 min
Time interval	=	1 min	Hyd. volume	=	6.086 acft
Drainage area	=	60.800 ac	Runoff coeff.	=	0.5
Intensity	=	3.928 in/hr	Tc by TR55	=	37.00 min
IDF Curve	=	Ft Lupton.IDF	Asc/Rec limb fact	=	1/1

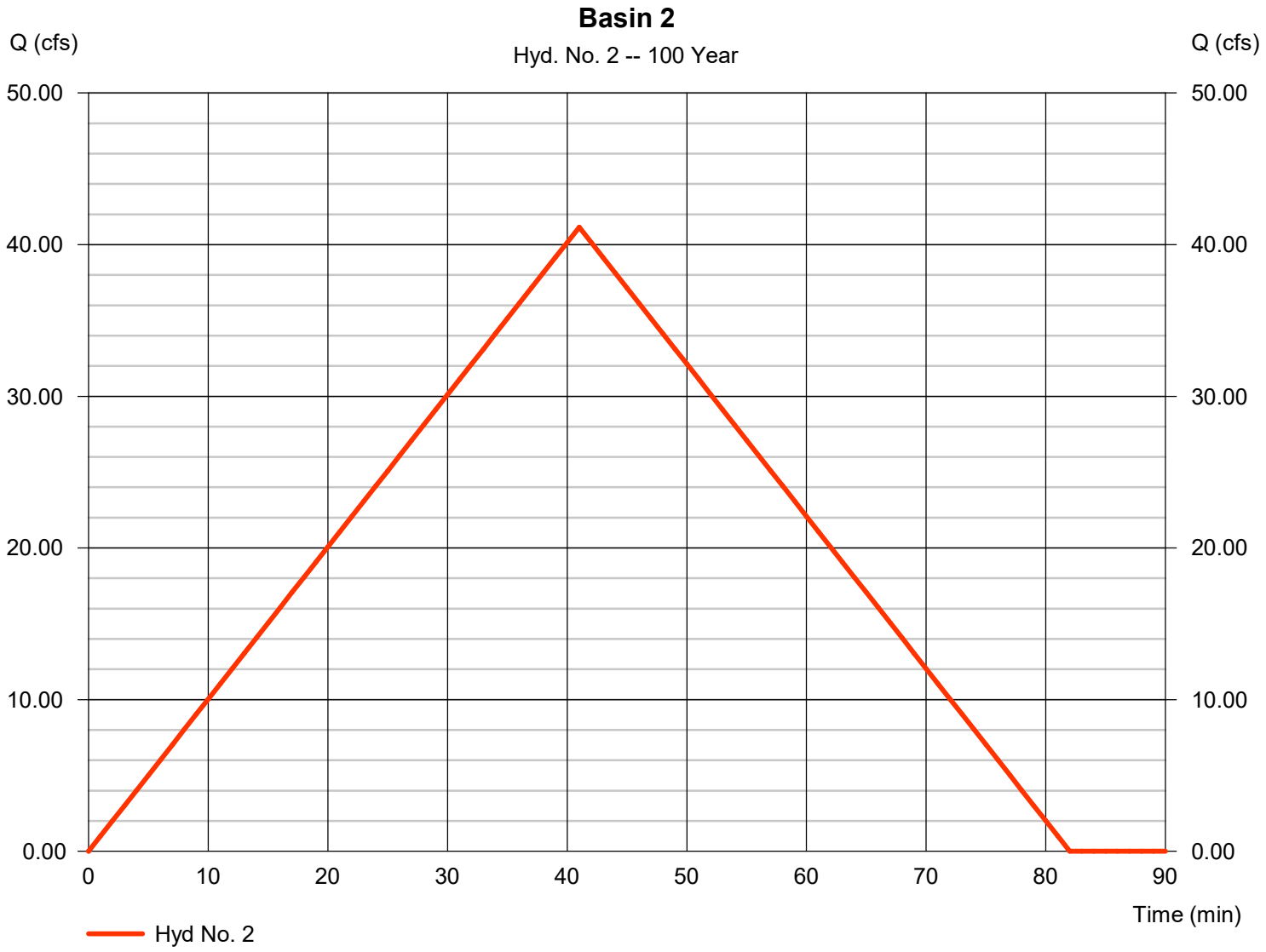


Hydrograph Report

Hyd. No. 2

Basin 2

Hydrograph type	=	Rational	Peak discharge	=	41.16 cfs
Storm frequency	=	100 yrs	Time to peak	=	41 min
Time interval	=	1 min	Hyd. volume	=	2.324 acft
Drainage area	=	22.400 ac	Runoff coeff.	=	0.5
Intensity	=	3.675 in/hr	Tc by TR55	=	41.00 min
IDF Curve	=	Ft Lupton.IDF	Asc/Rec limb fact	=	1/1

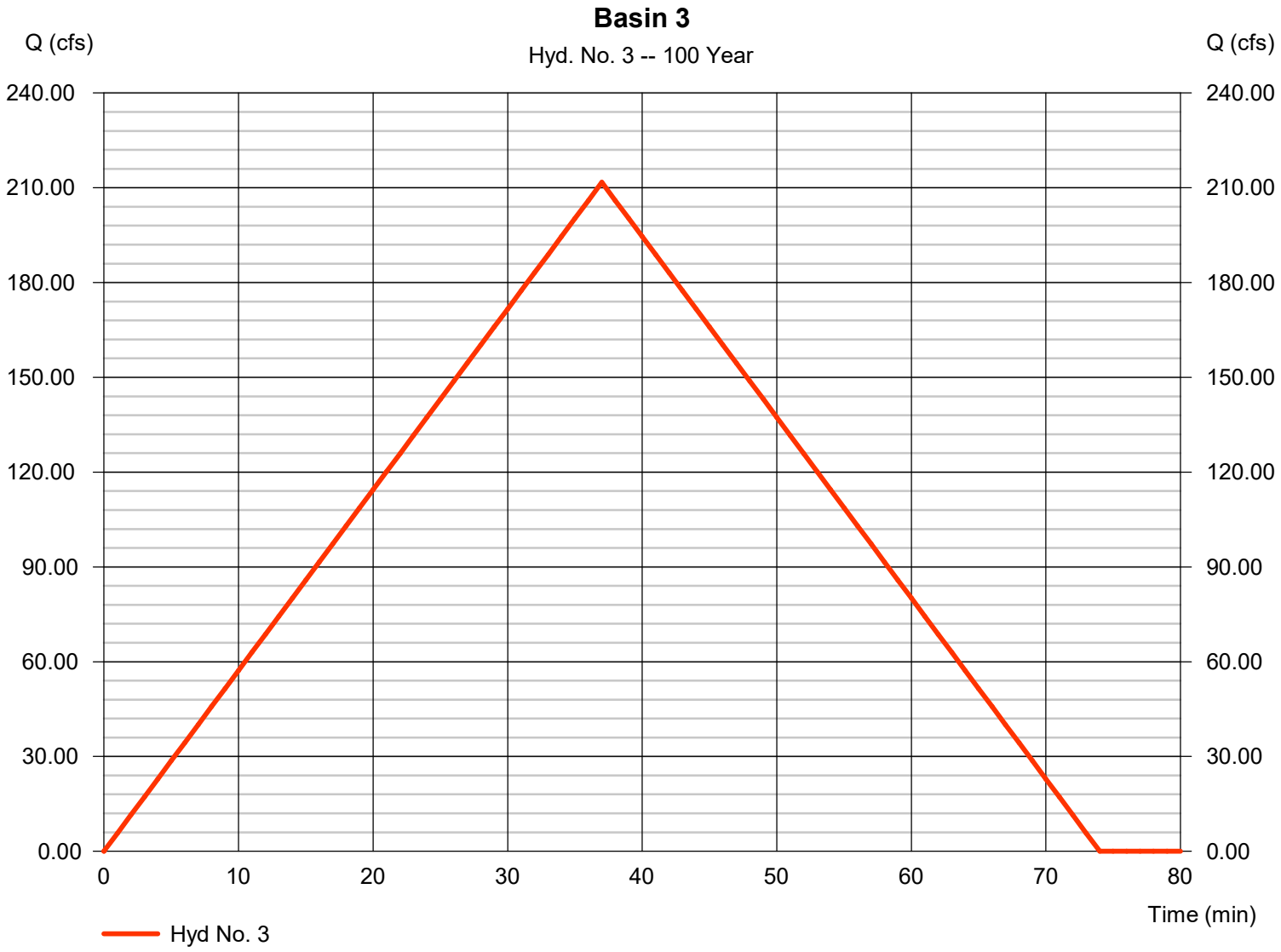


Hydrograph Report

Hyd. No. 3

Basin 3

Hydrograph type	=	Rational	Peak discharge	=	211.73 cfs
Storm frequency	=	100 yrs	Time to peak	=	37 min
Time interval	=	1 min	Hyd. volume	=	10.791 acft
Drainage area	=	107.800 ac	Runoff coeff.	=	0.5
Intensity	=	3.928 in/hr	Tc by TR55	=	37.00 min
IDF Curve	=	Ft Lupton.IDF	Asc/Rec limb fact	=	1/1

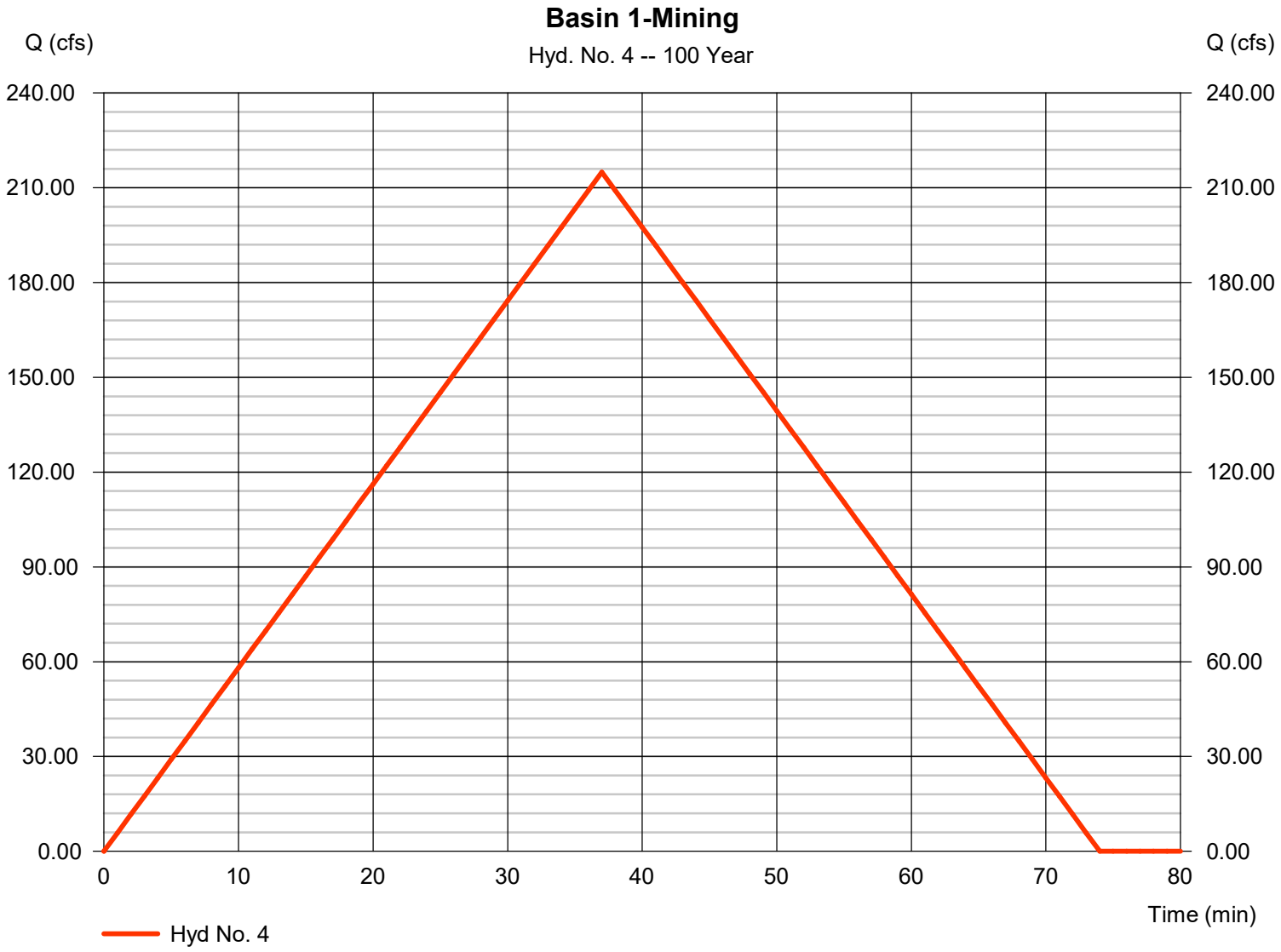


Hydrograph Report

Hyd. No. 4

Basin 1-Mining

Hydrograph type	= Rational	Peak discharge	= 214.95 cfs
Storm frequency	= 100 yrs	Time to peak	= 37 min
Time interval	= 1 min	Hyd. volume	= 10.955 acft
Drainage area	= 60.800 ac	Runoff coeff.	= 0.9
Intensity	= 3.928 in/hr	Tc by TR55	= 37.00 min
IDF Curve	= Ft Lupton.IDF	Asc/Rec limb fact	= 1/1

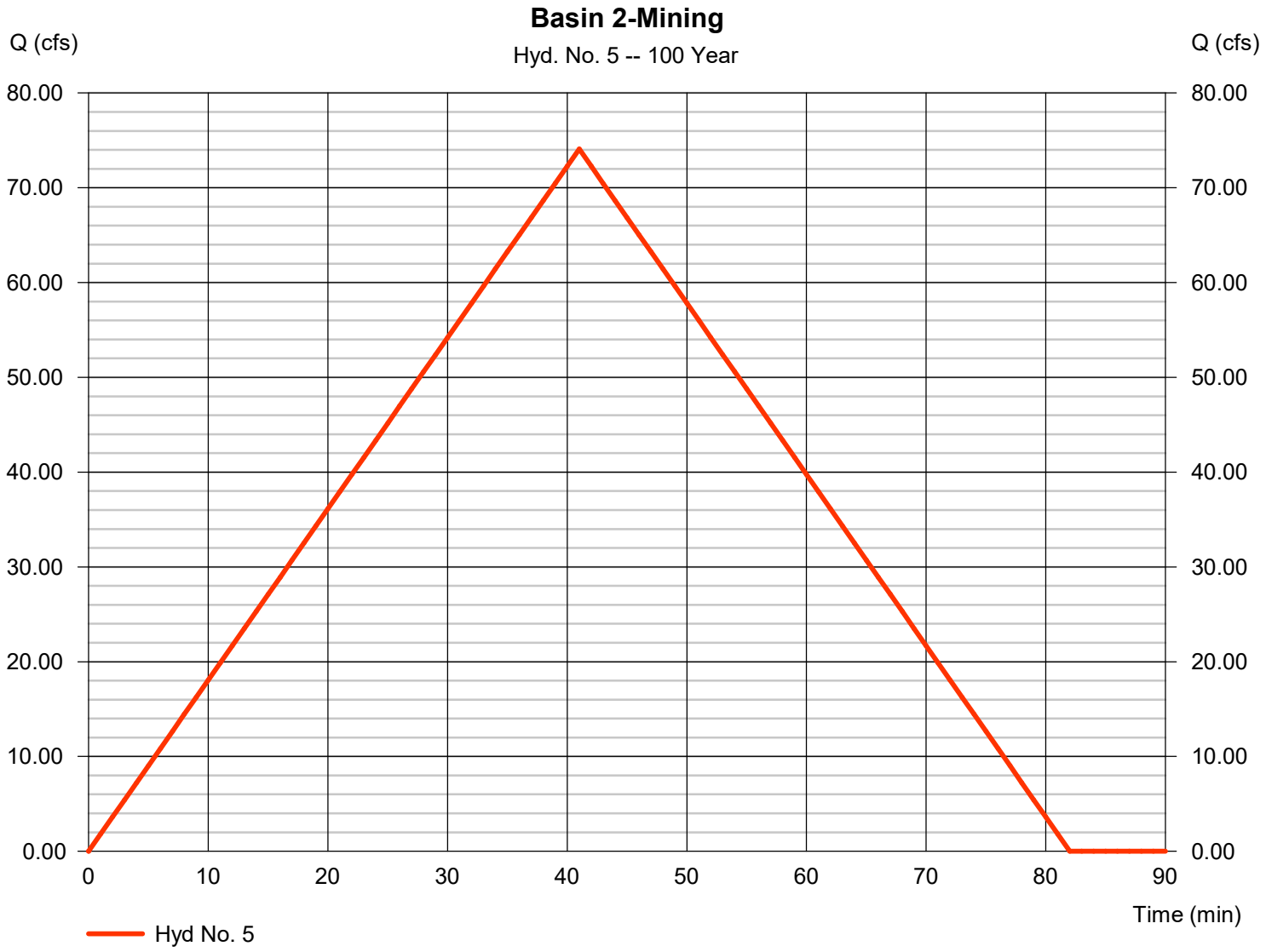


Hydrograph Report

Hyd. No. 5

Basin 2-Mining

Hydrograph type	= Rational	Peak discharge	= 74.08 cfs
Storm frequency	= 100 yrs	Time to peak	= 41 min
Time interval	= 1 min	Hyd. volume	= 4.184 acft
Drainage area	= 22.400 ac	Runoff coeff.	= 0.9
Intensity	= 3.675 in/hr	Tc by TR55	= 41.00 min
IDF Curve	= Ft Lupton.IDF	Asc/Rec limb fact	= 1/1

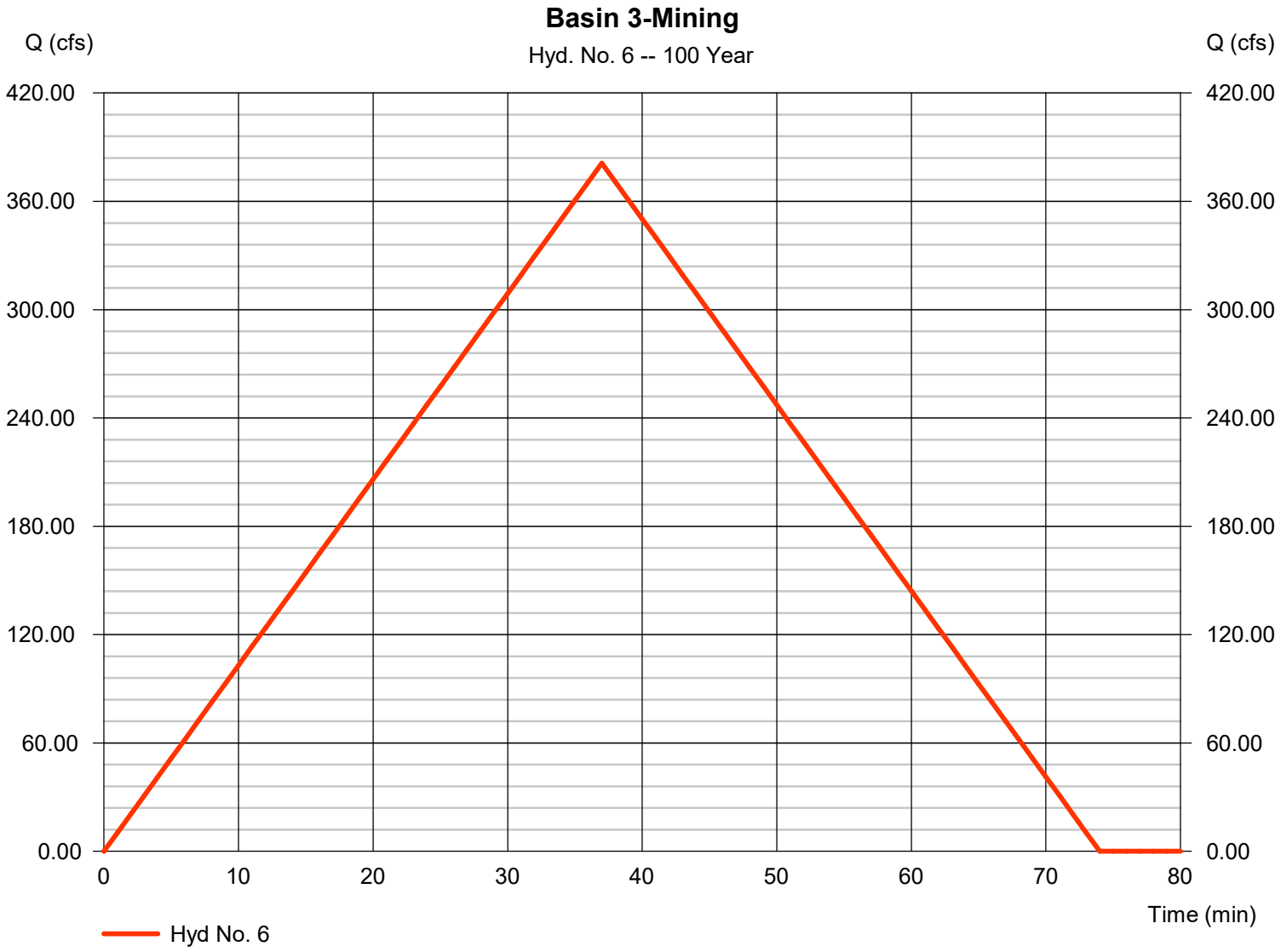


Hydrograph Report

Hyd. No. 6

Basin 3-Mining

Hydrograph type	=	Rational	Peak discharge	=	381.11 cfs
Storm frequency	=	100 yrs	Time to peak	=	37 min
Time interval	=	1 min	Hyd. volume	=	19.423 acft
Drainage area	=	107.800 ac	Runoff coeff.	=	0.9
Intensity	=	3.928 in/hr	Tc by TR55	=	37.00 min
IDF Curve	=	Ft Lupton.IDF	Asc/Rec limb fact	=	1/1



Pond Report - Storage Above Water Level

Pond No. 1 - Pod 1

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 4870.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	4870.00	1,629,710	0.000	0.000
5.00	4875.00	1,706,216	191.456	191.456

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .000	.000	.000	n/a
Orifice Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	4870.00	---	---	---	---	---	---	---	---	---	---	0.000
5.00	191.456	4875.00	---	---	---	---	---	---	---	---	---	---	0.000

Pond Report - Storage Above Water Level

Pond No. 3 - Pod 2

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 4814.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	4814.00	598,195	0.000	0.000
5.00	4819.00	648,614	71.557	71.557

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .000	.000	.000	n/a
Orifice Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	4814.00	---	---	---	---	---	---	---	---	---	---	0.000
5.00	71.557	4819.00	---	---	---	---	---	---	---	---	---	---	0.000

Pond Report - Storage Above Water Level

Pond No. 2 - Pod 3

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 4824.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	4824.00	1,164,467	0.000	0.000
5.00	4829.00	1,393,906	146.830	146.830

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .000	.000	.000	n/a
Orifice Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	4824.00	---	---	---	---	---	---	---	---	---	---	0.000
5.00	146.830	4829.00	---	---	---	---	---	---	---	---	---	---	0.000

Appendix G-2 Groundwater Quality Monitoring Plan

Table of Contents

Groundwater Quality Monitoring Plan

This groundwater quality monitoring plan will be implemented at the Ewing Gravel Pit located in Weld County, just north of Fort Lupton, Colorado. This plan outlines the methods that the mine operator will follow to protect and monitor the integrity of the local groundwater quality and quantity. This plan is intended to meet the requirements of the Division of Reclamation, Mining, and Safety (DRMS) Mineral Rules and Regulations Rule 3.1.7(7)(b) and the Colorado Department of Public Health & Environment (CDPHE) Regulation No. 41. The Ewing site is not located on any classified areas regarding groundwater; therefore, the statewide regulations (CDPHE Regulation 41) will be followed.

This monitoring plan requires the collection of pre-operational groundwater data that will be used as the baseline data to compare to the results of continued long-term groundwater monitoring. At least five quarters of monitoring data will be collected prior to operations commencing onsite. Continued monitoring will take place during operations. Results of this monitoring will be used to evaluate if any adverse impacts on groundwater have taken place as a result of the Ewing gravel mining operations.

The Ewing Gravel Pit will create three slurry wall encased water storage reservoirs (Map F-1). Initial dewatering of the mining pods following slurry wall installation will be via CDPHE approved discharge outfalls. There will be no ongoing interaction between mining operations and the local groundwater. The presence of slurry walls may impact local groundwater levels through mounding or shadow affects during mining and following reclamation. Based on these conditions, sampling of water chemistry at the Ewing Gravel Pit will be conducted on a quarterly basis. Sampling of water levels in the piezometers onsite will take place weekly.

1. Sampling Methods

This section defines the locations and type of groundwater sampling that will take place at the Ewing Gravel Pit.

1.1. Sampling Location

Water quality sampling will take place from three locations prior to mining operations to establish baseline conditions. Once mining has begun, chemistry will only be sampled for at GW-2, the compliance monitoring point as it is down gradient of the mining areas within the groundwater aquifer. Each sample point can be seen on Map C-1 and on Figure 1. Each sample point consists of a CDWR approved well and will be sampled over a period of at least 5 quarters in advance of mining.

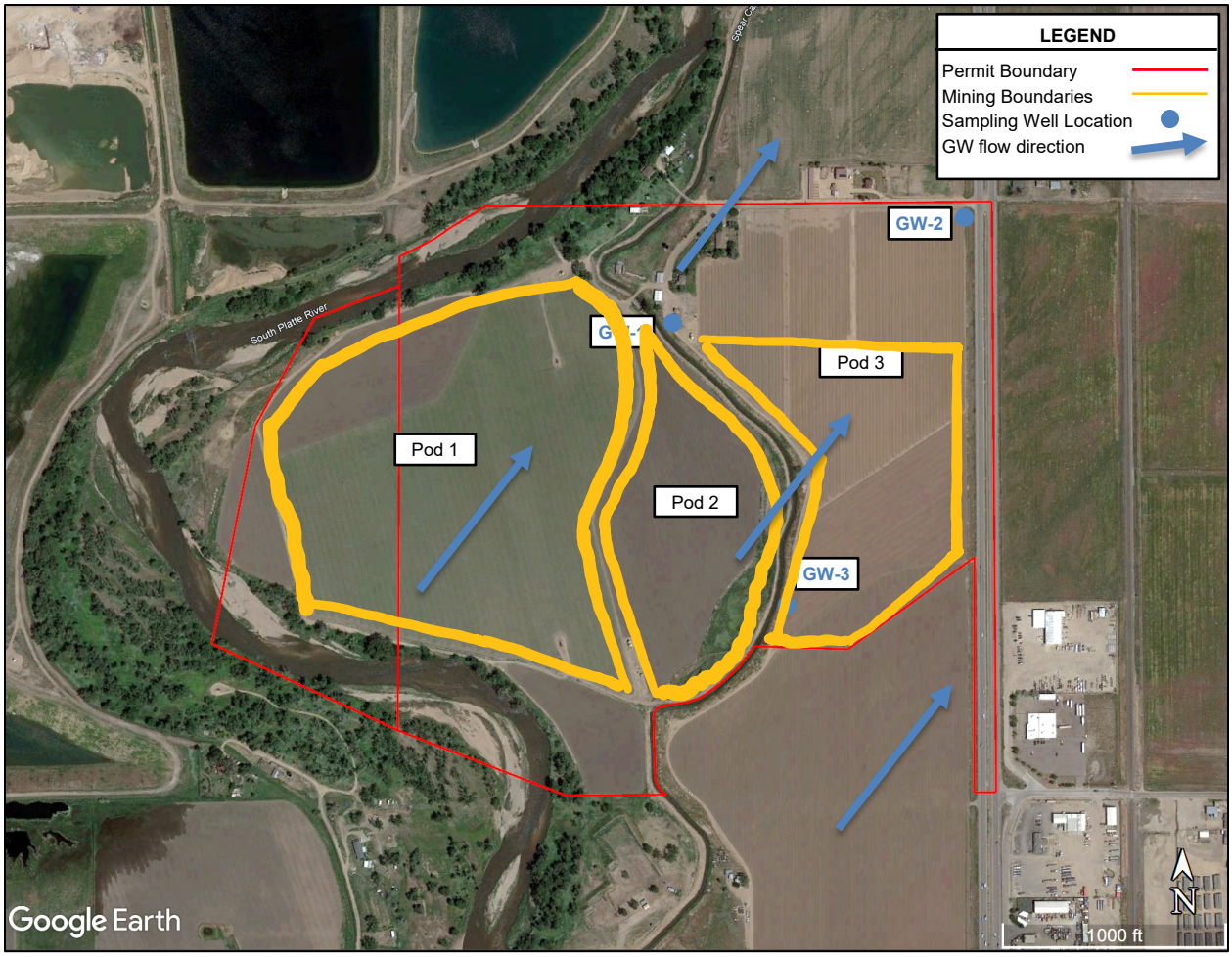


Figure 1 – Groundwater Sampling Location

1.2. Sampling Frequency

Baseline groundwater sampling will begin at least five quarters in advance of mining at the Ewing Gravel Mine. One sample per quarter will be taken at each of the groundwater sampling locations to define the baseline conditions of groundwater.

1.3. Sampling Parameters

BURNCO will perform field and laboratory analysis of their samples for the water quality parameters identified in Table 1. These parameters are those listed in Tables 1-4 of the CDPHE Regulation 41 for Domestic Water Supply, Agricultural Standards, and TDS Water Quality Standards. All laboratory analysis of the groundwater samples will be performed by a State of Colorado certified laboratory that follows industry standards and quality assurance/quality control (QA/QC) procedures.

Table 1 – Water Quality Parameters

Parameter		Phase	Units
	Aluminum	Dissolved & Total	mg/L
	Antimony	Dissolved	mg/L
	Arsenic	Dissolved & Total	mg/L
	Barium	Dissolved	mg/L
	Beryllium	Dissolved	mg/L
	Boron	Dissolved	mg/L
	Bicarbonate	Total	mg/L as $CaCO_3$
	Carbonate	Total	mg/L as $CaCO_3$
	Calcium as $CaCO_3$	Dissolve	mg/L
	Cadmium	Dissolved & Total	mg/L
	Chromium	Dissolved	mg/L
	Chloride	Dissolved	mg/L
	Cobalt	Dissolved	mg/L
	Conductivity	Field	umhos/cm
	Copper	Dissolved & Total	mg/L
	Cyanide	Total & WAD	mg/L
	Fluoride	Dissolved	mg/L
	Hydroxide	Total	mg/L as $CaCO_3$
	Iron	Dissolved & Total	mg/L
	Lead	Dissolved & Total	mg/L
	Lithium	Dissolved	mg/L
	MBAS	Lab	mg/L
	Manganese	Dissolved	mg/L
	Mercury	Dissolved & Total	mg/L
	Molybdenum	Dissolved & Total	mg/L
	Nickel	Dissolved	mg/L
	Nitrate	Dissolved	mg/L as N
	Nitrite	Dissolved	mg/L as N
	Total Dissolved Solids	Dissolved	mg/L
	Total Alkalinity	Total	mg/L as $CaCO_3$
	Total Nitrate + Nitrite	Dissolved	mg/L as N
	pH	Field & Lab	N/A
	Phenol - Total	Lab	Ug/L
	Selenium	Dissolved	mg/L
	Silver	Dissolved	mg/L
	Sulfate	Dissolved	mg/L
	Temperature	Field	°C
	Thallium	Dissolved	mg/L
	Uranium	Dissolved	mg/L
	Vanadium	Dissolved	mg/L
	Zinc	Dissolved & Total	mg/L
	Dissolved Oxygen	Field	mg/L

1.4. Sampling Procedure

The following protocol will be used for the collection and testing of water samples:

1) Specific bottles will be ordered from an appropriate laboratory which will be used for collecting water samples.
2) The static water level of the groundwater well will be measured and recorded using a water level well sounder prior to pumping of the well. The measurement location at the top edge of the well casing will be marked with a permanent ink pen. This mark will be touched up with fresh ink each time a sample is taken
3) The contents of the well will be purged prior to sample collection using a low-flow, submersible pump. This pump will be cleaned prior to being placed in the well. At least three well volumes will be removed prior to sampling.
4) The following field measurements will be taken with cleaned and calibrated meters:
    a. pH
    b. Temperature
    c. Dissolved Oxygen
    d. Conductivity
5) Water will be pumped from the well into a clean pitcher or bottle which will be used to fill the bottles from the laboratory. The bottles will be marked with the date, time, and site location of the sample as well as the person who collected the sample. If a pump controller system is used, the sample bottles may be filled directly from the well. Filled sample bottles with then be places in a cooler with ice.
6) A chain of custody will be completed for the sample which indicates what analyses need to be performed, the date and time of sampling, sample identification, and who assembled the sample. The samples will be delivered to the lab the day of collection.

2. Analytical Procedures

The results from the analytical water quality testing will be evaluated through comparison with the State groundwater quality standards. The Ewing Gravel Mine is not within any WQCC specified areas that would require conformance with anything other than statewide water quality standards.

2.1. State Water Quality Standards

The analytical results of water quality testing during mining will be compared to the regulatory limits established by Water Quality Control Commission (WQCC). The groundwater of the Ewing Gravel Mine is subject to the statewide groundwater quality standards as defined in Tables 1-4 of the WQCC Regulation 41. The site is not within any specified areas identified by the WQCC to have specific groundwater quality standards. If any exceedances of these standards are detected during mining at the Ewing Gravel Mine, the DRMS will be notified in accordance with Rule 3.1.7(9) and BURNCO will initiate a water quality mitigation plan as described below.

2.2. Reporting

Baseline water quality data will be reported to CDRMS prior to operations. Groundwater levels in the piezometers along the river will be reported in comparison to both pre mine levels and target levels from the groundwater model.

3. Sampling Quality Assurance Project Plan (QAPP)

BURNCO's quality assurance methods for water sampling includes only using Colorado State certified laboratories with an industry standard Quality Assurance/ Quality Control plan in place. On site quality assurance for field sampling is included in the Sampling Procedure described in Section 1.4. Certain steps of the procedure such as clearing three well volumes before sampling and using cleaned and calibrated testing equipment help to ensure that the testing results are accurate and free of altering contaminants. Any samples that are collected will include information on who took the sample, when it was taken, sample identification, and the chain of custody.

Baseline Groundwater Quality Data

	Date											
	GW-1				GW-2				GW-3			
Parameter, Limit	**9/28/2022**	**2/8/2023**	**3/30/2023**	**6/29/2023**	**9/28/2022**	**2/8/2023**	**3/30/2023**	**6/29/2023**	**9/28/2022**	**2/8/2023**	**3/30/2023**	**6/29/2023**
Dissolved												
Aluminum	0	0.002	0	0.003	0	0.006	0.002	0.005	0	0.003	0.006	0.003
Antimony	0	0	0	0	0	0	0	0	0	0	0	0
Arsenic	0.0018	0.0008	0.0006	0	0	0	0	0	0	0	0	0
Beryllium	0	0	0	0	0	0	0	0	0	0	0	0
Boron	0.22	0.22	0.35	0.25	0.24	0.24	0.3	0.31	0.21	0.16	0.21	0.23
Cadmium	0.0001	0.0002	0	0.0001	0	0.0002	0.0002	0.0002	0.0002	0.0001	0	0.0001
Chromium	0	0	0	0	0	0	0	0	0	0	0	0
Cobalt	0.0004	0.0008	0.0011	0.0016	0.0009	0.001	0.001	0.0009	0.0066	0.0058	0.0057	0.0078
Copper	0.0062	0.0015	0.0017	0.002	0.0008	0.0009	0.0008	0.0008	0.0025	0.0022	0.002	0.0029
Fluoride		1.52	1.5		1.58	1.69	1.64		1.24	1.32	1.26	
Iron	0.007	0.027	0.012	0	0	0	0	0	0	0	0	0.012
Lead	0	0	0	0	0	0	0	0	0	0	0	0.0001
Manganese	0.0011	0.057	0.0649	0.1023	0.5706	1.1	0.9947	0.9991	0.001	0.0044	0.0051	0.0042
Mercury		0	0	0		0	0	0		0	0	0
Molybdenum	0.0061	0.0039	0.0038	0.0037	0.0085	0.0058	0.0053	0.0042	0.0032	0.0036	0.0038	0.0033
Nickel	0.0023	0.003	0.003	0.0038	0.0033	0.0032	0.0031	0.0029	0.0052	0.0052	0.0046	0.0054
Selenium	0	0.0015	0	0	0.0073	0.0096	0.0112	0.0101	0	0	0	0
Silver	0	0	0	0	0	0	0	0	0	0	0	0
Thallium	0	0	0	0	0	0	0	0	0.0002	0	0	0
Uranium	0.0084	0.0167	0.0094	0.0097	0.0219	0.0398	0.0366	0.0338	0.0069	0.0082	0.0082	0.02
Vanadium	0.001	0	0	0	0	0	0	0	0	0	0	0
Zinc	0.001	0	0.001	0.001	0	0	0	0	0.001	0	0	0
Total												
Aluminum	0.014	0.014	0.005	0.003	3.21	0.392	0.867	0.522	0.005	0.088	1.17	0.036
Arsenic	0.002	0.0011	0.0006	0	0.0015	0	0.0007	0.0006	0	0	0.0009	0
Barium	0.0941	0.0899	0.078	0.0686	0.1106	0.0386	0.0568	0.049	0.0528	0.0529	0.0948	0.0625
Cadmium	0.0002	0.0002	0	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001
Calcium as CaCO3	176	11.74	203		346	302	328		208	222	245	
Copper	0.0083	0.0035	0.002	0.0023	0.0064	0.0015	0.0027	0.0021	0.0027	0.0023	0.0049	0.0036
Iron	0.322	0.263	0.071	0.16	4.96		1.72	1.03	0.005	0.056	1.85	0.031
Lead	0.0006	0.0004	0	0	0.0054	0.0003	0.001	0.0011	0.0001	0.0001	0.0015	0.0002
Mercury	0	0	0	0	0	0	0	0	0	0	0	0
Molybdenum	0.007	0.0044	0.0038	0.0038	0.0085	0.0061	0.0061	0.0046	0.0036	0.0038	0.0044	0.0037
Zinc	0.002	0.005	0.002	0.002	0.018	0.003	0.007	0.004	0.001	0	0.009	0.002
Field												
Dissolved Oxygen		0.0033	0.001	0.69	2.75	0.0219	12.8		0.9	0	12.0	

	Date											
	GW-1				GW-2				GW-3			
Parameter, Limit	**9/28/2022**	**2/8/2023**	**3/30/2023**	**6/29/2023**	**9/28/2022**	**2/8/2023**	**3/30/2023**	**6/29/2023**	**9/28/2022**	**2/8/2023**	**3/30/2023**	**6/29/2023**
Electroconductivity		0.0073	0.0032	1180	893	0	19.5		771	7.27	16.0	
pH	6.92	0	0.0052	7.16	7.8	0	18.7		7.4	7.27	10.2	
Temperature	20	0.0085	0	19.4	15.5	0	8.5		17.8	0.24	7.5	
Water Depth		21.2	19.9803156	17.0931764	19.4	23.3	20.013124		19.3	23.3	20.669292	

Appendix G-3 Groundwater Model

MEMORANDUM

TO: Mr. Jaimie Addy
U.S. Land and Resource Supervisor
BURNCO, Ltd
10100 Dallas Street
Henderson, Colorado 80640

FROM: Kurt Zeiler

RE: Ewing Gravel Pit Proposed Slurry Wall Groundwater Model

INTRODUCTION

Following completion of mining activities, BURNCO, Ltd (BURNCO) is proposing to construct two water storage reservoirs at the Ewing Gravel Mine north of Fort Lupton, Colorado (Figure 1). Slurry walls will be installed around each of the proposed reservoirs located east of the South Platte River, and the walls will be keyed into the underlying relatively impermeable bedrock.

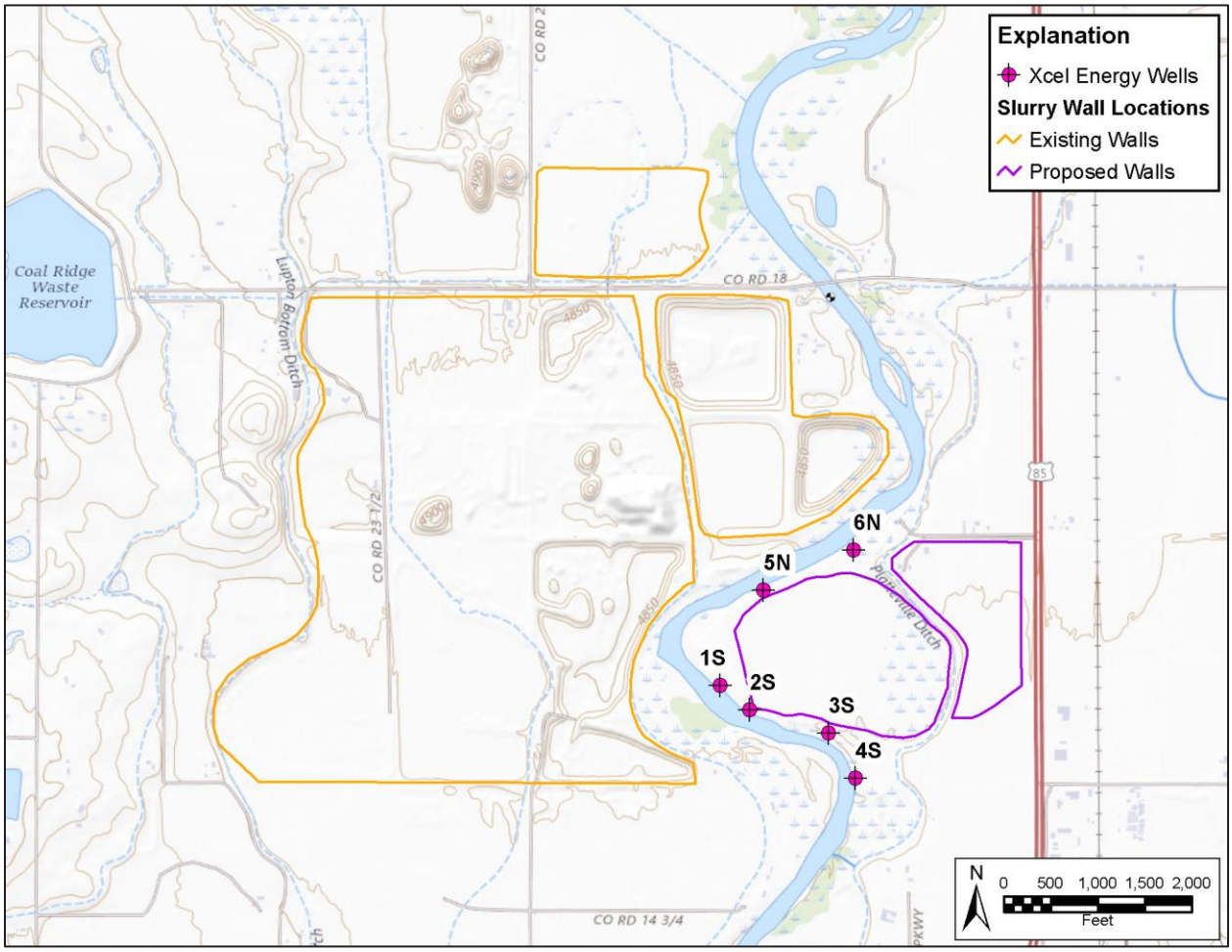


Figure 1. Ewing Gravel Mine Location Map

On the west side of the river, the Fort Lupton Sand and Gravel Mine has already installed water storage reservoirs with slurry walls. The presence of slurry walls in introduces an impedance to groundwater flow in the alluvial aquifer associated with the South Platte River and impacts groundwater levels in the aquifer. Additionally, Xcel Energy (Xcel) owns and operates six alluvial groundwater wells in the immediate vicinity of the proposed slurry walls, and the ability of these wells to extract groundwater could be impacted by the installation of these walls. Xcel provided daily groundwater pumping data for the six wells for January 2017 through October 2022, indicating that the maximum daily pumping rate was 2,554 gpm (Xcel, 2023).

The South Platte Decision Support System (SPDSS) Alluvial Groundwater Model (model) is a MODFLOW-based planning-level groundwater modeling tool that simulates the effects of regional hydrologic drivers such as groundwater pumping and recharge on the alluvial aquifer and streamflows of the South Platte River and tributaries (CDM-Smith, 2013; Brown and Caldwell, 2017). The SPDSS model was developed for the Colorado Division of Water Resources (DWR) and Colorado Water Conservation Board (CWCB) and is publicly available from the DWR/CWCB Decision Support System website. As described in Brown and Caldwell (2017), this version of the model simulates the period 1950 through 2012 with monthly stress periods, which includes a broad range of hydrologic and climatic conditions.

The SPDSS model has been used to previously perform a screening-level assessment of the potential impacts to the aquifer from the presence of slurry walls for water storage reservoirs (Zeiler and Lindburg, 2017). This study indicated that the Horizontal Flow Barrier (HFB) package of the MODFLOW family of groundwater modeling codes provides a mechanism to simulate slurry walls in the South Platte River alluvial aquifer, including demonstrating effects on groundwater levels observed in piezometers near slurry walls. These effects include increases in groundwater levels upgradient of slurry walls (“mounding”) and decreases in levels downgradient of slurry walls (“shadowing”), owing to the barriers to groundwater flow presented by the walls. This study also noted that the SPDSS model grid with model cell sizes of 1,000’ by 1,000’ feet (ft) laterally should be spatially refined to more accurately represent the impacts of the irregular shapes of these walls installed around reservoirs at former gravel mines (Hsieh and Freckleton, 1993).

As described below, GSI Environmental Inc. (GSI) has used a modified version of SPDSS model to predict the potential impacts of the Ewing Gravel Mine proposed water storage reservoirs’ slurry walls on groundwater levels in the South Platte River alluvial aquifer and the ability of the Xcel pumping wells to extract groundwater in sufficient rates.

GROUNDWATER MODELING METHODOLOGY

The current publicly available version of the SPDSS model is constructed using the MODFLOW-NWT code which provided improved simulation of unconfined aquifers, but only the ability to use a structured model grid, which is cumbersome to spatially refine around local features of interest (Niswonger et al., 2011). MODFLOW-USG is a newer version of MODFLOW that incorporates similar techniques as MODFLOW-NWT, but additional facilitates the use of unstructured model grids that can be efficiently spatially refined around localized aquifer features such as rivers, wells, and slurry walls (Panday et al., 2013). The SPDSS model was converted to MODFLOW-USG to allow for refinement of the model grid to the existing Fort Lupton Sand and Gravel Mine and Ewing Gravel Mine proposed slurry walls, the Xcel wells, and the South Platte River. The specific version of the MODFLOW-USG code chosen was USG-Transport because this version continues to have ongoing development and maintenance by GSI through Dr. Sorab Panday, the primary author of

the original MODFLOW-USG code (Panday, 2023). Note that the USG-Transport executable, source code files, and documentation are made freely available through the GSI website.

The most recent update to the DWR/CWCB SPDSS model included incorporation of the Partition Stress Boundary (PSB) capability into the MODFLOW-NWT source code (Banta, 2011; Brown and Caldwell, 2017). The PSB capability allows MODFLOW to separately input, track, and output data for different water budget components normally requiring a single MODFLOW package. PSB allows separation of groundwater pumping for agricultural irrigation from pumping for municipal/industrial uses and separation of recharge originating as precipitation vs. irrigation return flows or other sources. The PSB capability was added to the USG-Transport source code for this project and will be made available publicly in a future release of USG-Transport.

The MODFLOW-NWT model uses a structured model grid of 1,000-ft by 1,000-ft rectangular cells organized by rows and columns. For this project, this structured model grid was converted to an unstructured model grid organized by model cell connections but initially without spatial refinement, i.e., retaining a model cell size of 1,000-ft by 1,000-ft. The remaining original model input files were converted to the MODFLOW-USG unstructured grid formats primarily using a series of Python scripts. This resulting model without spatial refinement was then executed to confirm that it produced nearly identical results to the original MODFLOW-NWT model.

This unrefined unstructured model grid was then spatially refined in the vicinity of Fort Lupton Sand and Gravel Mine and proposed Ewing Gravel Mine using the GRIDGEN computer program designed to facilitate construction of spatially variably refined model grids for MODFLOW-USG and other numerical models (Lien et al., 2014). The unstructured grid was refined around the slurry walls, Xcel Wells, and the South Platte River. This spatial refinement to the model grid produced an unstructured grid with model cell sizes ranging from the original 1,000-ft by 1,000-ft outside the area of refinement down to 31.25-ft by 31.25-ft for the Xcel wells and the slurry walls. GRIDGEN uses a method known as quadtree smoothing to efficiently reduce model cell sizes in a manner that is numerically stable to run in the model. The model input files were then converted to the refined grid cells using Python scripts (Figure 2). This resulting refined grid model was then executed to confirm that it produced results comparable to the unrefined grid model.

This refined grid model was then used to predict the potential impacts of the proposed Ewing Gravel Mine slurry walls on the alluvial aquifer groundwater levels and the ability of the Xcel pumping wells to extract groundwater in sufficient rates. The model simulations included the full 1950-2012 period of hydrologic conditions. Two project-specific components were added to this version of the model for all simulations performed as part of this analysis.

First, slurry walls were added to the model using the HFB package, which adds a resistance to flow between 2 model cells calculated as the hydraulic conductivity (K) of the barrier (i.e., slurry wall) multiplied by the thickness of the barrier (Hsieh and Freckleton, 1993). The input value of K for the slurry walls was selected to be 1.0×10^{-8} centimeters/second (cm/s) (2.83×10^{-5} ft/day), based on a reported slurry wall K maximum value of 1.0×10^{-7} cm/s (2.83×10^{-4} ft/day) and reducing that by one order of magnitude (Andromalos et al, n.d.). The input value of slurry wall thickness was assumed to be 3 feet. An additional scenario was simulated for the Ewing Gravel Mine slurry walls in which the K value was assumed to be an additional order of magnitude lower, or 1.0×10^{-9} cm/s (2.83×10^{-6} ft/day).

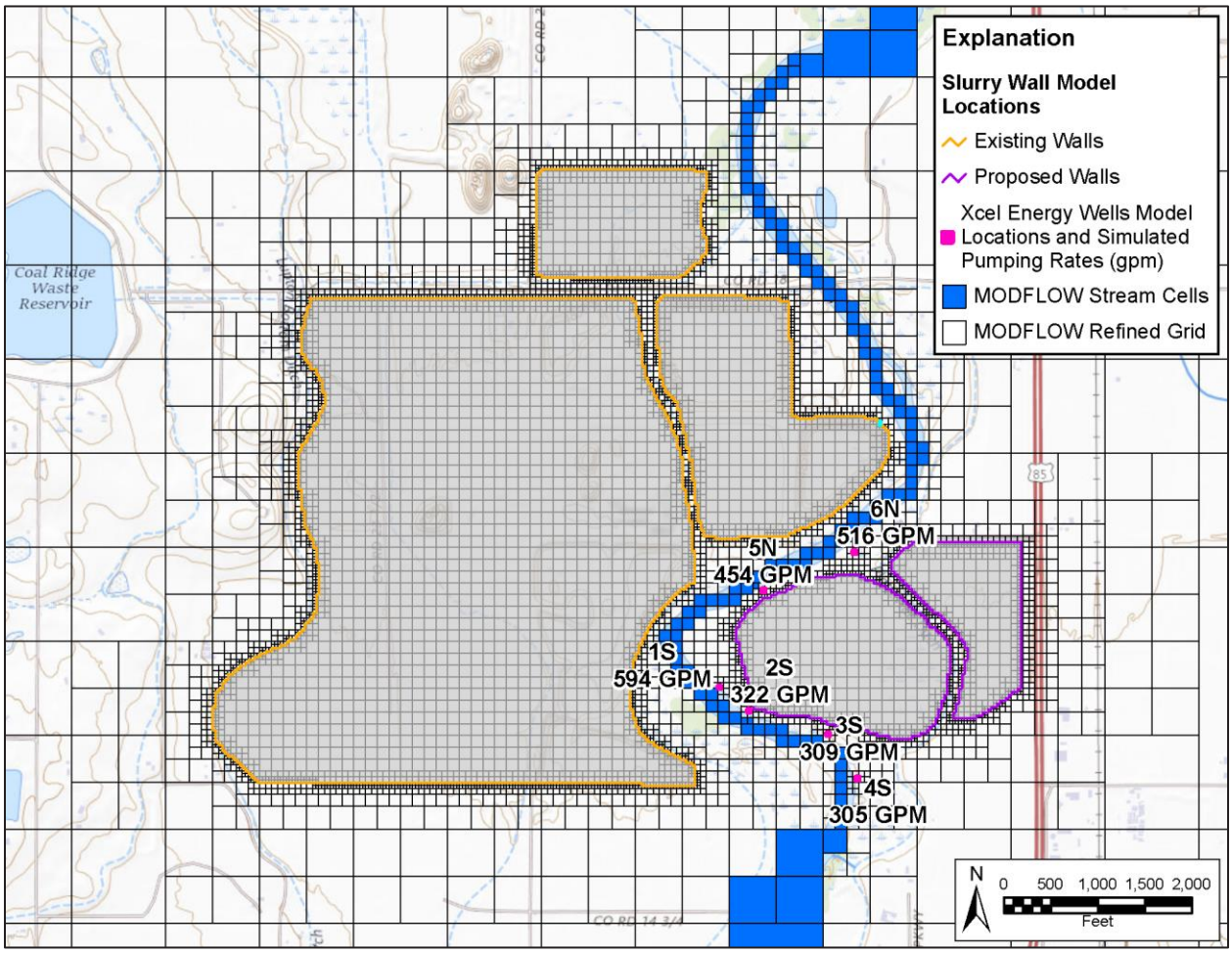


Figure 2. Refined Grid Model Construct Map

Second, the Xcel wells were simulated to pump a total of 2,500 gallons per minute (gpm) (near the provided 2017-2022 maximum total pumping rate) constantly throughout the 1950-2012 model period. This total pumping rate is nearly double the 2017-2022 average rate of approximately 1,258 gpm, and as such is conservative. The portion of the 2,500-gpm total pumping rate at each of the six wells was apportioned relative to the reported individual maximum pumping rates at each well for the 2017-2022 period. The modeling analysis included three model simulations:

1. **Baseline** – Simulation with the Xcel wells extracting a constant 2,500 gpm and the existing Fort Lupton Sand and Gravel slurry walls.
2. **Ewing Gravel Mine Slurry Walls** – Same as the baseline simulation, but also including the proposed Ewing Gravel Mine slurry walls with the base assumption of slurry wall K value of 1.0×10^{-8} cm/s.
3. **Ewing Gravel Mine Slurry Walls, Low K** – Same as the previous simulation, but with the Ewing Gravel Mine slurry wall K value reduced by one order of magnitude to 1.0×10^{-9} cm/s to assess the potential sensitivity of the model results to the input slurry wall K value.

The Xcel wells' constant pumping rate of 2,500 gpm would provide a maximum realistic condition to show a negative potential impact from the slurry walls on groundwater-water levels. and in turn on the ability of the Xcel wells to pump at those rates.

RESULTS

The Xcel wells were simulated to achieve their full combined extraction rate of 2,500 gpm with no simulated reductions in pumping at any individual well. The simulated groundwater-level results of the models with the Ewing Gravel Mine slurry walls were then compared to the baseline simulation results over the entire 63-year period of the model. The 63-year model period includes a broad range of hydrologic and climactic conditions with season variability. To simplify assessment of potential impacts spatially, the differences between simulated groundwater levels of the baseline model and the two Ewing Gravel Mine slurry wall models were summarized by maximum differences (whether increasing or decreasing) at each model cell over the entire model period. Figure 3 shows the distribution of maximum simulated groundwater-level changes (increasing or decreasing at each model cell throughout the entire model period, predicting maximum changes of increasing water levels upgradient (less than 4.3 ft) and decreasing water levels downgradient (no more than -1.8 ft). Note that the simulated water-level decreases downgradient of the walls were of a lesser magnitude than the increases upgradient because the South Platte River acts as a moderating boundary condition.

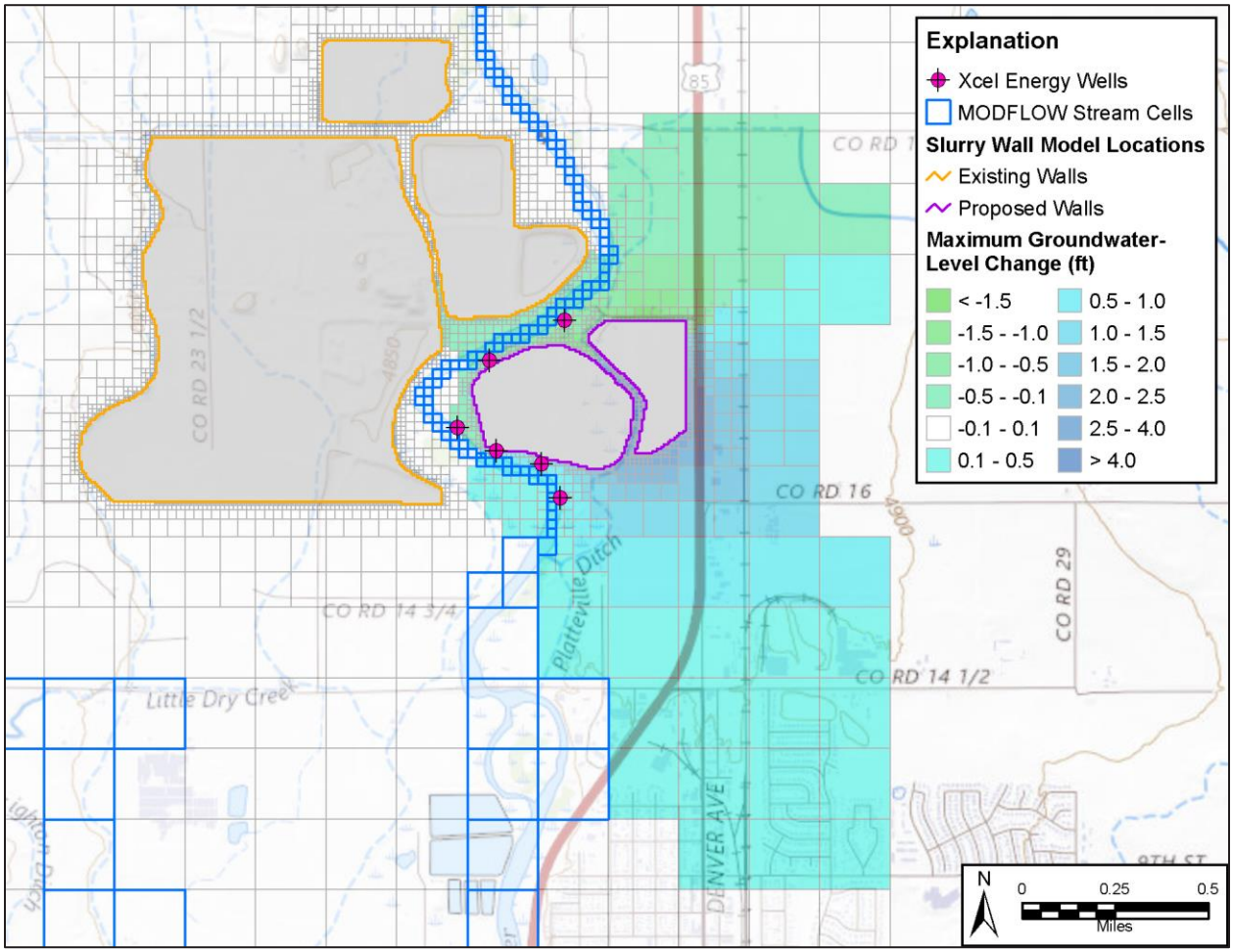


Figure 3. Maximum Simulated Water-Level Changes Through Entire Model Period with Ewing Gravel Mine Slurry Walls

Decreasing the assumed hydraulic conductivity value of the Ewing Gravel Mine slurry walls by one order of magnitude to $1x10^{-9}$ cm/s produced similar results as the base value of $1x10^{-8}$ cm/s. The maximum simulated water-level increase with the lower K value for the Ewing Gravel Mine slurry walls is also less than 4.3 ft and the maximum decrease was less than 1.8 ft. Figure 4 shows the distribution of maximum simulated groundwater-level changes (increasing or decreasing) at each model cell throughout the entire model period for the lower K value slurry wall simulation. The spatial extent of the maximum water-level changes greater than 0.1 feet was only slightly larger for the lower K slurry wall simulation, indicating only a slight sensitivity of the water-level changes to the input K value of the walls.

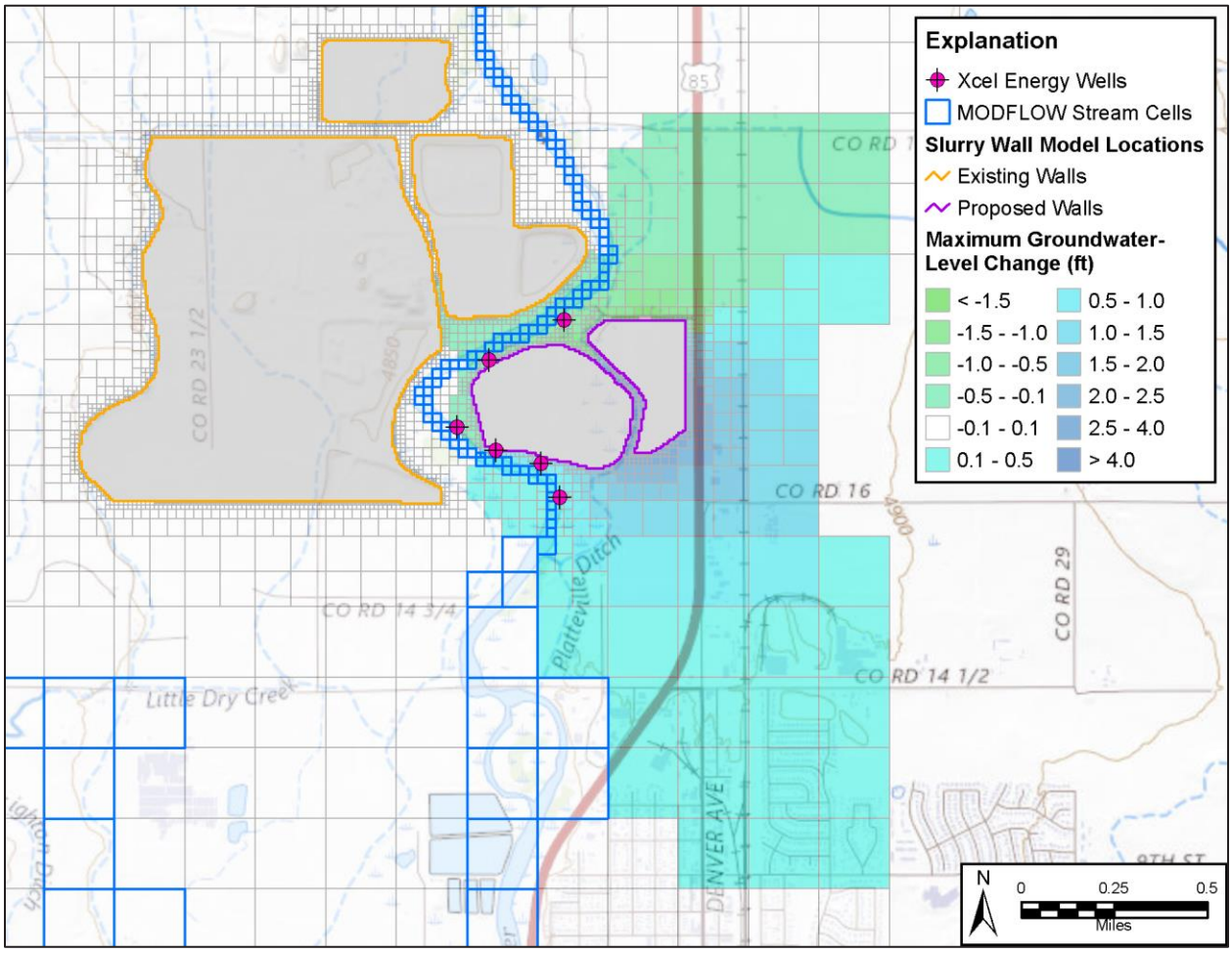


Figure 4. Maximum Simulated Water-Level Changes Through Entire Model Period with Ewing Gravel Mine Slurry Walls, Lower K Value

The changes in simulated groundwater levels at the model cells with Xcel wells were also extracted from the model results. Table 1 provides the ranges of simulated groundwater-level differences at each well for both Ewing Gravel Mine slurry wall scenarios relative to the baseline simulation. The ranges of simulated water-level differences at the Xcel wells between the models with the base and low K slurry wall hydraulic parameters were very similar, again indicating only a slight sensitivity of the water-level changes to the input K value of the walls.

Table 1. Range of Simulated Groundwater-Level Differences at Xcel Wells' Model Cells

Ewing Slurry Wall Hydraulic Parameter Values	Range of Simulated Groundwater-Level Differences (ft)					
	1S	2S	3S	4S	5S	6S
Estimated K ($K=1x10e^{-8}$ ft/day)	-0.11 to 0.01	-0.11 to 0.11	0.21 to 0.71	0.41 to 0.51	-0.71 to -0.41	-0.81 to -0.41
Low K ($K=1x10e^{-8}$ ft/day)	-0.13 to 0.02	-0.14 to 0.06	0.21 to 0.64	0.41 to 0.52	-0.74 to -0.45	-0.78 to -0.45

Figures 5 and 6 present hydrographs of simulated groundwater-level change hydrographs at the model cells of each Xcel well for the 2 Ewing Gravel Mine slurry wall predictive scenarios. These water-level difference hydrographs show the seasonal variations in the simulated water-level differences. These seasonal changes were generally of a small magnitude as would be expected from the relatively tight ranges of simulated groundwater-level differences as presented in Table 1.

Overall, the models with the Ewing Gravel Mine proposed slurry walls predicted groundwater-level changes that would be expected and have been observed at similar sites. The models predicted maximum groundwater-level declines of less than 2 feet and maximum increases of only slightly more than 4 feet due to the presence of the slurry walls through a broad range of hydrologic and climactic conditions. The models also predicted that the Xcel wells would be able to pump constantly at near the maximum daily rate of 2500 gpm through this range of hydrologic and climactic conditions, and as such that the slurry walls would not hinder the Xcel wells from pumping at normal rates.

GSI ENVIRONMENTAL

MEMORANDUM

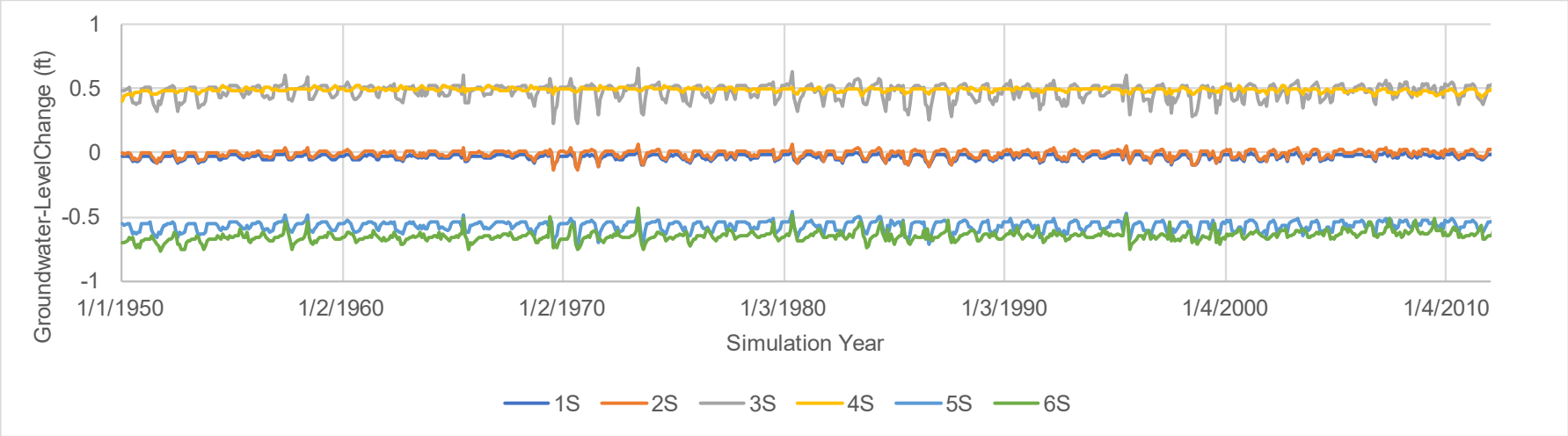


Figure 5. Simulated Groundwater-Level Change - Slurry Wall Base Hydraulic Parameters

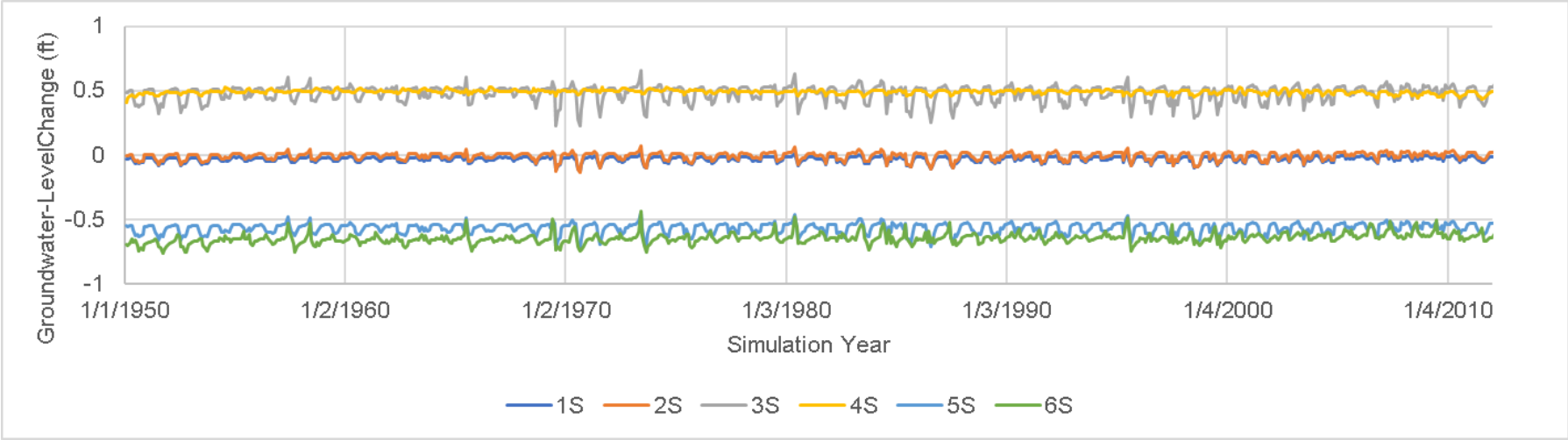


Figure 6. Simulated Groundwater-Level Change - Low K Slurry Wall Base Hydraulic Parameters

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EXHIBIT H WILDLIFE INFORMATION

1. Introduction

Given the location of the Ewing Gravel Pit just north of Fort Lupton, adjacent to the highway, and surrounded by an abundance of gravel pits and agricultural fields, it is safe to assume that wildlife habitat fragmentation has already occurred. Colorado Parks and Wildlife (CPW) habitat and range mapping has been used to develop this wildlife analysis. The CPW will be consulted as park of the mine permitting process.

2. Description of Significant Wildlife Resources on the Affected Land

The affected land within seasonal and general range of a few non-endangered species.

There are no bald eagle nests within 5,000 feet of the site, but the site is considered part of a few bald eagle ranges: summer forage, winter forage, and winter concentration.

The affected area is within the mule deer corridor and their severe and normal winter range. The site is not near any mule deer migration corridors or highway crossings. Mining operations will not take place during the winter so the Ewing Gravel Pit will not be affecting the mule deer's severe winter range. The site is also within the white-tailed deer concentration area and winter range.

3. Seasonal Use of the Area

Bald eagles make use of the site as summer and winter forage, as well as a winter concentration area. Mule deer and white-tailed deer use the site as winter range. All other significant wildlife resources are year-round in their usage.

4. Presence and Estimated Population of Threatened or Endangered Species

No federally listed threatened and endangered species and/or habitat were identified on the or immediately surrounding the affected land.

5. Effect of Proposed Operation on Existing Wildlife

Impacts on wildlife use from the proposed project would include direct temporary elimination of potential habitat within the affected area during mining, and temporary localized displacement associated with additional noise and lighting from the proposed project. This localized loss of

habitat would not disrupt regional migration or significant movement patterns and would not threaten the overall health and viability of any species. Nearby lands are also disturbed for similar uses, and as such the Ewing Gravel Pit will not cause a significant impact on the local area's wildlife habitat.

The affected area will be fully reclaimed at the conclusion of mining which will restore some degree of wildlife habitat over time. Concurrent reclamation and phased mining will also help to reduce the total impact on wildlife. Transformation of the bulk of the agricultural fields onsite into water storage ponds will be a permanent change in overall habitat.

6. Impacts to Fish

Mining will not take place in any water ways or natural lakes. Surface water controls will protect offsite drainages and fish habitats from sediment discharges. BURNCO will not stock the reclaimed lake with non-native species at any time.

EXHIBIT I SOILS INFORMATION

1. General

A soil report was generated using the United States Department of Agriculture's NRCS Web Soil Survey (WSS)[3] and is included in this exhibit as Appendix I-1 at the end of this exhibit. The WSS provides soil data and information produced by the National Cooperative Soil Survey. The majority of the site's soil consists of aquolls and aquents with a gravelly substratum on the lower terrace, and altvan loam on the upper terrace (see Map C-1). The A-horizon of the soil profile was used as the basis for determining the topsoil stripping depth during mining operations. These primary soil types that exist at the site are described as follows.

2. Suitability for Reclamation Revegetation

The two main soil types provide an average of two feet of suitable material for revegetation. The soil on the upper terrace (1-Altvan Loam) is not considered prime farmland, but the soil on the lower terrace (3-Aquolls and Aquents) is considered prime farmland. As the majority of the site will be reclaimed to ponds, converting the land back to agriculture is not considered for reclamation. However, the soil should be suitable to be converted to rangeland as portions of the site currently are rangeland. Revegetating disturbances as rangeland will also complement the reclaimed land use of open space.

3. Soil Type Descriptions

1—Altvan loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 361j
Elevation: 4,500 to 4,900 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

*Altvan and similar soils:*90 percent
*Minor components:*10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Altvan

Setting

Landform: Terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Old alluvium

Typical profile

[3] https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm.

H1 - 0 to 10 inches: loam
H2 - 10 to 25 inches: clay loam
H3 - 25 to 60 inches: gravelly sand

Properties and qualities

*Slope:*0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
*Capacity of the most limiting layer to transmit water (Ksat):*Moderately high to high (0.20 to 2.00 in/hr)
*Depth to water table:*More than 80 inches
Frequency of flooding: None
*Frequency of ponding :*None
*Calcium carbonate, maximum content:*5 percent
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

Minor Components

Cascajo

*Percent of map unit:*9 percent
Hydric soil rating: No

Aquic haplustolls

*Percent of map unit:*1 percent
Landform: Swales
Hydric soil rating: Yes

3—Aquolls and Aquents, gravelly substratum

Map Unit Setting

National map unit symbol: 3627
Elevation: 4,000 to 7,200 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 80 to 155 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

*Aquolls and similar soils:*55 percent
*Aquents, gravelly substratum, and similar soils:*30 percent
*Minor components:*15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Aquolls

Setting

Landform: Swales, flood plains, streams
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Recent alluvium

Typical profile

H1 - 0 to 48 inches: loam
H2 - 48 to 60 inches: gravelly sand

Properties and qualities

*Slope:*0 to 3 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained
Runoff class: Low
*Capacity of the most limiting layer to transmit water (Ksat):*Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 6 to 48 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: D
Ecological site: R067BY035CO - Salt Meadow
Hydric soil rating: Yes

Description of Aquents, Gravelly Substratum

Setting

*Landform:*S tream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Recent alluvium

Typical profile

H1 - 0 to 48 inches: variable
H2 - 48 to 60 inches: very gravelly sand

Properties and qualities

*Slope:*0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
*Capacity of the most limiting layer to transmit water (Ksat):*Moderately high to very high (0.57 to 19.98 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: Frequent None
Frequency of ponding: None
*Calcium carbonate, maximum content:*10 percent
Maximum salinity: Nonsaline to moderately saline (0.0 to 8.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): 6w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: D
Ecological site: R067BY035CO - Salt Meadow
Hydric soil rating: Yes

Minor Components

Bankard

*Percent of map unit:*10 percent
Hydric soil rating: No

Ustic torrifluvents

*Percent of map unit:*5 percent
Hydric soil rating: No

10—Ellicott-Ellicott sandy-skeletal complex, 0 to 3 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: 2xsth
Elevation: 3,950 to 5,960 feet

Mean annual precipitation: 13 to 17 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 135 to 165 days
Farmland classification: Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60

Map Unit Composition

*Ellicott, rarely flooded, and similar soils:*65 percent
*Ellicott sandy-skeletal, rarely flooded, and similar soils:*25 percent
*Minor components:*10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ellicott, Rarely Flooded

Setting

Landform: Drainageways, flood plains on intermittent streams
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Noncalcareous, stratified sandy alluvium

Typical profile

A - 0 to 4 inches: sand
AC - 4 to 13 inches: sand
C1 - 13 to 30 inches: sand
C2 - 30 to 44 inches: sand
C3 - 44 to 80 inches: coarse sand

Properties and qualities

*Slope:*0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Negligible
*Capacity of the most limiting layer to transmit water (Ksat):*High to very high (13.00 to 39.96 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: R067BY031CO - Sandy Bottomland
Hydric soil rating: No

Description of Ellicott Sandy-skeletal, Rarely Flooded

Setting

Landform: Channels on drainageways, channels on intermittent streams
Down-slope shape: Linear
Across-slope shape: Concave, linear
Parent material: Noncalcareous, stratified sandy alluvium

Typical profile

A - 0 to 4 inches: very gravelly coarse sand
AC - 4 to 13 inches: very gravelly sand
C1 - 13 to 30 inches: very gravelly sand
C2 - 30 to 44 inches: very gravelly sand
C3 - 44 to 80 inches: very gravelly coarse sand

Properties and qualities

*Slope:*0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained

Runoff class: Negligible
*Capacity of the most limiting layer to transmit water (Ksat):*High to very high (13.00 to 39.96 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: A
Ecological site: R067BY031CO - Sandy Bottomland
Hydric soil rating: No

Minor Components

Haverson

*Percent of map unit:*10 percent
Landform: Terraces
*Landform position (three-dimensional):*Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY036CO - Overflow
Hydric soil rating: No

68—Ustic Torriorthents, moderately steep

Map Unit Setting

National map unit symbol: 363l
Elevation: 4,450 to 5,100 feet
Mean annual precipitation: 10 to 16 inches
Mean annual air temperature: 46 to 54 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

*Ustic torriorthents and similar soils:*85 percent
*Minor components:*15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ustic Torriorthents

Setting

Landform: Breaks, escarpments
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly alluvium

Typical profile

H1 - 0 to 10 inches: gravelly sand
H2 - 10 to 60 inches: gravelly sand

Properties and qualities

*Slope:*9 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
*Capacity of the most limiting layer to transmit water (Ksat):*High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

*Calcium carbonate, maximum content:*5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: R067BY063CO - Gravel Breaks
Hydric soil rating: No

Minor Components

Columbo

*Percent of map unit:*10 percent
Hydric soil rating: No

Eckley

*Percent of map unit:*3 percent
Hydric soil rating: No

Otero

*Percent of map unit:*2 percent
Hydric soil rating: No

Appendix I-1 Soil Report

United States Department of Agriculture

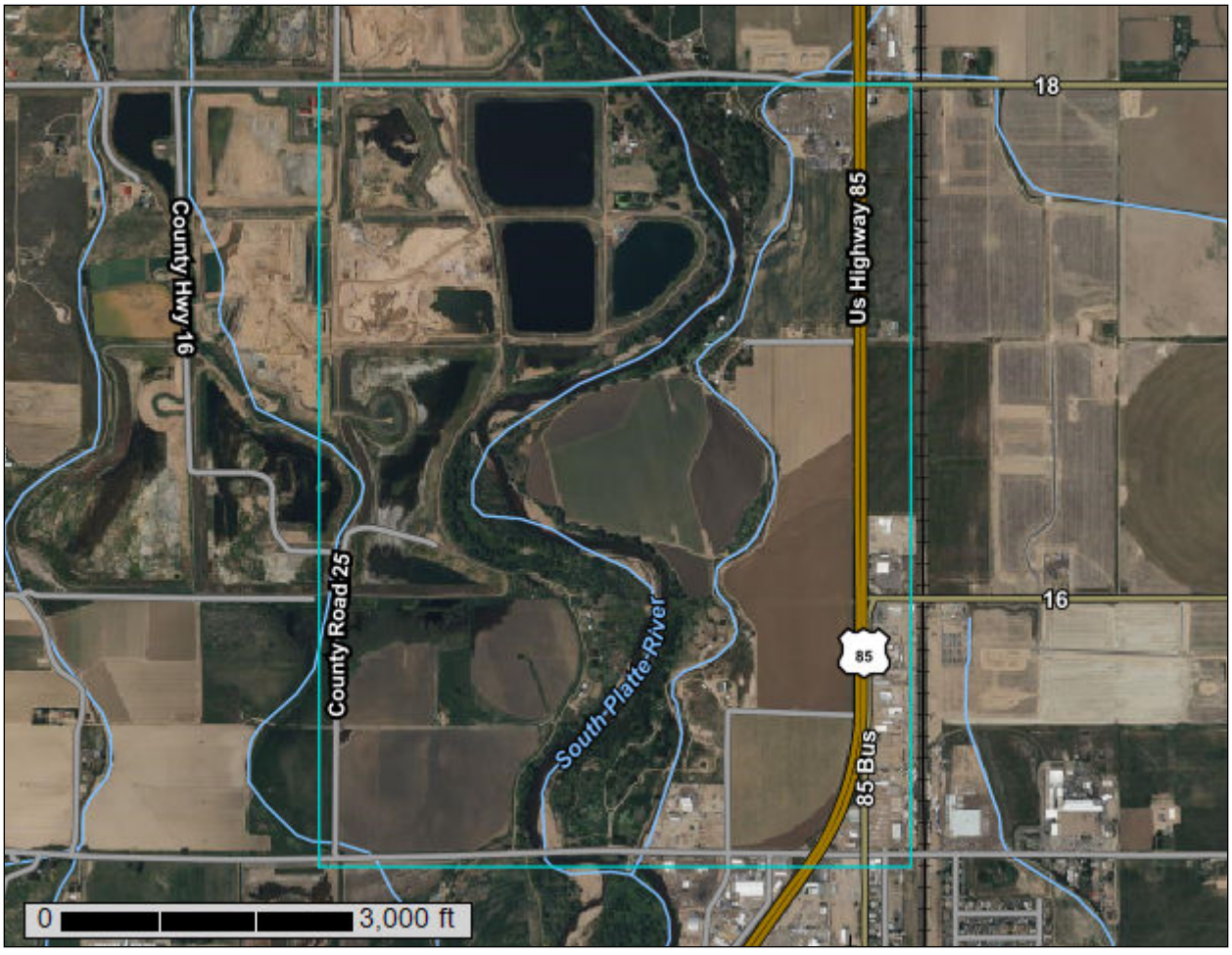
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Weld County, Colorado, Southern Part

Ewing Site



February 13, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

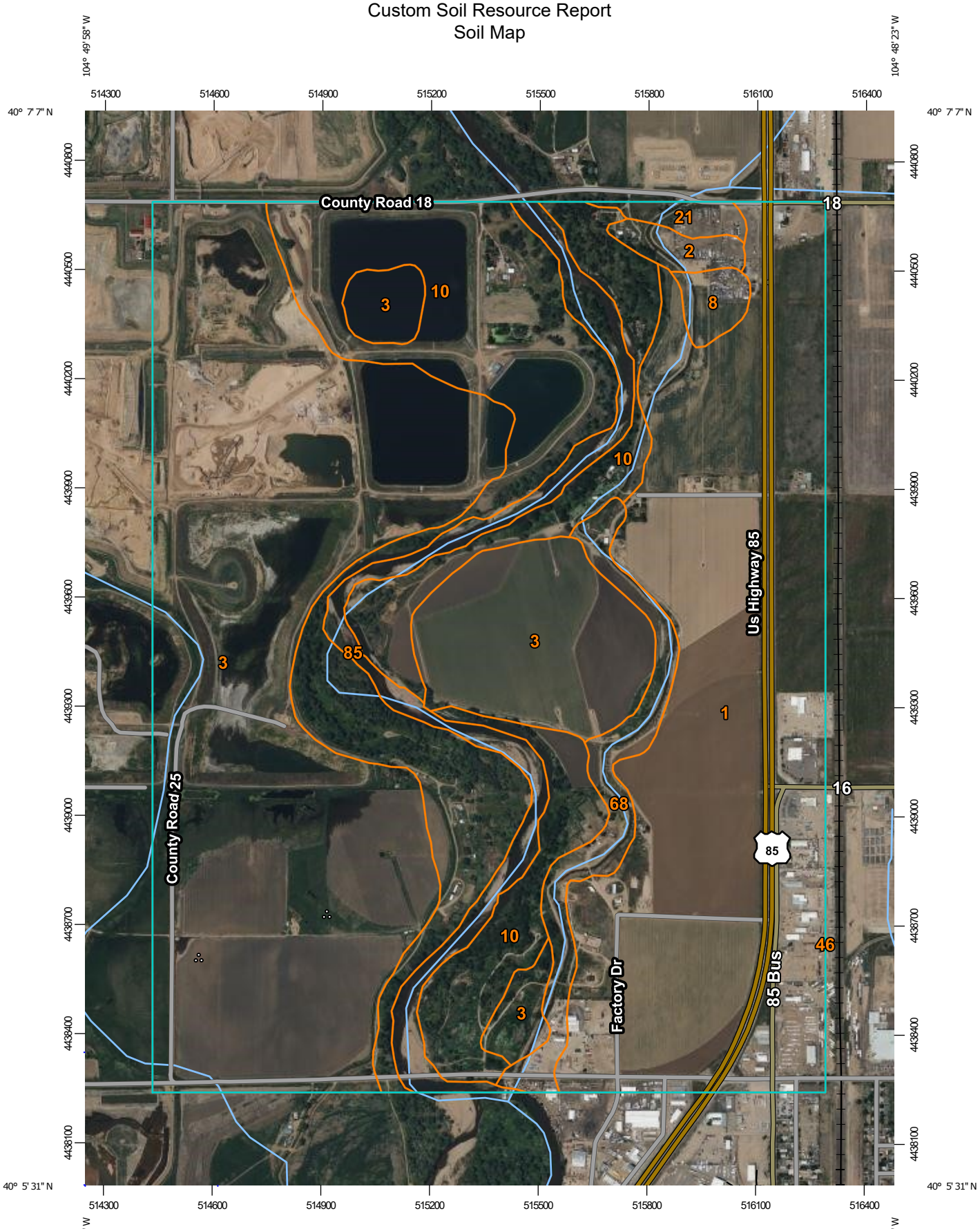
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:14,400 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Weld County, Colorado, Southern Part
Survey Area Data: Version 21, Sep 1, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 8, 2021—Jun 12, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Altvan loam, 0 to 1 percent slopes	313.6	27.8%
2	Altvan loam, 1 to 3 percent slopes	8.4	0.7%
3	Aquolls and Aquents, gravelly substratum	465.9	41.3%
8	Ascalon loam, 0 to 1 percent slopes	8.0	0.7%
10	Ellicott-Ellicott sandy-skeletal complex, 0 to 3 percent slopes, rarely flooded	242.0	21.5%
21	Dacono clay loam, 0 to 1 percent slopes	6.9	0.6%
46	Olney fine sandy loam, 0 to 1 percent slopes	0.0	0.0%
68	Ustic Torriorthents, moderately steep	34.7	3.1%
85	Water	48.2	4.3%
Totals for Area of Interest		**1,127.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They

generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Weld County, Colorado, Southern Part

1—Altvan loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 361j
Elevation: 4,500 to 4,900 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Altvan and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Altvan

Setting

Landform: Terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Old alluvium

Typical profile

H1 - 0 to 10 inches: loam
H2 - 10 to 25 inches: clay loam
H3 - 25 to 60 inches: gravelly sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

Minor Components

Cascajo

Percent of map unit: 9 percent
Hydric soil rating: No

Aquic haplustolls
Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

2—Altvan loam, 1 to 3 percent slopes

Map Unit Setting
National map unit symbol: 361w
Elevation: 4,500 to 4,900 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Altvan and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Altvan

Setting
Landform: Terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Old alluvium

Typical profile
H1 - 0 to 10 inches: loam
H2 - 10 to 24 inches: sandy clay loam
H3 - 24 to 60 inches: gravelly sand

Properties and qualities
Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 5.6 inches)

Interpretive groups
Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B

Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

Minor Components

Cascajo
Percent of map unit: 9 percent
Hydric soil rating: No

Aquic haplustolls
Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

3—Aquolls and Aquents, gravelly substratum

Map Unit Setting
National map unit symbol: 3627
Elevation: 4,000 to 7,200 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 80 to 155 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition
Aquolls and similar soils: 55 percent
Aquents, gravelly substratum, and similar soils: 30 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Aquolls

Setting
Landform: Swales, flood plains, streams
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Recent alluvium

Typical profile
H1 - 0 to 48 inches: loam
H2 - 48 to 60 inches: gravelly sand

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: About 6 to 48 inches

Frequency of flooding: FrequentNone
Frequency of ponding: None
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: D
Ecological site: R067BY035CO - Salt Meadow
Hydric soil rating: Yes

Description of Aquents, Gravelly Substratum

Setting

Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Recent alluvium

Typical profile

H1 - 0 to 48 inches: variable
H2 - 48 to 60 inches: very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (0.57 to 19.98 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to moderately saline (0.0 to 8.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): 6w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: D
Ecological site: R067BY035CO - Salt Meadow
Hydric soil rating: Yes

Minor Components

Bankard

Percent of map unit: 10 percent
Hydric soil rating: No

Ustic torrifluvents

Percent of map unit: 5 percent
Hydric soil rating: No

8—Ascalon loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2tlnq
Elevation: 3,870 to 6,070 feet
Mean annual precipitation: 13 to 16 inches
Mean annual air temperature: 47 to 54 degrees F
Frost-free period: 135 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Ascalon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ascalon

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind-reworked alluvium and/or calcareous sandy eolian deposits

Typical profile

Ap - 0 to 6 inches: loam
Bt1 - 6 to 12 inches: sandy clay loam
Bt2 - 12 to 19 inches: sandy clay loam
Bk - 19 to 35 inches: fine sandy loam
C - 35 to 80 inches: fine sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline (0.1 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c

Hydrologic Soil Group: B
Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

Minor Components

Olnest
Percent of map unit: 10 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

Nunn
Percent of map unit: 5 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

10—Ellicott-Ellicott sandy-skeletal complex, 0 to 3 percent slopes, rarely flooded

Map Unit Setting
National map unit symbol: 2xsth
Elevation: 3,950 to 5,960 feet
Mean annual precipitation: 13 to 17 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 135 to 165 days
Farmland classification: Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60

Map Unit Composition
Ellicott, rarely flooded, and similar soils: 65 percent
Ellicott sandy-skeletal, rarely flooded, and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ellicott, Rarely Flooded

Setting
Landform: Drainageways, flood plains on intermittent streams
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Noncalcareous, stratified sandy alluvium

Typical profile

A - 0 to 4 inches: sand
AC - 4 to 13 inches: sand
C1 - 13 to 30 inches: sand
C2 - 30 to 44 inches: sand
C3 - 44 to 80 inches: coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (13.00 to 39.96 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: R067BY031CO - Sandy Bottomland
Hydric soil rating: No

Description of Ellicott Sandy-skeletal, Rarely Flooded

Setting

Landform: Channels on drainageways, channels on intermittent streams
Down-slope shape: Linear
Across-slope shape: Concave, linear
Parent material: Noncalcareous, stratified sandy alluvium

Typical profile

A - 0 to 4 inches: very gravelly coarse sand
AC - 4 to 13 inches: very gravelly sand
C1 - 13 to 30 inches: very gravelly sand
C2 - 30 to 44 inches: very gravelly sand
C3 - 44 to 80 inches: very gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (13.00 to 39.96 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): 4s

Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: A
Ecological site: R067BY031CO - Sandy Bottomland
Hydric soil rating: No

Minor Components

Haverson
Percent of map unit: 10 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY036CO - Overflow
Hydric soil rating: No

21—Dacono clay loam, 0 to 1 percent slopes

Map Unit Setting
National map unit symbol: 361y
Elevation: 4,550 to 4,970 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Dacono and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dacono

Setting
Landform: Terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile
H1 - 0 to 12 inches: clay loam
H2 - 12 to 21 inches: clay loam
H3 - 21 to 27 inches: clay loam
H4 - 27 to 60 inches: very gravelly sand

Properties and qualities
Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.3 inches)

Interpretive groups
Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C
Ecological site: R067BY042CO - Clayey Plains
Hydric soil rating: No

Minor Components

Heldt
Percent of map unit: 5 percent
Hydric soil rating: No

Nunn
Percent of map unit: 5 percent
Hydric soil rating: No

Altvan
Percent of map unit: 5 percent
Hydric soil rating: No

46—Olney fine sandy loam, 0 to 1 percent slopes

Map Unit Setting
National map unit symbol: 362t
Elevation: 4,600 to 5,200 feet
Mean annual precipitation: 11 to 15 inches
Mean annual air temperature: 46 to 54 degrees F
Frost-free period: 125 to 175 days
Farmland classification: Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60

Map Unit Composition
Olney and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Olney

Setting
Landform: Plains
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Mixed deposit outwash

Typical profile

H1 - 0 to 10 inches: fine sandy loam
H2 - 10 to 20 inches: sandy clay loam
H3 - 20 to 25 inches: sandy clay loam
H4 - 25 to 60 inches: fine sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: B
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

Minor Components

Zigweid

Percent of map unit: 8 percent
Hydric soil rating: No

Vona

Percent of map unit: 7 percent
Hydric soil rating: No

68—Ustic Torriorthents, moderately steep

Map Unit Setting

National map unit symbol: 363l
Elevation: 4,450 to 5,100 feet
Mean annual precipitation: 10 to 16 inches
Mean annual air temperature: 46 to 54 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Ustic torriorthents and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ustic Torriorthents

Setting

Landform: Breaks, escarpments
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly alluvium

Typical profile

H1 - 0 to 10 inches: gravelly sand
H2 - 10 to 60 inches: gravelly sand

Properties and qualities

Slope: 9 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: R067BY063CO - Gravel Breaks
Hydric soil rating: No

Minor Components

Columbo

Percent of map unit: 10 percent
Hydric soil rating: No

Eckley

Percent of map unit: 3 percent
Hydric soil rating: No

Otero

Percent of map unit: 2 percent
Hydric soil rating: No

85—Water

Map Unit Composition

Water: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Minor Components

Aquolls

Percent of map unit: 5 percent
Landform: Marshes
Hydric soil rating: Yes

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EXHIBIT J VEGETATION INFORMATION

1. Existing Vegetation Community

The native vegetation at the Ewing Gravel Pit is mostly limited to the western banks of the Platte River and surrounding the Platteville ditch through the center of the property. The remaining portions of the site are agricultural fields. The native vegetation that is present consists of mature cottonwoods galleries with a shrubby midstory. The understory is predominantly dry grasses and shrubs.

Some small portions of the site contain dry rangeland vegetation. The remaining areas of the site are irrigated agricultural fields which do not contain native vegetation, and will be removed during mining. The mining areas are mostly restricted to the agricultural fields, so little to no native vegetation will be removed. The reclamation plan aims to revegetate the site to similar conditions of the existing native rangeland vegetation.

Figure J-1 Typical vegetation in river corridor

Figure J-2 Typical rangeland vegetation

2. Wetlands

Wetlands identified on the site from the National Wetlands Inventory are shown on Map C-1. A preliminary investigation of wetlands onsite indicates a small area of potential wetlands in the southeast corner of Pod 2 (see Appendix J-1). A full delineation will be conducted prior to mining in this area.

3. Estimated Carrying Capacity

The final use for the site will be water storage ponds with surrounding rangeland which will serve as open space and public recreation. Since the ponds make up the vast majority of the site area, the rangeland is not anticipated to be used for grazing.

Appendix J-1 Wetlands Report

Trinity Consultants

MEMORANDUM

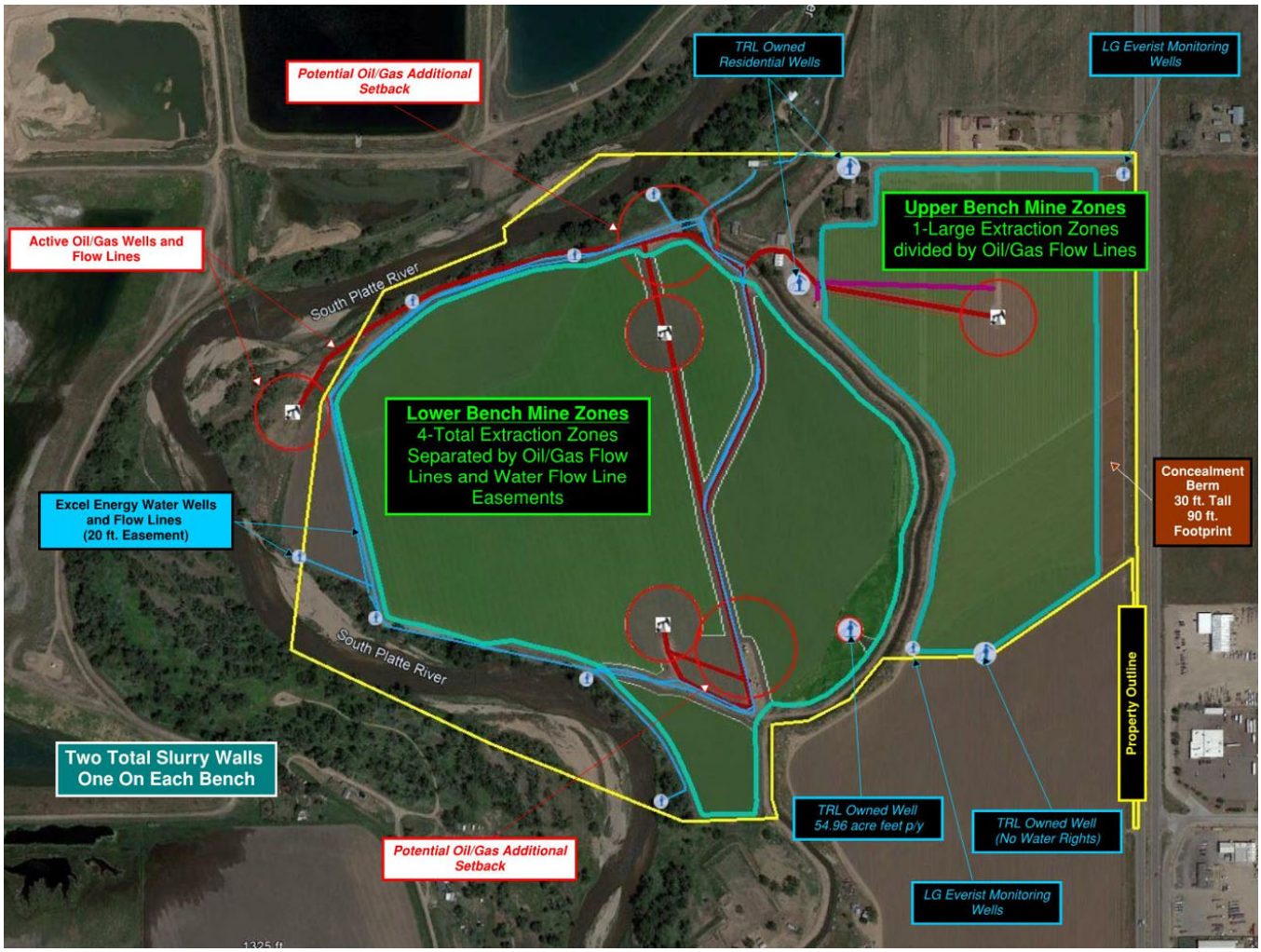
To: Ben Langenfeld, Lewicki & Associates
Chris Oestreich, Burnco
From: Taylor Wilson, Trinity Consultants
Cc: Anna Unruh, Trinity Consultants
Date: 5/26/2023
RE: Burnco – Proposed Ewing Property
7501 U.S. 85, Fort Lupton, Colorado
Desktop Wetlands & Endangered Species Evaluation

Trinity has conducted a review of various sources of information as part of a high-level desktop wetlands and endangered & threatened species evaluation for the proposed Ewing Property. The following sections outline the results of Trinity's review as well as our conclusions.

Description of Proposed Action

The proposed action consists of exploration and mining of the proposed Ewing Property. The property has two primary mining areas referred to as the Lower Bench Mine Zone and Upper Bench Mine Zone. The figure on the following page provides details of overall property.

15900 College Blvd, Suite 200, Lenexa, KS 66219
P 913.894.4500



Wetlands Evaluation

Definition of Wetlands

Within the 1987 USACE Wetlands Delineation Manual (Environmental Laboratory, 1987) wetlands are defined as follows:

> *"Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."*

Three criteria are used to determine if a subject property is classifiable as a wetland. These three criteria are soils, hydrology, and vegetation.

Soils: As currently defined by the USACE, some indicators of hydric soils include a chroma value of two or less (i.e. grayish color) in the Munsell Soil Color Chart or a gleied color, the presence of a sulfidic odor, a high organic content in surface layer of sandy soils, concretions (e.g. manganese), or the listing of the soil series on the national or local hydric soils list.

Hydrology: Primary indicators of wetland hydrology include the presence of free water in an excavated pit or saturated soils within the upper twelve inches of the soil, standing water or inundated conditions, sediment deposits, or drainage patterns. Secondary indicators include, but are not limited to, water-stained leaves and oxidized root channels in the upper twelve inches of the soil. Only one primary hydrology indicator is required in order for an area to contain wetland hydrology, however two secondary indicators are required if there is no primary indicator present.

Vegetation: Vegetation commonly found in and adjacent to wetlands are rated based on the percentage of time that each species is found in a wetland or on high ground that is not wetland. Species found almost exclusively in wetlands (99% or more) are considered obligate wetland species (OBL). Species found 67% to 98% of the time in wetlands, are considered facultative wetland (FACW) species and species found in wetlands 34% to 66% of the time are considered facultative species (FAC). Facultative Upland Species (FACU) and Obligate Upland Species (UPL) refer to those species that occur predominately in upland, or non-wetland areas. In order for an evaluated area to meet the hydrophytic vegetation requirement, 50% or greater of the dominant plant species must be FAC or wetter.

Positive indicators of all three parameters must be found for the area to be considered a wetland.

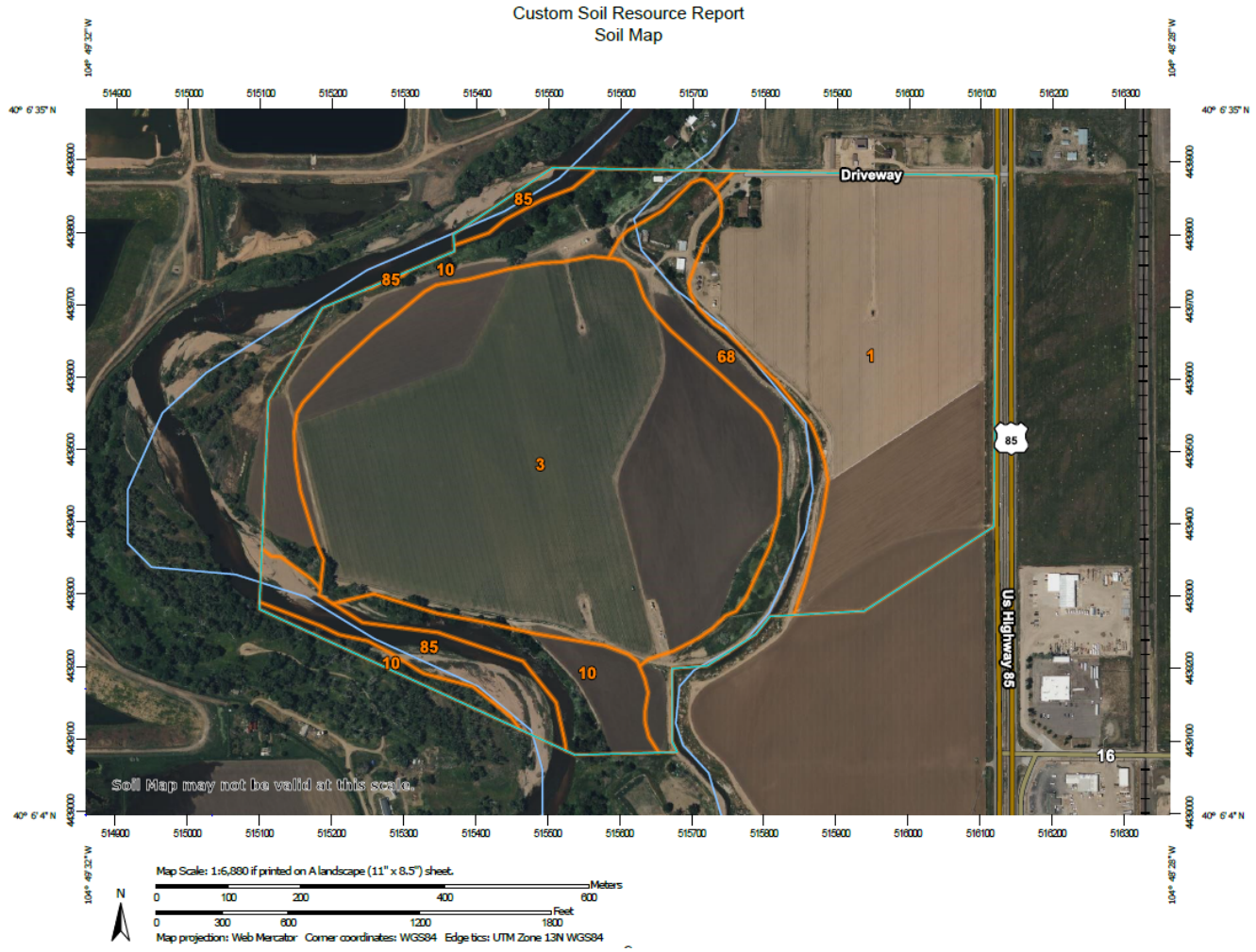
Soils

According to the Natural Resources Conservation Service (NRCS) soils map, soils at the subject property are distributed as follows.[1]

Soil Map Number	Soil Series/Map Unit Name	Acres	Percent of Subject Property[2]
1	Altvan loam, 0 to 1 percent slopes	44.9	28.7%
3	Aqulolls and Aquents, gravelly substratum	68.6	43.9%
10	Ellicot-Ellicot sandy-skeletal complex, 0 to 3 precent slopes, rarely flooded	22.4	14.3%
68	Ustic Torriothents, moderately steep	13.0	8.4%
85	Water	7.4	4.7%

[1] Web Soil Surveys obtained from NRCS at https://www.nrcs.usda.gov/resources/data-and-reports/web-soil-survey.

[2] Total area of interest selected is approximately 156 acres. Water is reported to make up approximatley 4.7% (7.4 acres) of the area of interest.



Hydric soils

The NRCS maintains a list of hydric soils. The lists of hydric soils were created by using National Soil Information System (NASIS) database selection criteria that were developed by the National Technical Committee for Hydric Soils. These criteria are selected soil properties that are documented in Soil Taxonomy (Soil Survey Staff, 1999) and were designed primarily to generate a list of potentially hydric soils from the National Soil Information System (NASIS) database.

A query of the national list for the southern portion of Weld County identified the following soil series as hydric that also were identified as present at the Ewing Property;[3]

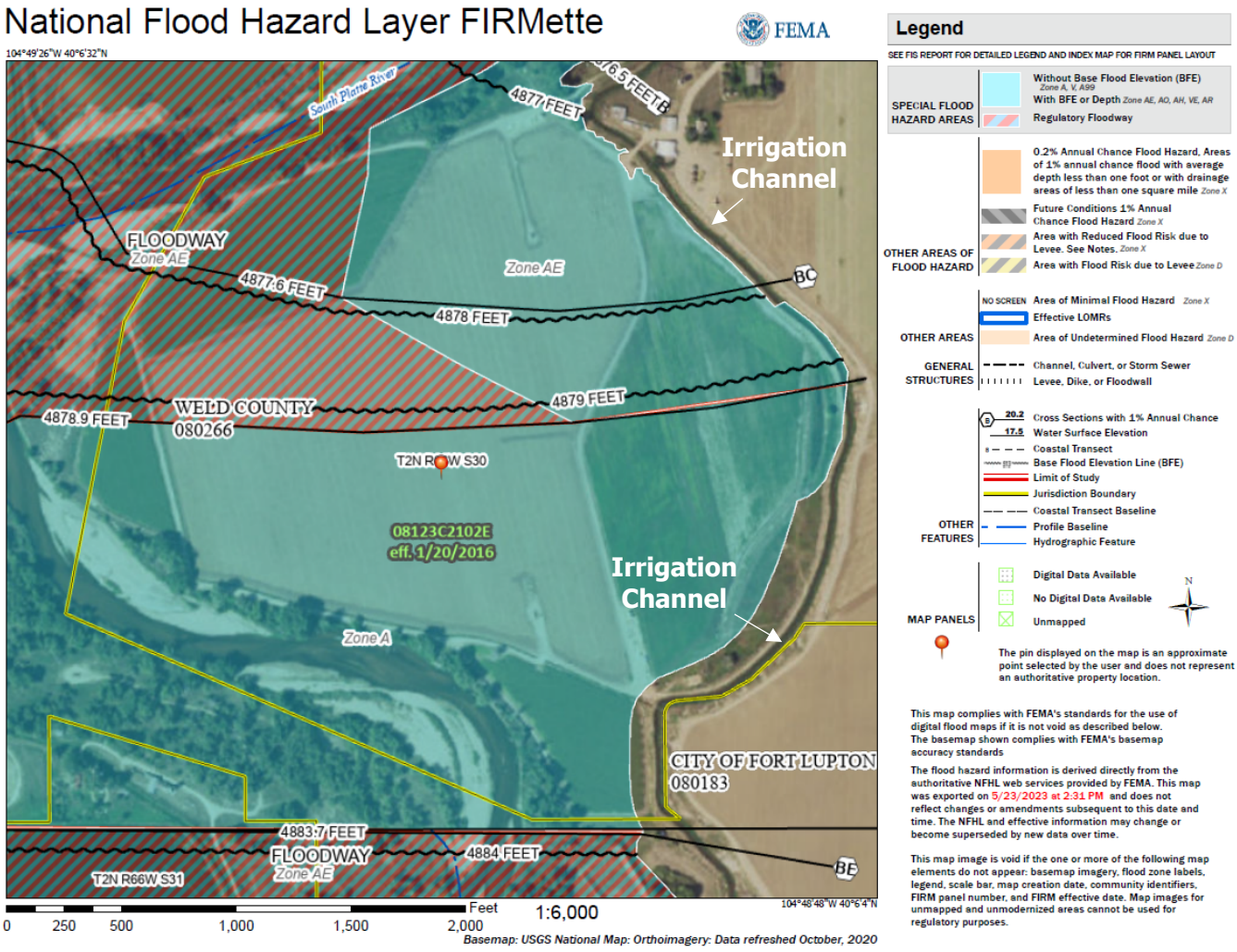
- Altvan loam
- Aquolls and Aquents

These soils make up approximately 72.6% of the total subject property. Altvan loam is the primary soil type for the Upper Bench Mining Zone while Aquolls and Aquents is the primary soil type for the Lower Bench Mining Zone.

[3] Hydric soil list obtained from NRCS at https://www.nrcs.usda.gov/publications/query-by-state.html

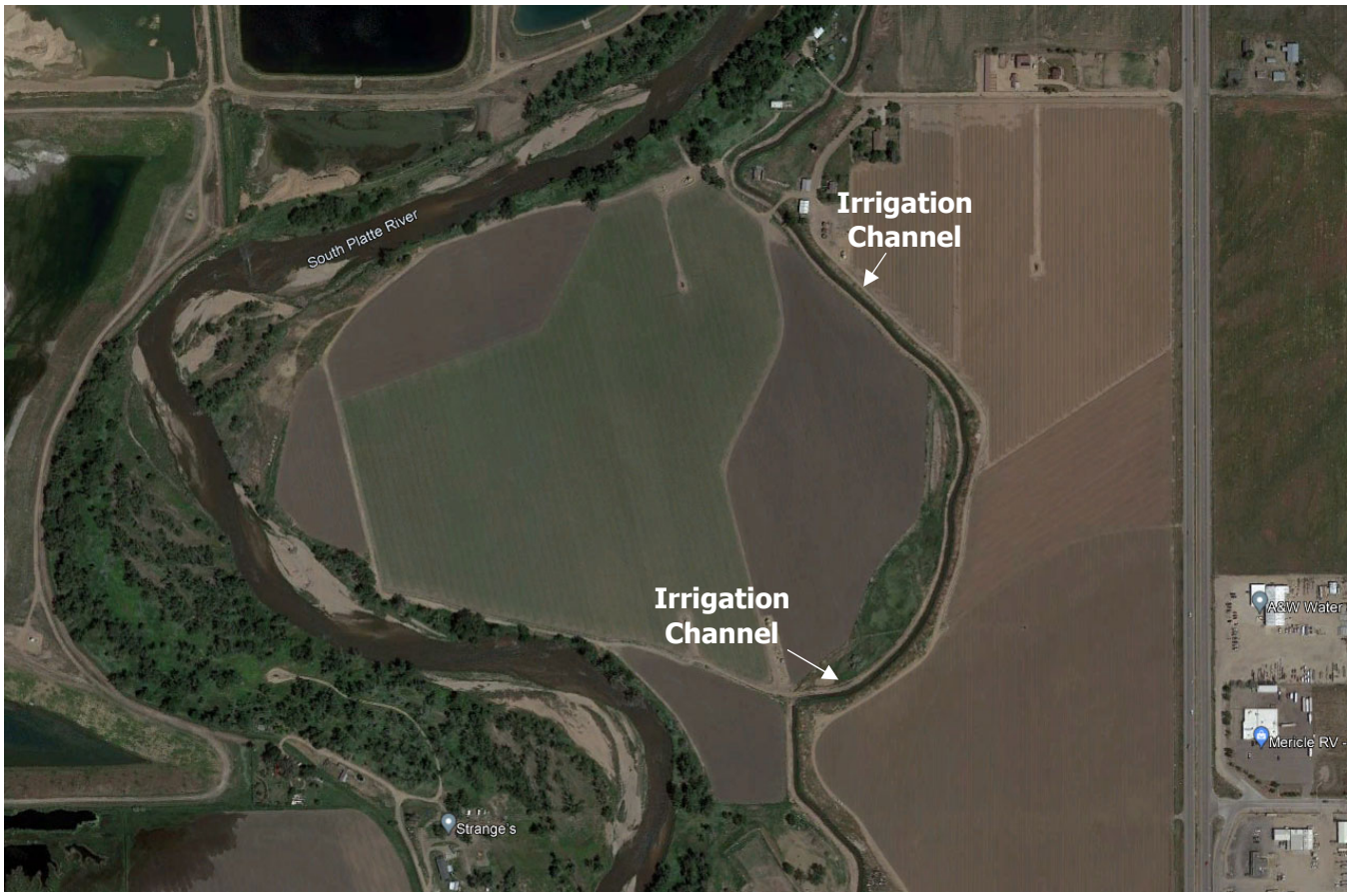
Hydrology

The main hydrological feature in the area is the South Platte River, running along the western border of the subject property. Connected to South Platte River, there is also a drainage channel (assumed irrigation channel) that flows through approximately the center of the property dividing the Upper Bench Mining Zone from the Lower Bench Mining Zone. The evaluation of hydrological components relied on a review of the Federal Emergency Management Administration (FEMA) Flood Insurance Rate Map (FIRM)[4]. The FIRM map image is shown below.



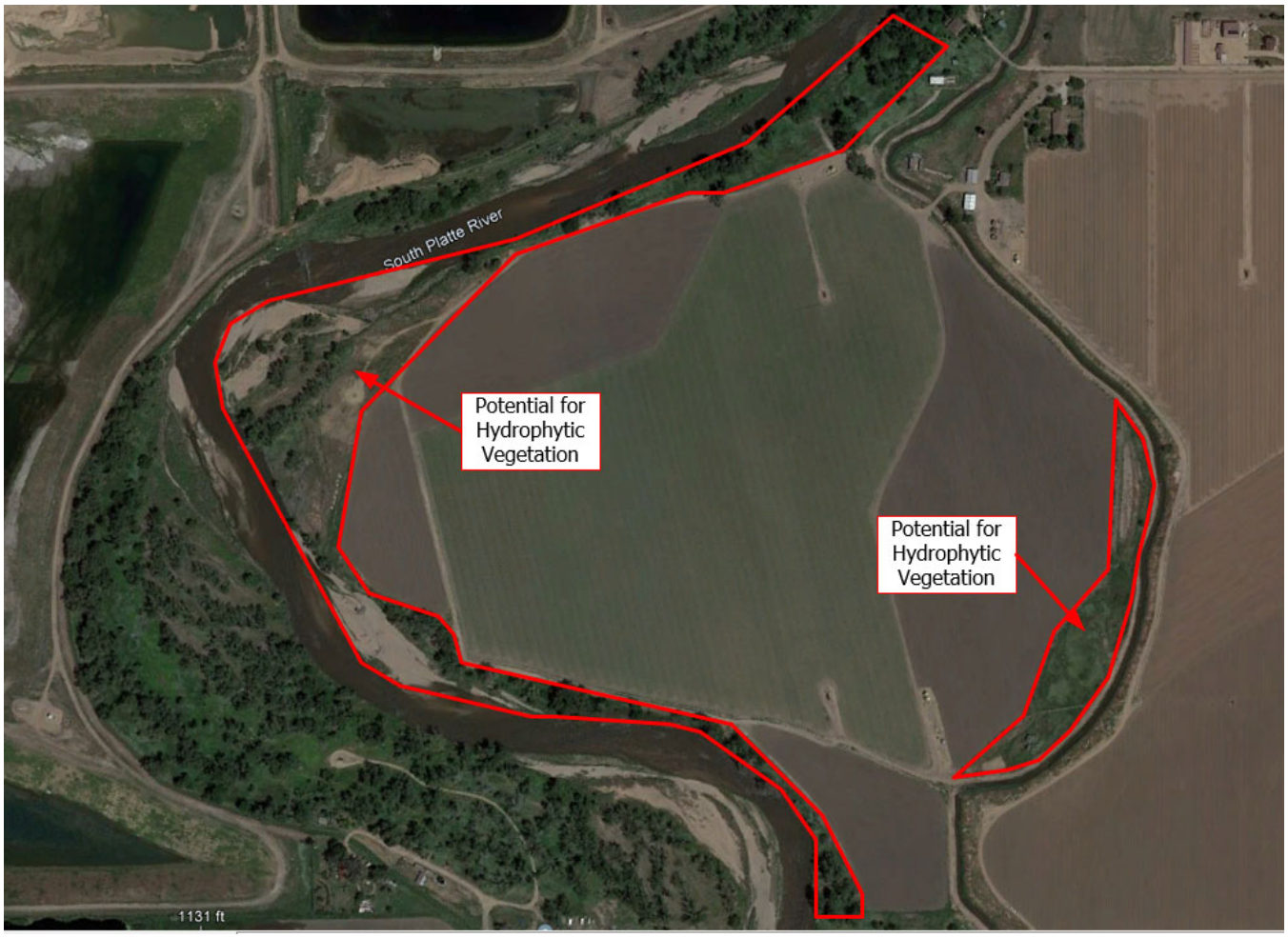
Based on the FIRM map, the whole extent of the Lower Bench Mining Zone appears to be within the 100-year flood plain (FEMA floodway). The Upper Bench Mining Zone area is considered an area of minimal flood hazards.

[4] Flood map obtained from FEMA at https://msc.fema.gov/portal/home



Vegetation

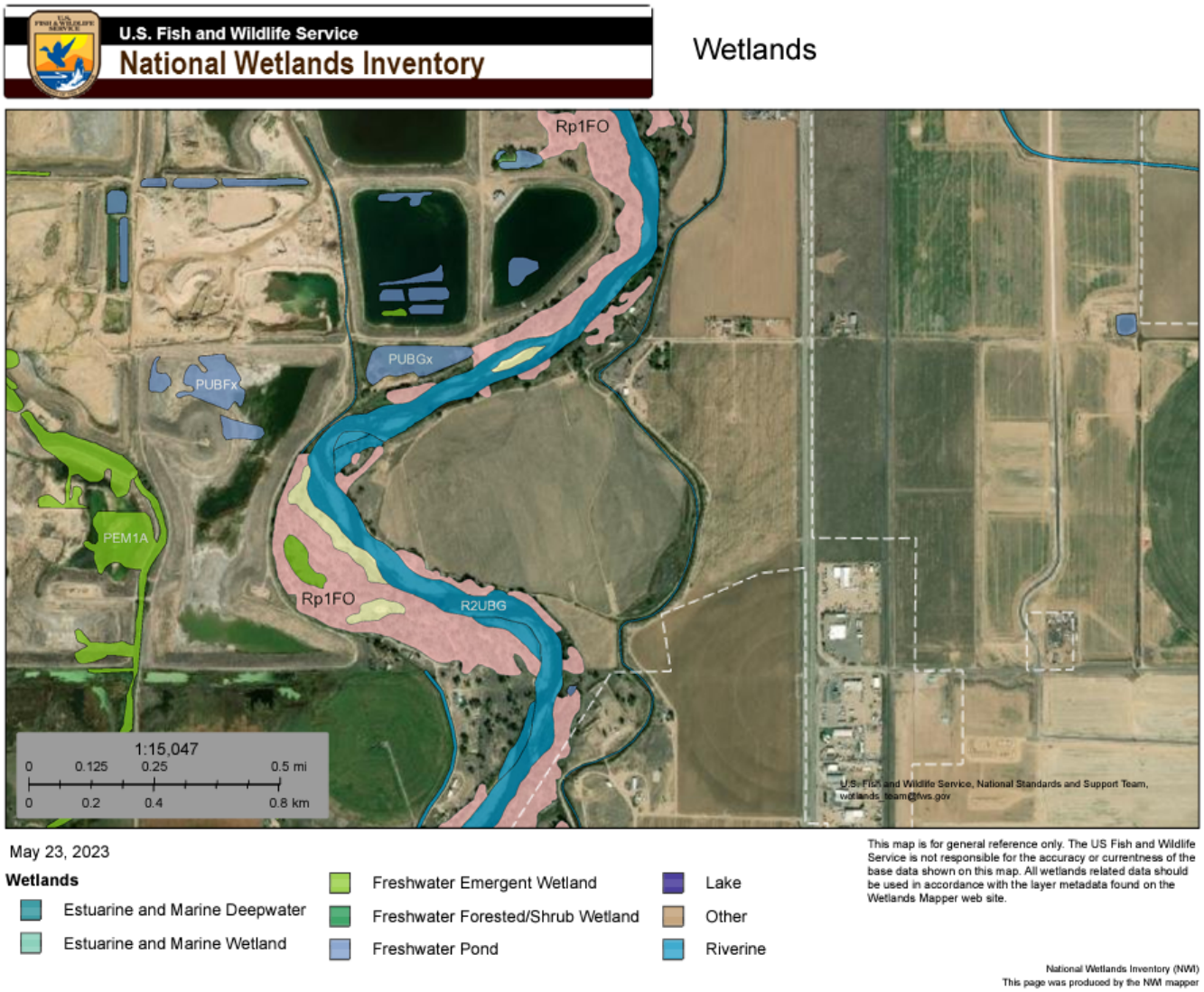
Review of aerial photographs (Google Earth imagery) reveal significant alterations at the site that have eliminated natural vegetation. The areas immediately adjacent to the South Platte River and irrigation channel show potential evidence pointing to the presence of hydrophytic vegetation; however, it is noteworthy that the soils adjacent to these water features are not considered hydric soils based on NRCS data. The hydrologic regime along the South Platte River particularly supports a high potential for presence of OBL and FACW plant species immediately adjacent to the river (outside of the proposed Lower Bench Mining Zone), while the small area next the irrigation channel is inconclusive regarding the presence of OBL and FACW plant species.



National Wetlands Inventory Map

A review of the National Wetlands Inventory Map (NWI) revealed presence of various types of wetland habitats at the subject property[5]. The wetlands are concentrated along the South Platte River. No wetlands were identified in the NWI map within the Lower Bench Mining Zone or Upper Bench Mining Zone.

[5] NWI map obtained from the U.S. Fish & Wildlife Service at: https://www.fws.gov/program/national-wetlands-inventory/wetlands-mapper



The following table summarizes the types of wetlands found (limited to wetlands identified east of the South Platte River, within the Ewing property), estimated wetland values, as well as a rough estimate of coverage area for each type of wetland.[6]

Wetland Type	Estimated Coverage	Typical Wetland Value
Rp1FO – Riverine forested	5.16 acres	High

Wetlands Conclusions

Based on information evaluated and outlined above, Trinity concludes that the potential for wetlands within the Upper Bench Mining Zone are minimal. The Lower Bench Mining Zone may have a small area that contains wetlands immediately adjacent to irrigation channel; further investigation (e.g., field study) is needed. Wetlands may be present immediately adjacent to the South Platte River; however, this is outside the proposed mining zones.

[6] Coverage estimates were determined from NWI information for each wetland cell. Some wetlland cells may partially fall outside of the subject property boundary, and thus, overestimation is anticipated.

Endangered and Threatened Species Evaluation

The Endangered Species Act (ESA) established a procedure for listing and protecting fish, wildlife, and plants that are considered "threatened" or "endangered" of becoming extinct. The ESA also provided a mechanism to identify "critical habitats" that are defined as areas that listed species rely upon for conservation.

The U.S. Fish and Wildlife Service maintains an Information for Planning and Consultation (IPaC) website to identify endangered and threatened species in potential project areas, including identification of any critical habitats[7]. A query of the Ewing property identified the following nine endangered and threatened species:

Type	Common Name	Scientific Name	Status
Mammal	Gray Wolf	Canis lupus	Endangered
Mammal	Preble's Meadow Jumping Mouse	Zapus hudsonius preblei	Threatened
Bird	Eastern Black Rail	Laterallus jamaicensis ssp. jamaicensis	Threatened
Bird	Piping Plover	Charadrius melodus	Threatened
Bird	Whooping Crane	Grus americana	Endangered
Fish	Pallid Sturgeon	Scaphirhynchus albus	Endangered
Insect	Monarch Butterfly	Danaus plexippus	Candidate
Flowering Plant	Ute Ladies-tresses	Spiranthes diluvialis	Threatened
Flowering Plant	Western Prairie Fringed Orchid	Platanthera praeclara	Threatened

No critical habitats were identified on the Ewing property.

Given the potential presence of endangered and threatened species, a field study and/or coordination with the U.S. Fish and Wildlife Service may be warranted to identify the nearest known occurrences of these species.

[7] IPaC accessed at: https://ipac.ecosphere.fws.gov/

EXHIBIT K CLIMATE INFORMATION

The Ewing Gravel Pit is located just north of Fort Lupton, Colorado at an elevation of approximately 4880 feet. The area is classified as a cold semi-arid climate (BSk) under the Koppen Climate Classification system. This climate type is typically characterized as dry and moderate with cool, wetter winters and warm, dryer summers. Table K-1 shows a summary of the climate for this area based on records from 1980-2016.

Table K-1 Climate Data of Fort Lupton, Colorado[4]

	Average Temperature (F)		Average Precipitation (in)	
	Maximum	Minimum	Total precip.	Total snow
January	43	20	0.5	2.1
February	47	23	0.4	2.3
March	56	29	0.9	2.7
April	63	36	1.3	1.6
May	82	45	2.4	0.2
June	83	54	1.7	0.0
July	88	59	1.3	0.0
August	86	57	1.2	0.0
September	78	48	1.2	0.2
October	65	37	0.8	1.3
November	52	27	0.5	2.5
December	42	20	0.3	2.6
Yearly (avg)	**65.4**	**37.9**	**12.4**	**15.5**

[4] https://weatherspark.com/y/3746/Average-Weather-in-Fort-Lupton-Colorado-United-States-Year-Round

EXHIBIT L RECLAMATION COSTS

The Ewing Gravel Pit will have a bond to cover the worst-case reclamation scenario. Prior to the start of mining in Pod 1, the operator/applicant will post the necessary bond. Since the slurry wall will be installed prior to mining, there is no worst-case reclamation scenario in which a slurry wall needs to be built.

The worst-case reclamation scenario will occur at the beginning of Pod 1, before any mining commences due to the cost of slurry wall construction. Pod 1 and 2 slurry wall is the longer of the two to be constructed. Once it has been constructed, potential bond costs related to other reclamation activities will add up to less than the bond for the slurry wall, given the slurry wall's great cost. It is assumed at this stage that the processing area has not been developed. Once the first slurry wall is installed, the permittee may pursue a reduced bond via a bond reduction request to CDRMS.

A detailed breakdown of the estimated worst-case reclamation cost is shown in Table L-1.

Table L-1 Phase 2

Description	Material Quantity	Unit	Unit Cost	Cost
Pod 1 and 2 slurry wall. 6500-ft by 50-ft deep.	325,000	Sq. ft.	$4.30	$1,397,500
Topsoiling to 2 FT. deep along the slurry wall installation path. 20-ft wide x 6500-ft long x 2-ft deep.	26,200	CY	$1.50	$39,300
Discing of topsoil to a depth of 2 FT. over 3 acres.	3	acres	$105	$ 315
Seeding of 3 acres (slurry wall installation path)	3	acres	$400	$ 315
Mulching and crimping of mulch over 3 acre disturbance area	3	acres	$850	$2,550
Weed control management for two years.	N/A	N/A	$750	$750
Subtotal				$1,440,730
DRMS cost (28%)				$403,404
Total				$1,844,134

EXHIBIT M OTHER PERMITS REQUIRED

The following permits are necessary to operate at the Ewing Gravel Pit. Copies of all permits will be provided to the Division after they have been acquired.

1. Fort Lupton Annexation
2. Fort Lupton Use Permit
3. Colorado Air Pollution Control Division Fugitive Dust Permit and Air Pollution Emission Notice (APEN)
4. Water Quality Control Commission Discharge Permit
5. Colorado Dept. of Transportation access permit
6. Fort Lupton Floodplain Development permit
7. Colorado Division of Water Resources gravel well permit

EXHIBIT N RIGHT OF ENTRY

The surface and mineral owner of the property to be mined is Tricycle Lane Texas, LLC. A right of entry affidavit is attached.

DEMONSTRATION OF LEGAL RIGHT-TO-ENTER

IN ACCORDANCE WITH HARD ROCK AND CONSTRUCTION MATERIALS RULE 6.3.7

The undersigned is Scott Burns, the Manager (authorized signer) of Tricycle Lane Texas, LLC ("Tricycle"). Tricycle hereby agrees that:

1. Tricycle is the owner of the lands identified as parcel number 130930000039 (account no. R1021202) and parcel number 130930000007 (account no. R5270086) as depicted on Exhibit A, attached and incorporated herein;
2. Burnco Colorado, LLC has the legal right to enter and mine.

Tricycle Lane Texas LLC

Name: Scott Burns

Title: Manager

Province Alberta

STATE OF COLORADO)

) ss.

City

COUNTY OF Calgary)

The foregoing instrument was acknowledged before me this 31 day of August, 2023, by Scott Burns, the Manager of Tricycle Lane Texas LLC.

Witness my hand and official seal.

My commission expires:

Notary Public David Both
Barrister & Solicitor

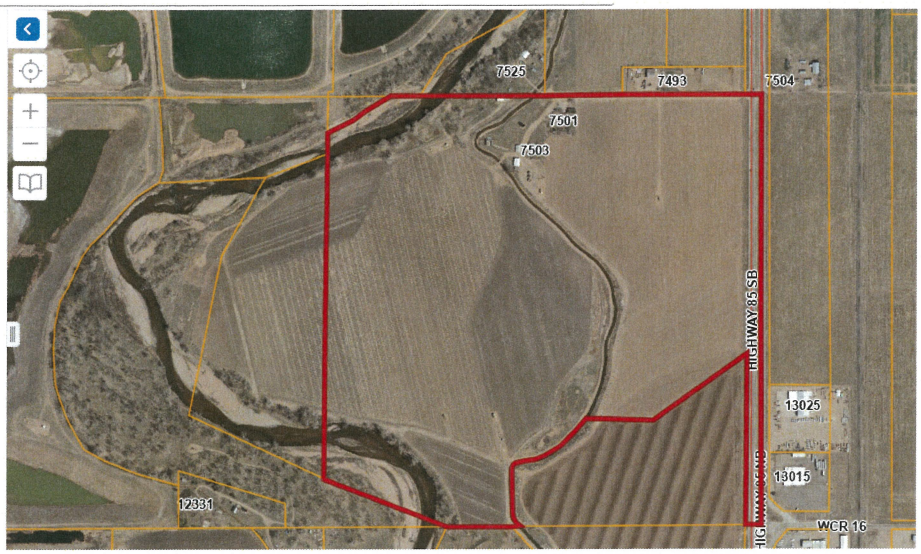
EXHIBIT A

Parcels (1)

Owner: TRICYCLE LANE TEXAS LLC

Account: R1021202 **Parcel:** 130930000039
Address: 7501 HIGHWAY 85 WELD
Subdivision:
Section: 30 **Township:** 2N **Range:** 66W
Taxes Property Report Data Search Buffer Sales

Displaying 1 - 1 (Total: 1)



Parcels (1)

Owner: TRICYCLE LANE TEXAS LLC

Account: R5270086 **Parcel:** 130930000007
Address:
Subdivision:
Section: 30 **Township:** 2N **Range:** 66W
Taxes Property Report Data Search Buffer Sales

Displaying 1 - 1 (Total: 1)

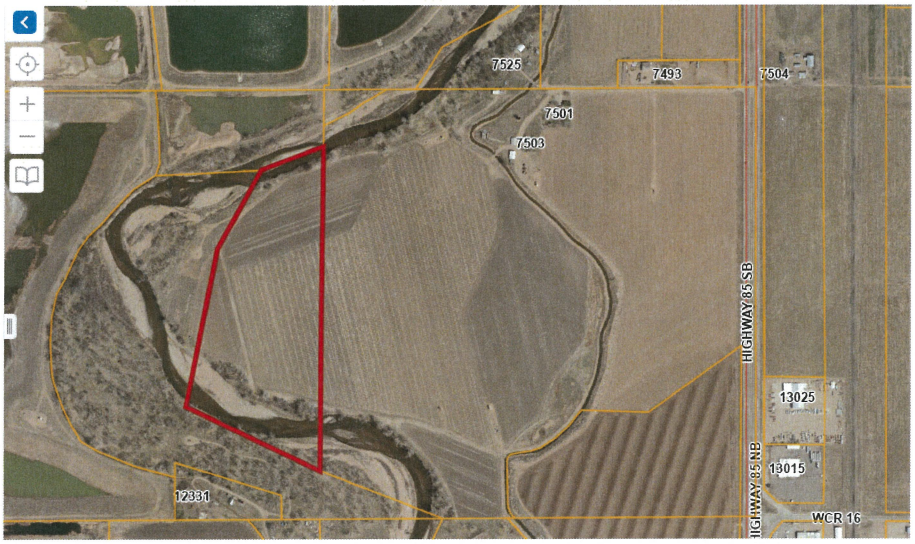


EXHIBIT O OWNERS OF AFFECTED LAND AND MINERAL TO BE MINED

The owner(s) of record of affected land (surface area) and owners of substance to be mined is Tricycle Lane Texas, LLC.

EXHIBIT P MUNICIPALITIES WITHIN TWO MILES

The Ewing Gravel Pit is located directly north of Fort Lupton, Colorado, a city in Weld County.

Fort Lupton

130 S McKinley Avenue

Fort Lupton, CO

EXHIBIT Q PROOF OF MAILING OF NOTICES TO THE BOARD OF COUNTY COMMISSIONERS AND SOIL CONSERVATION DISTRICT

Notices were filed with the Weld County Board of Commissioners and the West Greeley Conservation District in support of this permit application.

Weld County Board of Commissioners
1150 O Street
P.O. Box 758
Greeley, CO 80631

Platte Valley Conservation District
57 W Bromley Lane
Brighton, CO 80601

U.S. Postal Service
Certified Mail Receipt

OUTBOUND TRACKING NUMBER
9414 7118 9956 2067 6124 64

RETURN RECEIPT TRACKING NUMBER
9490 9118 9956 2067 6124 20

FEES

Postage per piece	$0.870
Certified Fee	$4.350
Return Receipt Fee	$3.550
Total Postage & Fees:	**$8.770**

ARTICLE ADDRESS TO:

Weld County BOCC
1150 O Street
PO Box 758
Greeley CO 80632-0758

Postmark Here

TOWER STATION PO, AURORA CO 80015
AUG 24 2023
USPS

U.S. Postal Service
Certified Mail Receipt

OUTBOUND TRACKING NUMBER
9414 7118 9956 2067 6491 25

RETURN RECEIPT TRACKING NUMBER
9490 9118 9956 2067 6491 05

FEES

Postage per piece	$0.870
Certified Fee	$4.350
Return Receipt Fee	$3.550
Total Postage & Fees:	**$8.770**

ARTICLE ADDRESS TO:

Platte Valley Conservation District
57 W Bromley Ln
Brighton CO 80601-3025

Postmark Here

TOWER STATION PO, AURORA CO 80015
AUG 24 2023
USPS

EXHIBIT R PROOF OF FILING WITH COUNTY CLERK

A return receipt from the Weld County Clerk & Recorder is attached.

Weld County Clerk and Recorder
1250 H Street
Greeley, CO 80631

Lewicki & Associates
ENGINEERING | GEOLOGY | ENVIRONMENTAL

September 1, 2023

Weld County Clerk and Recorder
1250 H St
Greeley, CO 80631

Dear Weld County Clerk:

Please certify that a copy of the Ewing Gravel Pit 112c Construction Materials Reclamation Permit is currently available for public viewing.

The applicant is BURNCO Colorado, LLC. The Colorado Division of Reclamation, Mining, and Safety requires evidence that a public copy of the updated application has been provided to your office. This copy is to be available for viewing by members of the public upon request; recording is not requested.

Please sign and date below certifying that the application has been filed. Return this page to the email address provided below.

The application was received on the following date:

Date: 9/5/2023

Recipient: Adela Segura Carly Shoppes

Regards,

Ben Langenfeld, P.E.
Lewicki & Associates, PLLC
benl@lewicki.biz
(720) 842-531, ex. 1

EXHIBIT S PERMANENT MAN-MADE STRUCTURES

The following is a list of man-made structures within 200 feet of the affected area. All of these structures are shown on Map C-1. Landowner boundaries can also be found on Map C-1. Proof of delivery of structure agreements is attached to this exhibit. In the event that a structure agreement is unobtainable, defer to the Geotechnical Stability Exhibit which indicates that all structures will be protected.

Table S-1. Permanent Structures within 200' of the Affected Area

Owner	Owner Address	Structures	General Location
Rocky Mountain Energy Center LLC (XCEL Energy)	1800 Larimer St Ste 400 Denver, CO 80202	Wells, pump house, water pipelines, and related structures.	Multiple locations across property.
Public Service Company of Colorado (Xcel Energy)	1800 Larimer St Ste 400 Denver, CO 80202	Gas pipelines.	Running along northeast of the permit area.
Bachofer, Ross	7525 US Highway 85 Fort Lupton, CO 80621	Residence, driveway, fences, sheds	North of permit area.
Martinez, Humberto C & Gayton, Rocio	7493 Highway 85 Fort Lupton, CO 80621	Residences, livestock buildings, fences, driveway, sheds, water well.	Northeast of permit area.
Weld-85	1540 Main St Ste 218/303	Agriculture buildings, driveway, fences.	
Colorado Department of Transportation	10601 W. 10th St. Greeley, CO 80634	US Highway 85 and related structures.	East of permit area.
United Power	500 Cooperative Way	Overhead Power Line.	Northeastern area of permit area and north to south through the upper terrace.
Platteville Irrigating and Milling Company	12994 WCR 28 Platteville, CO 80651	Platteville Ditch.	North to south through the center of the permit area.
KP Kauffman Company Inc	1700 Lincoln St Ste 4550 Denver, CO 80203	Gas pipelines and wells.	Multiple locations across property.
Crestone Peak Resources Operating LLC	1801 California Street #2500 Denver, CO 80202	Gas pipelines and wells.	Multiple locations across property.
L.G. Everist Inc	350 S Main Ave Ste 400 Sioux Falls, SD	Water wells and related structures	Multiple locations across property

RULE 1.6.2(1)(B)

Prior to the submittal of the application, a sign was erected at the entrance to the site that contains the required information dictated by Rule 1.6.2(1)(b).

Please see attached sign certification.

THIS SITE IS THE LOCATION OF A PROPOSED CONSTRUCTION MATERIALS OPERATION. BURNCO COLORADO, LLC, WHOSE ADDRESS AND PHONE NUMBER IS 10100 DALLAS STREET, HENDERSON, CO 80640, (720) 682-1124, HAS APPLIED FOR A REGULAR 112 CONSTRUCTION MATERIALS OPERATION RECLAMATION PERMIT AMENDMENT WITH THE COLORADO MINED LAND RECLAMATION BOARD.

ANYONE WISHING TO COMMENT ON THE APPLICATION MAY VIEW THE APPLICATION AT THE WELD COUNTY CLERK AND RECORDER'S OFFICE; 1250 H STREET, GREELEY, CO 80631, AND SHOULD SEND COMMENTS PRIOR TO THE END OF THE PUBLIC COMMENT PERIOD TO THE DIVISION OF RECLAMATION, MINING, AND SAFETY, 1313 SHERMAN ST., ROOM 215, DENVER, COLORADO 80203.

Certification:

I, Devon Glosser, hereby certify that I posted a sign containing the above notice for the proposed permit area known as the Ewing Gravel Pit, on August 16th, 2023.

Devon Glosser — 08/16/23

Signature — Date

,

RULE 6.5: GEOTECHNICAL STABILITY EXHIBIT

There are no known geologic hazards on the proposed site. Based on a slope stability analysis, buildings or other structures within 200' of the Ewing Gravel Pit affected area will not be affected by mining excavation. Sufficient buffers will be maintained to structures. Maps C-2 and F-1 shows these buffers. Slurry walls installed prior to mining will be 30-ft away from the edge of mining. Map C-3 shows the mining and reclamation slopes of the mine. A standard slope in Pod 1 was analyzed for stability as it is a good example of nearby structures: an internal road used by Xcel Energy to access wells that they own and the slurry wall

The material properties are derived from Table 2.5 in the SME Mining Reference Handbook[1], as there is no site-specific strength data of the material available. Therefore, all materials are matched to a classification from this table that best matches the materials in terms of description. The native alluvial material is best classified as sand and gravel with a mixed grain size. A layer of overburden and sand lies atop the sand and gravel deposit. This material is best described as loose sand, mixed grain size. The bedrock is an soft sedimentary rock (claystone/siltstone) according to the SME Table 2.5. A summary of the material properties can be seen in Table 6.5-1.

Table 6.5-1 Material Properties

Material	Unit Weight (lbs/ft)	Cohesion	Friction Angle
Sand and gravel, mixed grain size	110	0	45
Loose sand, mixed grain size	99	0	34
Bedrock	110	20,000	25.0

The final mining (1.5H:1V) and final reclamation (3H:1V) slopes were analyzed. Mining will be conducted at a near active highwall angle until the highwall has reached the half-way point of the final mining slope. Then the vertical active highwall slope will be knocked down to the final mining slope of 1.5H:1V. Then it will be backfilled with overburden/sand to the final reclamation slope of 3H:1V. The final mining and reclaimed slope crests will be the closest excavation comes to the slurry wall and any structures.

[1] Original source: Hoek and Bray 1977

1. Mining and Reclamation Slopes

Factor of Safety is expressed in terms of strength divided by stress as a ratio. It is arrived at by an iterative computer process where a slope failure is assumed, the strength and stress of that slope failure are calculated, and those values are compared to determine a lowest factor of safety. In the case of the Ewing slope stability analysis, the Bishop's Method of Slices was the iterative calculation used, and the software GALENA was used to model slopes and calculate the factor of safety. One slope closest to major structures (see Figure GS-1) was analyzed to look at the factor of safety. Table GS-1 lists the analysis conducted and their respective factors of safety.

GALENA data tables and analysis result figures are attached as Appendix GS-1.

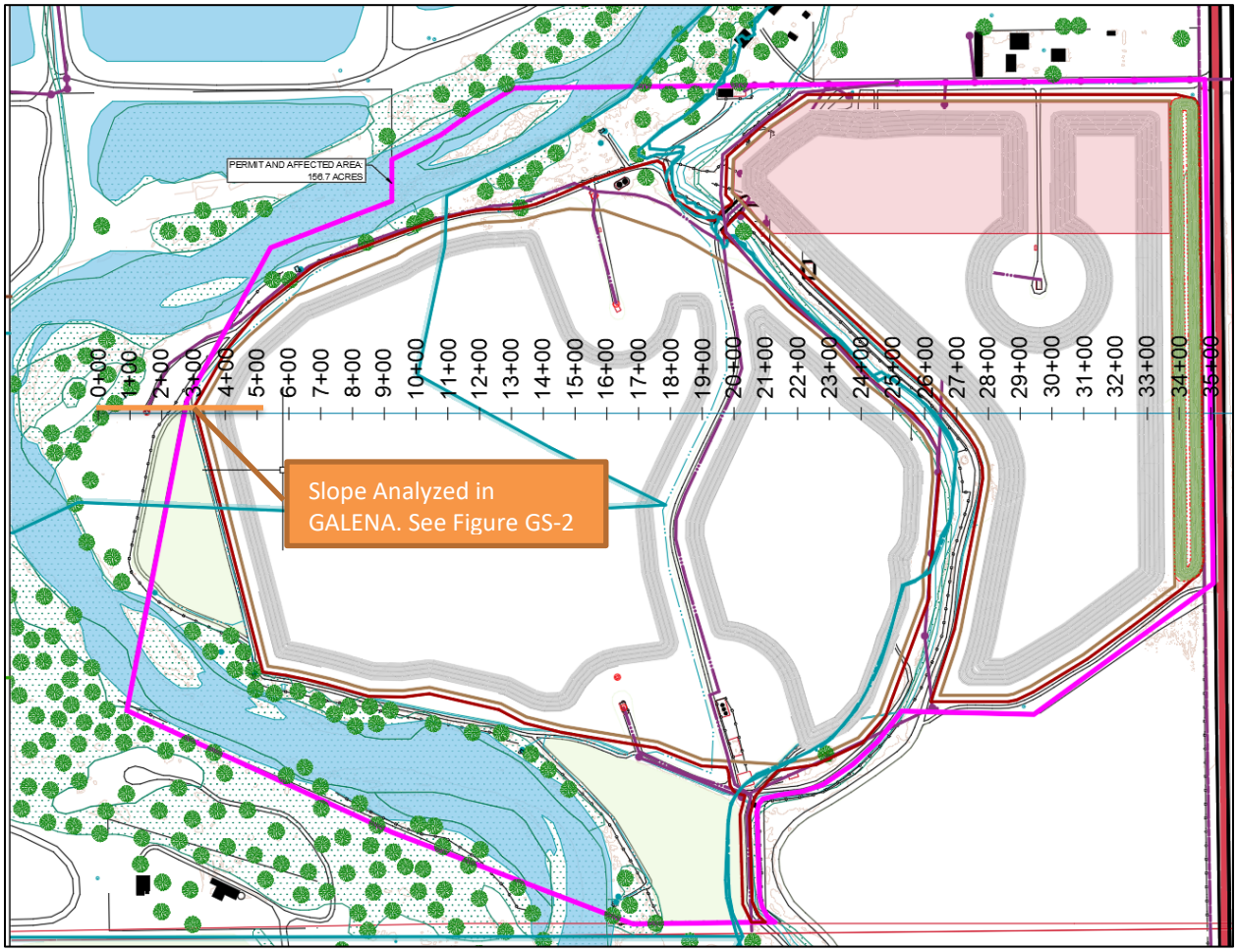


Figure GS-1. Locations of Slope Stability Analysis from Map F-1

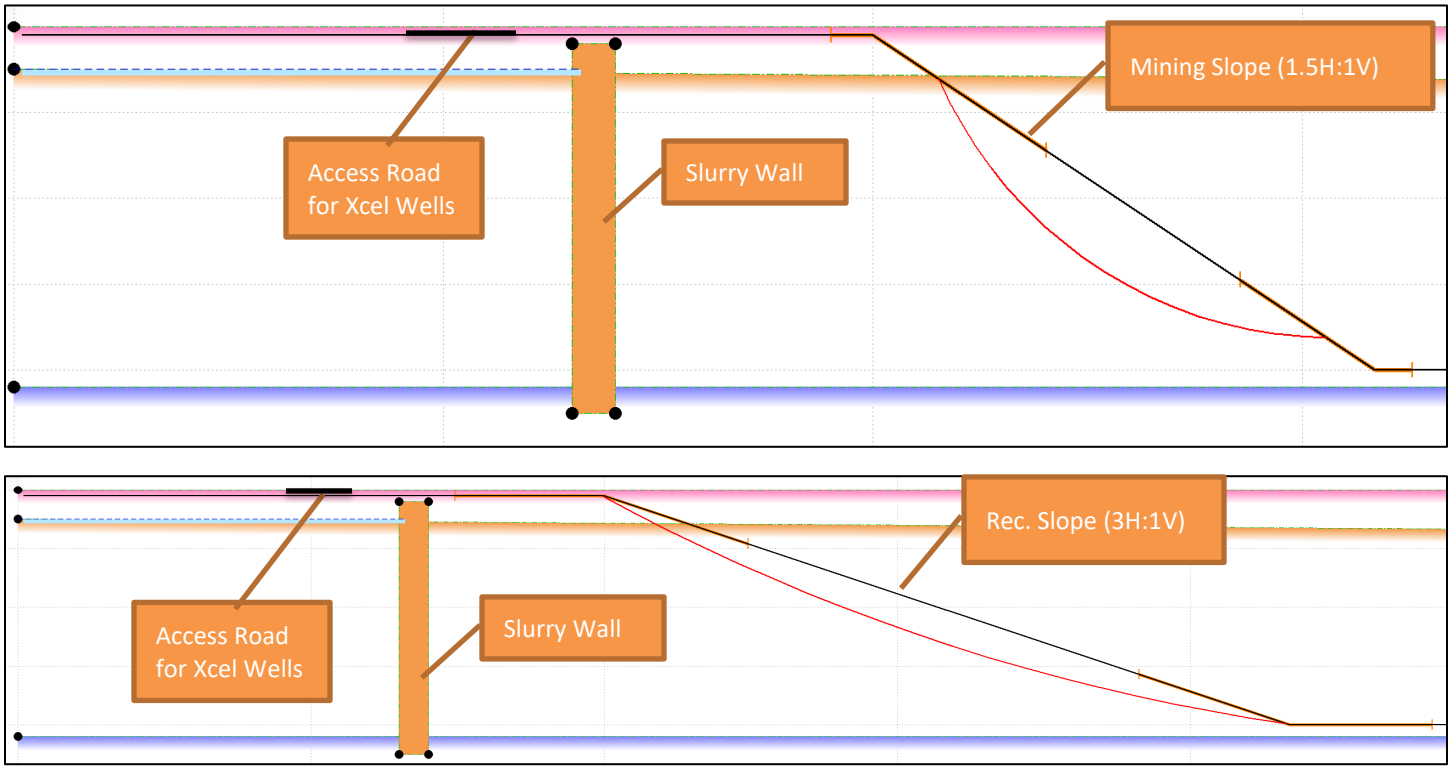


Figure GS-2. GALENA Cross Sections (Mining and Reclamation)

Table GS-1. Factors of Safety for Slope Stability

Slope Condition	Lowest Factor of Safety (static)	Lowest Factor of Safety (seismic)	Nearest Structure
Full Mining	1.55	1.35	Slurry wall
Final Reclamation	3.00	2.53	Slurry wall

2. Conclusion

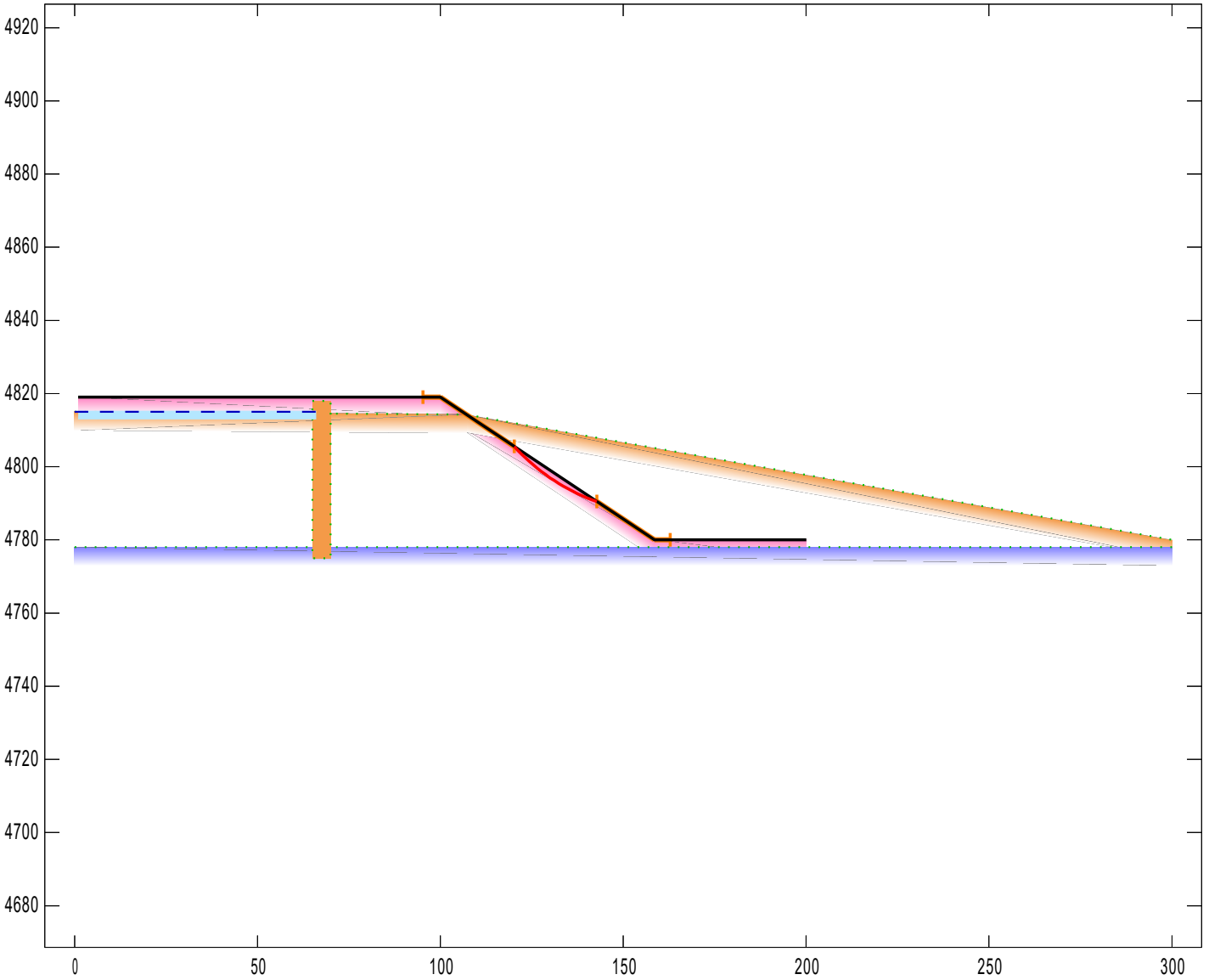
The Final Reclamation slope has a minimum factor of safety (FoS = 3.00) of greater than 1.5 for static conditions. The Final Mining slope also has a minimum FoS greater than 1.5 (1.55) for static conditions. These Factors of Safety are greater than the CDRMS minimum for critical structure of 1.5. The seismic conditions analysis for both scenarios are similarly above the CDRMS minimums for critical structures: 1.35 > 1.3 and 2.53 > 1.3

The slope stability analysis in this permit has been prepared according to appropriate engineering standards and practices.

Ben Langenfeld, P.E.

P.E.# 0047151

APPENDIX GS-1 GALENA INFORMATION



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Sand and gravel, mixed grain size

2: OB - loose sand, mixed grain size

3: Bedrock - claystone

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.55

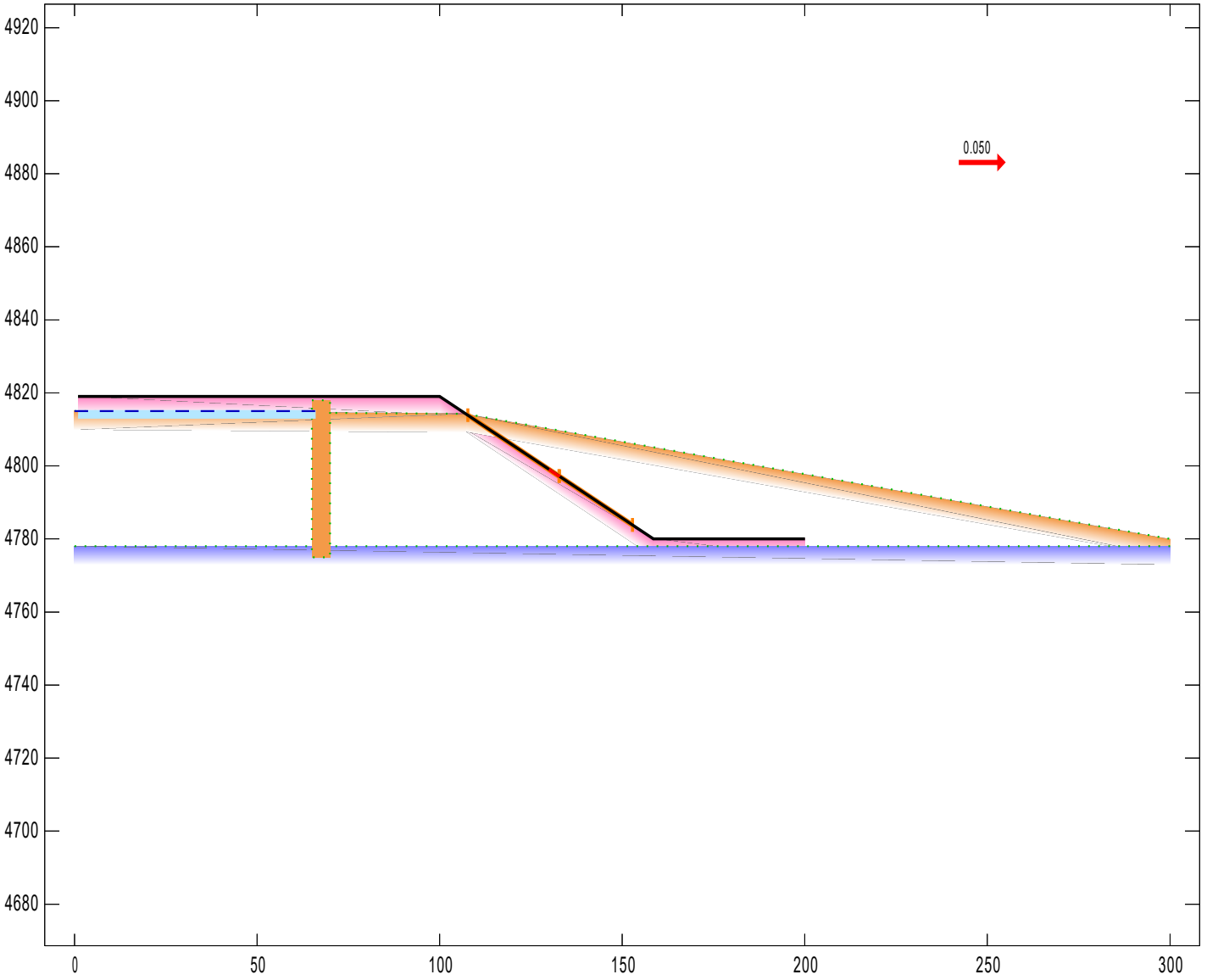
Edited: 18 Aug 2023

Processed: 18 Aug 2023

Project Ewing Gravel Pit
Mining Condition

File: E:\Work\GLA Dropbox\Ben Langenfeld\BurnCo\Ewing\Slope Stability\Ewing Slope Stability.gmf

Lewicki & Associates



GALENA Version 7.1

Licensed to: Greg Lewicki and Associates

Material Keys

1: Sand and gravel, mixed grain size

2: OB - loose sand, mixed grain size

3: Bedrock - claystone

Analysis 2

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular (Critical Seed)

Results

Critical Factor of Safety: 1.35

Edited: 18 Aug 2023

Processed: 18 Aug 2023

Project Ewing Gravel Pit
Mining Condition

File: E:\Work\GLA Dropbox\Ben Langenfeld\BurnCo\Ewing\Slope Stability\Ewing Slope Stability.gmf

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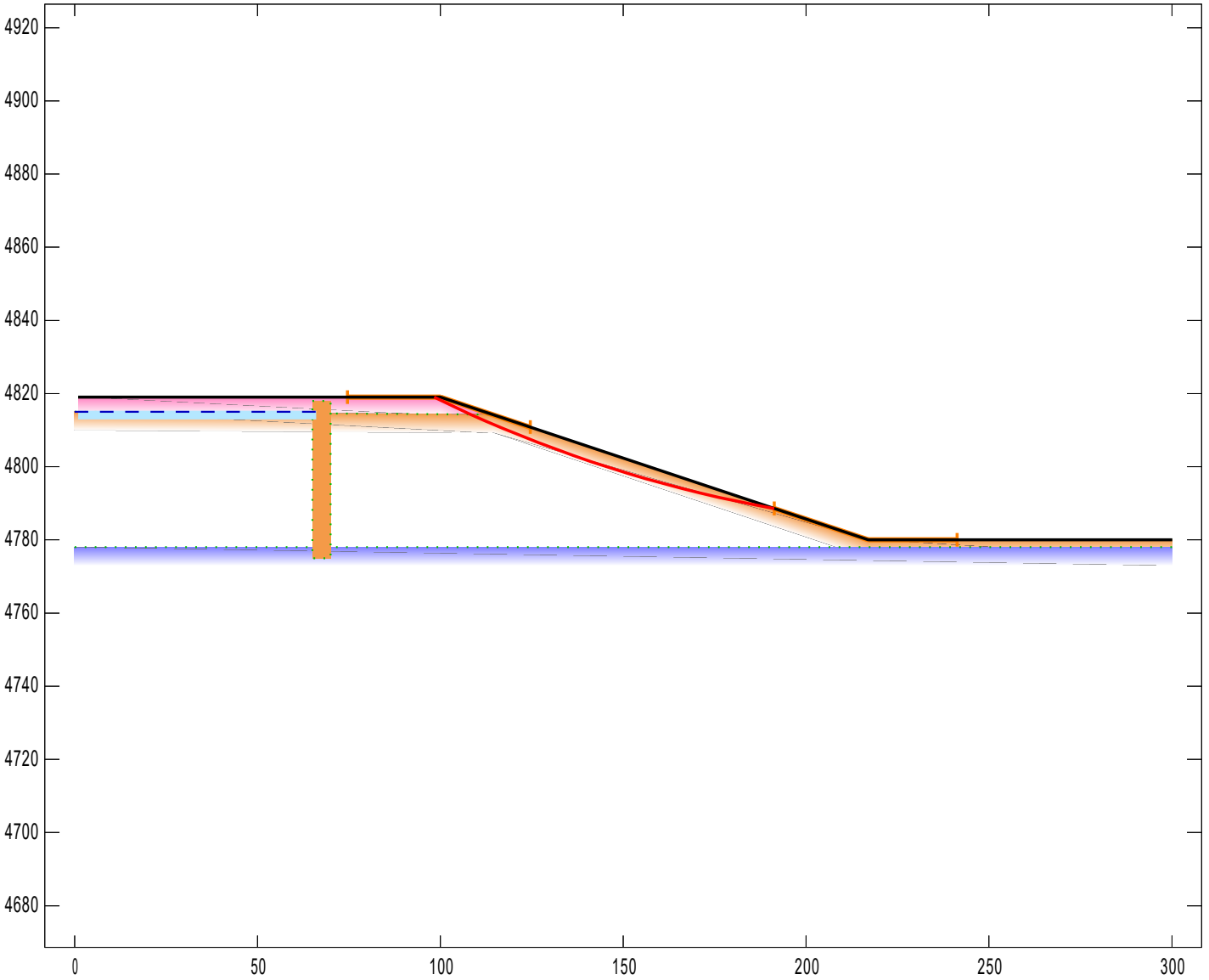

GALENA Version 7.1

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Material Keys

1: Sand and gravel, mixed grain size

2: OB - loose sand, mixed grain size

3: Bedrock - claystone

Analysis 3

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 3.00

Edited: 18 Aug 2023

Processed: 18 Aug 2023

Project Ewing Gravel Pit
Reclaimed Condition

File: E:\Work\GLA Dropbox\Ben Langenfeld\BurnCo\Ewing\Slope Stability\Ewing Slope Stability.gmf

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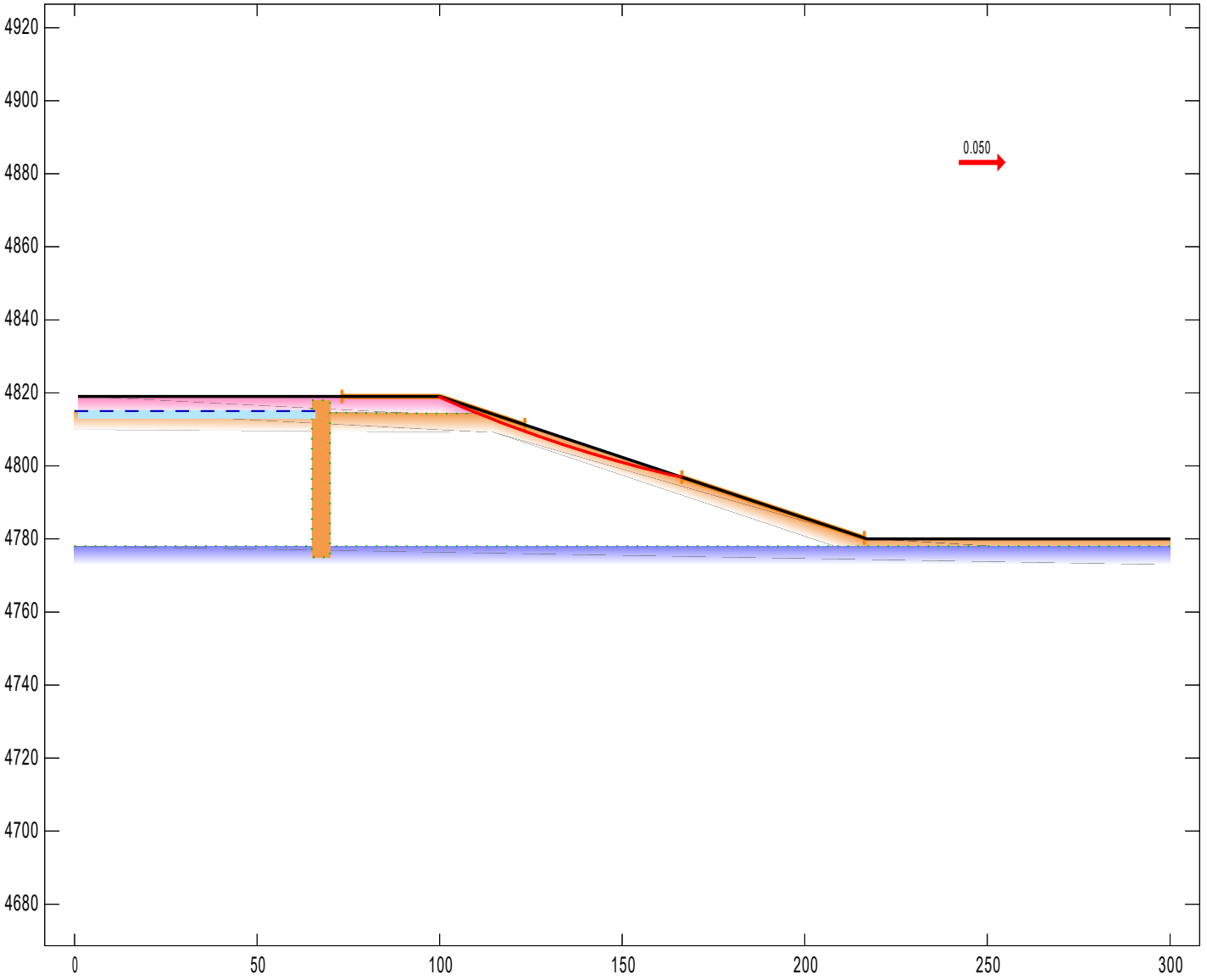

GALENA Version 7.1

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Material Keys

1: Sand and gravel, mixed grain size

2: OB - loose sand, mixed grain size

3: Bedrock - claystone

Analysis 4

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular (Critical Seed)

Results

Critical Factor of Safety: 2.52

Edited: 18 Aug 2023

Processed: 18 Aug 2023

Project Ewing Gravel Pit
Reclaimed Condition

File: E:\Work\GLA Dropbox\Ben Langenfeld\BurnCo\Ewing\Slope Stability\Ewing Slope Stability.gmf

Lewicki & Associates

GALENA 7.1 Analysis Results Version: 7.10.1.04 Licensee: Greg Lewicki and Associates

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Project: Ewing Gravel Pit
File: E:\Work\GLA Dropbox\Ben Langenfeld\BurnCo\Ewing\Slope Stability\Ewing Slope Stability.gmf
Processed: 18 Aug 2023 13:58:57

DATA: Analysis 1 - Mining Condition

Material Properties (4 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and gravel, mixed grain size

Cohesion	Phi	UnitWeight	Ru
0.00	45.0	110.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - OB - loose sand, mixed grain size

Cohesion	Phi	UnitWeight	Ru
0.00	34.0	99.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Bedrock - claystone

Cohesion	Phi	UnitWeight	Ru
20000.00	25.0	110.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall

	Cohesion	Phi	UnitWeight	Ru
Unsaturated:	0.00	0.0	112.00	Auto
Saturated:	0.00	0.0	115.00	Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 0.000

Material Profiles (4 profiles)

Profile: 1 (2 points) Material beneath: 2 - OB - loose sand, mixed grain size
0.00 4820.00 300.00 4820.00

Profile: 2 (2 points) Material beneath: 1 - Sand and gravel, mixed grain size
0.00 4815.00 300.00 4813.00

Profile: 3 (2 points) Material beneath: 3 - Bedrock - claystone
0.00 4778.00 300.00 4778.00

Profile: 4 (5 points) Material within: 1 - Sand and gravel, mixed grain size
65.00 4818.00 70.00 4818.00 70.00 4775.00 65.00 4775.00 65.00 4818.00

Slope Surface (4 points)

1.00 4819.00 100.00 4819.00 158.50 4780.00 200.00 4780.00

Phreatic Surface (2 points)

0.00 4815.00 66.00 4815.00

Piezometric Surfaces (1 surface)

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL: 107.70 YL: 4813.87 XR: 152.80 YR: 4783.80
Centre: XC: 153.56 YC: 4833.79 Radius: R: 50.00

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	25.00	20.00	10.50

Trial positions within range: 10 10 10

- --
-- -- -- -- -- -- -- -- -- -

RESULTS: Analysis 1 - Mining Condition

Bishop Simplified Method of Analysis - Circular Failure Surface
----
Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 1.800

There were: 945 successful analyses from a total of 1001 trial surfaces
56 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.55

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	120.20	4805.53	142.80	4790.47	161.21	4842.56	55.25	1.554	<-- Critical Surface
2	120.20	4805.53	142.80	4790.47	160.54	4841.56	54.08	1.556	
3	120.20	4805.53	142.80	4790.47	159.87	4840.55	52.92	1.559	
4	120.20	4805.53	142.80	4790.47	159.20	4839.55	51.75	1.561	
5	120.20	4805.53	142.80	4790.47	158.53	4838.54	50.58	1.564	
6	120.20	4805.53	145.02	4788.99	162.12	4841.52	55.25	1.565	
7	120.20	4805.53	142.80	4790.47	157.86	4837.53	49.42	1.568	
8	120.20	4805.53	145.02	4788.99	161.45	4840.51	54.08	1.568	
9	117.42	4807.39	142.80	4790.47	159.57	4843.11	55.25	1.568	
10	120.20	4805.53	142.80	4790.47	157.18	4836.52	48.25	1.571	
11	120.20	4805.53	145.02	4788.99	160.77	4839.50	52.92	1.571	
12	117.42	4807.39	142.80	4790.47	158.89	4842.10	54.08	1.571	
13	117.42	4807.39	142.80	4790.47	158.22	4841.09	52.92	1.575	
14	120.20	4805.53	145.02	4788.99	160.10	4838.49	51.75	1.575	
15	120.20	4805.53	142.80	4790.47	156.51	4835.51	47.08	1.575	
16	120.20	4805.53	147.24	4787.50	163.01	4840.46	55.25	1.578	
17	117.42	4807.39	142.80	4790.47	157.54	4840.07	51.75	1.578	
18	120.20	4805.53	145.02	4788.99	159.42	4837.48	50.58	1.578	
19	120.20	4805.53	142.80	4790.47	155.83	4834.50	45.92	1.579	
20	117.42	4807.39	145.02	4788.99	160.46	4842.04	55.25	1.581	
21	120.20	4805.53	147.24	4787.50	162.34	4839.44	54.08	1.582	
22	117.42	4807.39	142.80	4790.47	156.86	4839.06	50.58	1.582	

23	120.20	4805.53	145.02	4788.99	158.74	4836.46	49.42
1.582							
24	120.20	4805.53	142.80	4790.47	155.15	4833.48	44.75
1.583							
25	114.64	4809.24	142.80	4790.47	157.90	4843.61	55.25
1.585							
26	117.42	4807.39	145.02	4788.99	159.78	4841.02	54.08
1.585							
27	120.20	4805.53	147.24	4787.50	161.66	4838.42	52.92
1.585							
28	117.42	4807.39	142.80	4790.47	156.18	4838.04	49.42
1.586							
29	120.20	4805.53	145.02	4788.99	158.06	4835.44	48.25
1.587							
30	114.64	4809.24	142.80	4790.47	157.22	4842.59	54.08
1.589							
31	117.42	4807.39	145.02	4788.99	159.10	4840.00	52.92
1.589							
32	120.20	4805.53	147.24	4787.50	160.98	4837.40	51.75
1.590							
33	117.42	4807.39	142.80	4790.47	155.50	4837.01	48.25
1.591							
34	120.20	4805.53	145.02	4788.99	157.38	4834.42	47.08
1.591							
35	120.20	4805.53	149.47	4786.02	163.89	4839.36	55.25
1.592							
36	114.64	4809.24	142.80	4790.47	156.53	4841.57	52.92
1.593							
37	117.42	4807.39	145.02	4788.99	158.41	4838.97	51.75
1.593							
38	120.20	4805.53	147.24	4787.50	160.29	4836.38	50.58
1.594							
39	117.42	4807.39	142.80	4790.47	154.82	4835.99	47.08
1.596							
40	117.42	4807.39	147.24	4787.50	161.32	4840.93	55.25
1.596							
41	120.20	4805.53	145.02	4788.99	156.70	4833.39	45.92
1.596							
42	120.20	4805.53	149.47	4786.02	163.20	4838.33	54.08
1.596							
43	114.64	4809.24	142.80	4790.47	155.85	4840.54	51.75
1.598							
44	117.42	4807.39	145.02	4788.99	157.73	4837.95	50.58
1.598							
45	120.20	4805.53	147.24	4787.50	159.61	4835.35	49.42
1.599							
46	114.64	4809.24	145.02	4788.99	158.76	4842.50	55.25
1.600							
47	117.42	4807.39	147.24	4787.50	160.64	4839.90	54.08
1.600							
48	117.42	4807.39	142.80	4790.47	154.14	4834.96	45.92
1.601							
49	120.20	4805.53	149.47	4786.02	162.52	4837.30	52.92
1.601							
50	120.20	4805.53	145.02	4788.99	156.01	4832.36	44.75
1.602							
51	114.64	4809.24	142.80	4790.47	155.16	4839.52	50.58
1.602							
52	117.42	4807.39	145.02	4788.99	157.04	4836.92	49.42
1.603							
53	111.87	4811.09	142.80	4790.47	156.19	4844.07	55.25
1.604							
54	120.20	4805.53	147.24	4787.50	158.92	4834.32	48.25
1.604							
55	114.64	4809.24	145.02	4788.99	158.07	4841.47	54.08
1.604							
56	117.42	4807.39	147.24	4787.50	159.95	4838.87	52.92

1.605
57 120.20 4805.53 149.47 4786.02 161.83 4836.27 51.75
1.606
58 117.42 4807.39 142.80 4790.47 153.45 4833.93 44.75
1.607
59 114.64 4809.24 142.80 4790.47 154.48 4838.48 49.42
1.608
60 120.20 4805.53 151.69 4784.54 164.74 4838.23 55.25
1.608
61 111.87 4811.09 142.80 4790.47 155.51 4843.04 54.08
1.608
62 117.42 4807.39 145.02 4788.99 156.36 4835.89 48.25
1.609
63 114.64 4809.24 145.02 4788.99 157.38 4840.44 52.92
1.609
64 120.20 4805.53 147.24 4787.50 158.23 4833.29 47.08
1.610
65 117.42 4807.39 147.24 4787.50 159.26 4837.84 51.75
1.610
66 120.20 4805.53 149.47 4786.02 161.14 4835.24 50.58
1.611
67 117.42 4807.39 149.47 4786.02 162.17 4839.79 55.25
1.612
68 120.20 4805.53 151.69 4784.54 164.05 4837.19 54.08
1.613
69 114.64 4809.24 142.80 4790.47 153.79 4837.45 48.25
1.613
70 111.87 4811.09 142.80 4790.47 154.82 4842.00 52.92
1.614
71 117.42 4807.39 145.02 4788.99 155.67 4834.85 47.08
1.614
72 114.64 4809.24 145.02 4788.99 156.69 4839.40 51.75
1.615
73 120.20 4805.53 147.24 4787.50 157.54 4832.25 45.92
1.616
74 117.42 4807.39 147.24 4787.50 158.57 4836.80 50.58
1.616
75 114.64 4809.24 147.24 4787.50 159.60 4841.35 55.25
1.616
76 120.20 4805.53 149.47 4786.02 160.45 4834.20 49.42
1.617
77 117.42 4807.39 149.47 4786.02 161.48 4838.75 54.08
1.617
78 120.20 4805.53 151.69 4784.54 163.36 4836.15 52.92
1.618
79 111.87 4811.09 142.80 4790.47 154.12 4840.96 51.75
1.619
80 114.64 4809.24 142.80 4790.47 153.09 4836.41 47.08
1.619
81 111.87 4811.09 145.02 4788.99 157.03 4842.92 55.25
1.620
82 114.64 4809.24 145.02 4788.99 156.00 4838.36 50.58
1.620
83 117.42 4807.39 145.02 4788.99 154.97 4833.81 45.92
1.621
84 114.64 4809.24 147.24 4787.50 158.91 4840.31 54.08
1.621
85 117.42 4807.39 147.24 4787.50 157.88 4835.76 49.42
1.622
86 120.20 4805.53 147.24 4787.50 156.85 4831.21 44.75
1.622
87 117.42 4807.39 149.47 4786.02 160.78 4837.71 52.92
1.623
88 120.20 4805.53 149.47 4786.02 159.76 4833.16 48.25
1.623
89 120.20 4805.53 151.69 4784.54 162.66 4835.11 51.75
1.624

```
  90       109.09     4812.94      142.80     4790.47      154.46     4844.47       55.25
  1.625
  91       120.20     4805.53      153.91     4783.06      165.57     4837.07       55.25
  1.625
  92       111.87     4811.09      142.80     4790.47      153.43     4839.92       50.58
  1.625
  93       111.87     4811.09      145.02     4788.99      156.33     4841.87       54.08
  1.626
  94       114.64     4809.24      142.80     4790.47      152.40     4835.37       45.92
  1.626
  95       114.64     4809.24      145.02     4788.99      155.31     4837.32       49.42
  1.627
  96       114.64     4809.24      147.24     4787.50      158.21     4839.27       52.92
  1.627
  97       117.42     4807.39      145.02     4788.99      154.28     4832.77       44.75
  1.628
  98       117.42     4807.39      147.24     4787.50      157.18     4834.72       48.25
  1.628
  99       117.42     4807.39      149.47     4786.02      160.09     4836.67       51.75
  1.629

Critical Failure Surface (circle 1)
-----------------------
Intersects:  XL:     120.20      YL:    4805.53      XR:     142.80      YR:    4790.47
    Centre:  XC:     161.21      YC:    4842.56                  Radius:  R:      55.25
Generated failure surface: (20 points)
    120.20   4805.53          121.18   4804.47          122.19   4803.44          123.23
    4802.43          124.29   4801.46
    125.38   4800.50          126.49   4799.58          127.62   4798.69          128.78
    4797.83          129.96   4796.99
    131.16   4796.19          132.39   4795.42          133.63   4794.69          134.89
    4793.98          136.17   4793.31
    137.46   4792.67          138.78   4792.07          140.10   4791.50          141.44
    4790.97          142.80   4790.47

Slice Geometry and Properties - Critical Failure Surface (circle 1,  38 slices)
-----------------------------------------------------
Slice                X-S     ------------------- Base ---------------------
PoreWater      Normal    Test
        X-Left      Area    Angle    Width    Length  Matl   Cohesion    Phi       Weight
        Force       Stress   Factor
  1      120.20      0.05    47.2     0.49     0.72     1       0.00    45.0         5.46
  0.00         6.56    0.87
  2      120.69      0.15    47.2     0.49     0.72     1       0.00    45.0        16.40
  0.00        19.71    0.87
  3      121.18      0.25    45.7     0.50     0.72     1       0.00    45.0        27.46
  0.00        32.80    0.86
  4      121.69      0.34    45.7     0.50     0.72     1       0.00    45.0        37.46
  0.00        44.74    0.86
  5      122.19      0.44    44.2     0.52     0.72     1       0.00    45.0        48.07
  0.00        57.09    0.86
  6      122.71      0.52    44.2     0.52     0.72     1       0.00    45.0        57.09
  0.00        67.80    0.86
  7      123.23      0.61    42.7     0.53     0.72     1       0.00    45.0        67.10
  0.00        79.33    0.85
  8      123.76      0.68    42.7     0.53     0.72     1       0.00    45.0        75.03
  0.00        88.67    0.85
  9      124.29      0.77    41.2     0.54     0.72     1       0.00    45.0        84.25
  0.00        99.20    0.85
 10      124.83      0.83    41.2     0.54     0.72     1       0.00    45.0        90.97
 0.00       107.06    0.85
 11      125.38      0.90    39.7     0.56     0.72     1       0.00    45.0        99.26
 0.00       116.39    0.85
 12      125.93      0.95    39.7     0.56     0.72     1       0.00    45.0       104.81
 0.00       122.95    0.85
 13      126.49      1.02    38.2     0.57     0.72     1       0.00    45.0       111.98
 0.00       130.94    0.84
```

14	127.06	1.06	38.2	0.57	0.72	1	0.00	45.0	116.25
0.00	135.98	0.84							
15	127.62	1.11	36.7	0.58	0.72	1	0.00	45.0	122.21
0.00	142.61	0.84							
16	128.20	1.14	36.7	0.58	0.72	1	0.00	45.0	125.10
0.00	146.04	0.84							
17	128.78	1.18	35.2	0.59	0.72	1	0.00	45.0	129.68
0.00	151.15	0.84							
18	129.37	1.19	35.2	0.59	0.72	1	0.00	45.0	131.18
0.00	152.89	0.84							
19	129.96	1.22	33.7	0.60	0.72	1	0.00	45.0	134.26
0.00	156.31	0.84							
20	130.56	1.22	33.7	0.60	0.72	1	0.00	45.0	134.29
0.00	156.41	0.84							
21	131.16	1.23	32.2	0.61	0.72	1	0.00	45.0	135.83
0.00	158.16	0.84							
22	131.77	1.22	32.2	0.61	0.72	1	0.00	45.0	134.29
0.00	156.36	0.84							
23	132.39	1.22	30.7	0.62	0.72	1	0.00	45.0	134.15
0.00	156.30	0.84							
24	133.01	1.19	30.7	0.62	0.72	1	0.00	45.0	131.01
0.00	152.65	0.84							
25	133.63	1.17	29.2	0.63	0.72	1	0.00	45.0	129.11
0.00	150.59	0.84							
26	134.26	1.13	29.2	0.63	0.72	1	0.00	45.0	124.37
0.00	145.12	0.84							
27	134.89	1.10	27.7	0.64	0.72	1	0.00	45.0	120.58
0.00	140.97	0.84							
28	135.53	1.04	27.7	0.64	0.72	1	0.00	45.0	114.19
0.00	133.46	0.84							
29	136.17	0.99	26.2	0.65	0.72	1	0.00	45.0	108.48
0.00	127.14	0.85							
30	136.82	0.91	26.2	0.65	0.72	1	0.00	45.0	100.44
0.00	117.72	0.85							
31	137.46	0.84	24.7	0.66	0.72	1	0.00	45.0	92.72
0.00	109.03	0.85							
32	138.12	0.75	24.7	0.66	0.72	1	0.00	45.0	82.92
0.00	97.51	0.85							
33	138.78	0.67	23.2	0.66	0.72	1	0.00	45.0	73.15
0.00	86.37	0.85							
34	139.44	0.56	23.2	0.66	0.72	1	0.00	45.0	61.64
0.00	72.80	0.85							
35	140.10	0.45	21.7	0.67	0.72	1	0.00	45.0	49.80
0.00	59.09	0.86							
36	140.77	0.33	21.7	0.67	0.72	1	0.00	45.0	36.47
0.00	43.27	0.86							
37	141.44	0.21	20.2	0.68	0.72	1	0.00	45.0	22.64
0.00	27.01	0.86							
38	142.12	0.07	20.2	0.68	0.72	1	0.00	45.0	7.50
0.00	8.94	0.86							

X-S Area: 30.71 Path Length: 27.44 X-S Weight: 3377.60

DATA: Analysis 2 - Mining Condition

Material Properties (4 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and gravel, mixed grain size

Cohesion	Phi	UnitWeight	Ru
0.00	45.0	110.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - OB - loose sand, mixed grain size

Cohesion	Phi	UnitWeight	Ru
0.00	34.0	99.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Bedrock - claystone

```
   Cohesion   Phi   UnitWeight   Ru
  20000.00   25.0     110.00    Auto
Material:  4 (Mohr-Coulomb Isotropic) - Slurry Wall
                  Cohesion   Phi   UnitWeight   Ru
    Unsaturated:     0.00    0.0     112.00    Auto
      Saturated:     0.00    0.0     115.00    Auto

Water Properties
----------------
Unit weight of water: 62.400          Unit weight of water/medium above ground:   0.000

Material Profiles (4 profiles)
------------------
Profile:  1 (2 points)   Material beneath:  2 - OB - loose sand, mixed grain size
      0.00     4820.00         300.00     4820.00
Profile:  2 (2 points)   Material beneath:  1 - Sand and gravel, mixed grain size
      0.00     4815.00         300.00     4813.00
Profile:  3 (2 points)   Material beneath:  3 - Bedrock - claystone
      0.00     4778.00         300.00     4778.00
Profile:  4 (5 points)   Material within:   1 - Sand and gravel, mixed grain size
     65.00     4818.00          70.00     4818.00          70.00     4775.00          65.00
     4775.00          65.00     4818.00

Slope Surface (4 points)
-------------
      1.00     4819.00         100.00     4819.00         158.50     4780.00         200.00
      4780.00

Phreatic Surface (2 points)
----------------
      0.00     4815.00          66.00     4815.00

Piezometric Surfaces (1 surface)
--------------------

Failure Surface (Critical, from previous analysis)
---------------
Initial circular surface for critical search defined by: XL,XR,R
  Intersects:  XL:     120.20      YL:    4805.53      XR:     142.80      YR:    4790.47
      Centre:  XC:     161.21      YC:    4842.56                  Radius:  R:      55.25

Earthquake Force
----------------
Pseudo-static earthquake (seismic) coefficient:  0.050

Variable Restraints
-------------------
Parameter descriptor:              XL         XR         R
Range of variation:             25.00      20.00      10.50
Trial positions within range:     10         10         10

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RESULTS: Analysis  2 - Mining Condition

Bishop Simplified Method of Analysis - Circular Failure Surface
------------------------------------------------------------
Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation:   1.399

There were: 981 successful analyses from a total of 1001 trial surfaces
            20 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety:  1.35
```

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS
1	129.92	4799.05	132.80	4797.13	164.26	4847.44	59.33	1.349 <-- Critical Surface
2	129.92	4799.05	132.80	4797.13	163.61	4846.47	58.17	1.349
3	129.92	4799.05	132.80	4797.13	162.32	4844.53	55.83	1.349
4	129.92	4799.05	132.80	4797.13	164.91	4848.41	60.50	1.349
5	129.92	4799.05	132.80	4797.13	162.96	4845.50	57.00	1.349
6	129.92	4799.05	132.80	4797.13	160.37	4841.61	52.33	1.349
7	129.92	4799.05	132.80	4797.13	161.02	4842.58	53.50	1.349
8	129.92	4799.05	132.80	4797.13	161.67	4843.56	54.67	1.349
9	129.92	4799.05	132.80	4797.13	159.73	4840.64	51.17	1.349
10	129.92	4799.05	132.80	4797.13	159.08	4839.67	50.00	1.349
11	132.70	4797.20	137.24	4794.17	168.50	4845.97	60.50	1.350
12	132.70	4797.20	137.24	4794.17	167.85	4845.00	59.33	1.350
13	132.70	4797.20	137.24	4794.17	166.55	4843.06	57.00	1.350
14	132.70	4797.20	137.24	4794.17	167.20	4844.03	58.17	1.350
15	132.70	4797.20	137.24	4794.17	165.91	4842.08	55.83	1.350
16	132.70	4797.20	137.24	4794.17	165.26	4841.11	54.67	1.350
17	129.92	4799.05	135.02	4795.65	165.99	4847.63	60.50	1.350
18	132.70	4797.20	137.24	4794.17	164.61	4840.14	53.50	1.350
19	129.92	4799.05	135.02	4795.65	164.69	4845.68	58.17	1.350
20	129.92	4799.05	135.02	4795.65	165.34	4846.65	59.33	1.350
21	132.70	4797.20	137.24	4794.17	163.96	4839.17	52.33	1.350
22	129.92	4799.05	135.02	4795.65	164.04	4844.71	57.00	1.351
23	132.70	4797.20	137.24	4794.17	163.31	4838.20	51.17	1.351
24	129.92	4799.05	135.02	4795.65	163.40	4843.74	55.83	1.351
25	132.70	4797.20	137.24	4794.17	162.67	4837.23	50.00	1.351
26	127.14	4800.90	132.80	4797.13	163.48	4849.28	60.50	1.351
27	129.92	4799.05	135.02	4795.65	162.75	4842.77	54.67	1.351
28	129.92	4799.05	135.02	4795.65	162.10	4841.79	53.50	1.351
29	127.14	4800.90	132.80	4797.13	162.83	4848.31	59.33	1.351
30	129.92	4799.05	135.02	4795.65	161.45	4840.82	52.33	1.351
31	127.14	4800.90	132.80	4797.13	162.18	4847.33	58.17	1.351

32	127.14	4800.90	132.80	4797.13	161.53	4846.36	57.00
1.351							
33	129.92	4799.05	135.02	4795.65	160.80	4839.85	51.17
1.351							
34	127.14	4800.90	132.80	4797.13	160.89	4845.39	55.83
1.351							
35	129.92	4799.05	135.02	4795.65	160.15	4838.88	50.00
1.351							
36	127.14	4800.90	132.80	4797.13	160.24	4844.42	54.67
1.351							
37	127.14	4800.90	132.80	4797.13	159.59	4843.44	53.50
1.352							
38	127.14	4800.90	132.80	4797.13	158.94	4842.47	52.33
1.352							
39	127.14	4800.90	132.80	4797.13	158.29	4841.50	51.17
1.352							
40	132.70	4797.20	139.47	4792.69	169.57	4845.17	60.50
1.352							
41	127.14	4800.90	132.80	4797.13	157.64	4840.52	50.00
1.352							
42	132.70	4797.20	139.47	4792.69	168.92	4844.20	59.33
1.352							
43	132.70	4797.20	139.47	4792.69	168.27	4843.22	58.17
1.352							
44	132.70	4797.20	139.47	4792.69	167.62	4842.25	57.00
1.352							
45	129.92	4799.05	137.24	4794.17	167.05	4846.82	60.50
1.353							
46	132.70	4797.20	139.47	4792.69	166.97	4841.28	55.83
1.353							
47	129.92	4799.05	137.24	4794.17	166.40	4845.84	59.33
1.353							
48	132.70	4797.20	139.47	4792.69	166.32	4840.30	54.67
1.353							
49	129.92	4799.05	137.24	4794.17	165.76	4844.87	58.17
1.353							
50	132.70	4797.20	139.47	4792.69	165.67	4839.33	53.50
1.353							
51	132.70	4797.20	139.47	4792.69	165.03	4838.36	52.33
1.353							
52	129.92	4799.05	137.24	4794.17	165.11	4843.90	57.00
1.353							
53	129.92	4799.05	137.24	4794.17	164.46	4842.92	55.83
1.353							
54	127.14	4800.90	135.02	4795.65	164.54	4848.46	60.50
1.353							
55	132.70	4797.20	139.47	4792.69	164.38	4837.38	51.17
1.353							
56	127.14	4800.90	135.02	4795.65	163.89	4847.49	59.33
1.354							
57	129.92	4799.05	137.24	4794.17	163.81	4841.95	54.67
1.354							
58	132.70	4797.20	139.47	4792.69	163.73	4836.41	50.00
1.354							
59	127.14	4800.90	135.02	4795.65	163.24	4846.51	58.17
1.354							
60	129.92	4799.05	137.24	4794.17	163.16	4840.98	53.50
1.354							
61	127.14	4800.90	135.02	4795.65	162.59	4845.54	57.00
1.354							
62	129.92	4799.05	137.24	4794.17	162.51	4840.00	52.33
1.354							
63	124.37	4802.76	132.80	4797.13	162.02	4850.11	60.50
1.354							
64	127.14	4800.90	135.02	4795.65	161.94	4844.57	55.83
1.354							
65	124.37	4802.76	132.80	4797.13	161.37	4849.13	59.33

1.354
66 129.92 4799.05 137.24 4794.17 161.86 4839.03 51.17
1.354
67 127.14 4800.90 135.02 4795.65 161.29 4843.59 54.67
1.354
68 124.37 4802.76 132.80 4797.13 160.73 4848.16 58.17
1.355
69 129.92 4799.05 137.24 4794.17 161.21 4838.05 50.00
1.355
70 127.14 4800.90 135.02 4795.65 160.64 4842.62 53.50
1.355
71 124.37 4802.76 132.80 4797.13 160.08 4847.18 57.00
1.355
72 132.70 4797.20 141.69 4791.21 170.62 4844.34 60.50
1.355
73 127.14 4800.90 135.02 4795.65 159.99 4841.64 52.33
1.355
74 124.37 4802.76 132.80 4797.13 159.43 4846.21 55.83
1.355
75 132.70 4797.20 141.69 4791.21 169.97 4843.37 59.33
1.355
76 127.14 4800.90 135.02 4795.65 159.34 4840.67 51.17
1.355
77 132.70 4797.20 141.69 4791.21 169.32 4842.39 58.17
1.355
78 124.37 4802.76 132.80 4797.13 158.78 4845.23 54.67
1.355
79 129.92 4799.05 139.47 4792.69 168.10 4845.98 60.50
1.356
80 124.37 4802.76 132.80 4797.13 158.13 4844.26 53.50
1.356
81 127.14 4800.90 135.02 4795.65 158.69 4839.69 50.00
1.356
82 132.70 4797.20 141.69 4791.21 168.67 4841.42 57.00
1.356
83 129.92 4799.05 139.47 4792.69 167.45 4845.01 59.33
1.356
84 124.37 4802.76 132.80 4797.13 157.48 4843.28 52.33
1.356
85 132.70 4797.20 141.69 4791.21 168.02 4840.44 55.83
1.356
86 129.92 4799.05 139.47 4792.69 166.80 4844.03 58.17
1.356
87 132.70 4797.20 141.69 4791.21 167.37 4839.47 54.67
1.356
88 124.37 4802.76 132.80 4797.13 156.83 4842.31 51.17
1.356
89 127.14 4800.90 137.24 4794.17 165.58 4847.62 60.50
1.357
90 129.92 4799.05 139.47 4792.69 166.15 4843.06 57.00
1.357
91 132.70 4797.20 141.69 4791.21 166.72 4838.49 53.50
1.357
92 124.37 4802.76 132.80 4797.13 156.17 4841.33 50.00
1.357
93 127.14 4800.90 137.24 4794.17 164.93 4846.65 59.33
1.357
94 129.92 4799.05 139.47 4792.69 165.50 4842.08 55.83
1.357
95 132.70 4797.20 141.69 4791.21 166.07 4837.52 52.33
1.357
96 127.14 4800.90 137.24 4794.17 164.28 4845.67 58.17
1.357
97 129.92 4799.05 139.47 4792.69 164.85 4841.10 54.67
1.357
98 132.70 4797.20 141.69 4791.21 165.42 4836.54 51.17
1.357

99 124.37 4802.76 135.02 4795.65 163.06 4849.26 60.50
1.357

Critical Failure Surface (circle 1)

Intersects: XL: 129.92 YL: 4799.05 XR: 132.80 YR: 4797.13
Centre: XC: 164.26 YC: 4847.44 Radius: R: 59.33
Generated failure surface: (20 points)
129.92 4799.05 130.07 4798.95 130.22 4798.84 130.37
4798.74 130.52 4798.63
130.67 4798.53 130.82 4798.43 130.97 4798.33 131.12
4798.22 131.27 4798.12
131.42 4798.02 131.57 4797.92 131.73 4797.82 131.88
4797.72 132.03 4797.62
132.18 4797.52 132.34 4797.42 132.49 4797.33 132.65
4797.23 132.80 4797.13

Slice Geometry and Properties - Critical Failure Surface (circle 1, 38 slices)

Slice X-S ---------- Base ----------
PoreWater Normal Test
X-Left Area Angle Width Length Matl Cohesion Phi Weight
Force Stress Factor

1	129.92	0.00	35.4	0.07	0.09	1	0.00	45.0	0.01
0.00	0.11	0.80							
2	130.00	0.00	35.1	0.07	0.09	1	0.00	45.0	0.04
0.00	0.32	0.80							
3	130.07	0.00	35.0	0.07	0.09	1	0.00	45.0	0.06
0.00	0.53	0.80							
4	130.15	0.00	35.3	0.07	0.09	1	0.00	45.0	0.08
0.00	0.74	0.80							
5	130.22	0.00	35.0	0.07	0.09	1	0.00	45.0	0.10
0.00	0.92	0.80							
6	130.29	0.00	34.7	0.07	0.09	1	0.00	45.0	0.12
0.00	1.10	0.80							
7	130.37	0.00	34.9	0.07	0.09	1	0.00	45.0	0.14
0.00	1.24	0.80							
8	130.44	0.00	34.7	0.07	0.09	1	0.00	45.0	0.16
0.00	1.42	0.80							
9	130.52	0.00	34.4	0.07	0.09	1	0.00	45.0	0.18
0.00	1.57	0.80							
10	130.59	0.00	34.6	0.07	0.09	1	0.00	45.0	0.19
0.00	1.63	0.80							
11	130.67	0.00	34.3	0.08	0.09	1	0.00	45.0	0.20
0.00	1.78	0.80							
12	130.74	0.00	34.6	0.08	0.09	1	0.00	45.0	0.21
0.00	1.85	0.80							
13	130.82	0.00	34.3	0.08	0.09	1	0.00	45.0	0.22
0.00	1.96	0.80							
14	130.89	0.00	34.0	0.08	0.09	1	0.00	45.0	0.23
0.00	2.04	0.80							
15	130.97	0.00	34.0	0.08	0.09	1	0.00	45.0	0.23
0.00	2.08	0.80							
16	131.04	0.00	34.2	0.08	0.09	1	0.00	45.0	0.24
0.00	2.14	0.80							
17	131.12	0.00	33.9	0.08	0.09	1	0.00	45.0	0.25
0.00	2.19	0.80							
18	131.20	0.00	33.9	0.08	0.09	1	0.00	45.0	0.25
0.00	2.22	0.80							
19	131.27	0.00	33.8	0.08	0.09	1	0.00	45.0	0.25
0.00	2.22	0.80							
20	131.35	0.00	33.6	0.08	0.09	1	0.00	45.0	0.25
0.00	2.23	0.80							
21	131.42	0.00	33.5	0.08	0.09	1	0.00	45.0	0.25
0.00	2.20	0.80							
22	131.50	0.00	33.5	0.08	0.09	1	0.00	45.0	0.25
0.00	2.23	0.80							

23	131.57	0.00	33.5	0.08	0.09	1	0.00	45.0	0.25
0.00	2.16	0.80							
24	131.65	0.00	33.2	0.08	0.09	1	0.00	45.0	0.24
0.00	2.13	0.80							
25	131.73	0.00	33.2	0.08	0.09	1	0.00	45.0	0.23
0.00	2.06	0.80							
26	131.80	0.00	33.2	0.08	0.09	1	0.00	45.0	0.23
0.00	1.99	0.80							
27	131.88	0.00	32.9	0.08	0.09	1	0.00	45.0	0.22
0.00	1.93	0.81							
28	131.96	0.00	32.9	0.08	0.09	1	0.00	45.0	0.21
0.00	1.82	0.80							
29	132.03	0.00	33.1	0.08	0.09	1	0.00	45.0	0.19
0.00	1.70	0.80							
30	132.11	0.00	32.8	0.08	0.09	1	0.00	45.0	0.18
0.00	1.56	0.81							
31	132.18	0.00	32.8	0.08	0.09	1	0.00	45.0	0.16
0.00	1.42	0.81							
32	132.26	0.00	32.5	0.08	0.09	1	0.00	45.0	0.15
0.00	1.31	0.81							
33	132.34	0.00	32.4	0.08	0.09	1	0.00	45.0	0.13
0.00	1.13	0.81							
34	132.42	0.00	32.4	0.08	0.09	1	0.00	45.0	0.11
0.00	0.95	0.81							
35	132.49	0.00	32.4	0.08	0.09	1	0.00	45.0	0.09
0.00	0.77	0.81							
36	132.57	0.00	32.1	0.08	0.09	1	0.00	45.0	0.06
0.00	0.55	0.81							
37	132.65	0.00	32.1	0.08	0.09	1	0.00	45.0	0.04
0.00	0.37	0.81							
38	132.72	0.00	32.1	0.08	0.09	1	0.00	45.0	0.01
0.00	0.11	0.81							

X-S Area: 0.06 Path Length: 3.46 X-S Weight: 6.42

DATA: Analysis 3 - Reclaimed Condition

Material Properties (4 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Sand and gravel, mixed grain size

Cohesion	Phi	UnitWeight	Ru
0.00	45.0	110.00	Auto

Material: 2 (Mohr-Coulomb Isotropic) - OB - loose sand, mixed grain size

Cohesion	Phi	UnitWeight	Ru
0.00	34.0	99.00	Auto

Material: 3 (Mohr-Coulomb Isotropic) - Bedrock - claystone

Cohesion	Phi	UnitWeight	Ru
20000.00	25.0	110.00	Auto

Material: 4 (Mohr-Coulomb Isotropic) - Slurry Wall

	Cohesion	Phi	UnitWeight	Ru
Unsaturated:	0.00	0.0	112.00	Auto
Saturated:	0.00	0.0	115.00	Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 0.000

Material Profiles (4 profiles)

Profile: 1 (2 points) Material beneath: 2 - OB - loose sand, mixed grain size
0.00 4820.00 300.00 4820.00

Profile: 2 (2 points) Material beneath: 1 - Sand and gravel, mixed grain size
0.00 4815.00 300.00 4813.00

Profile: 3 (2 points) Material beneath: 3 - Bedrock - claystone

```
      0.00     4778.00         300.00     4778.00
Profile:  4 (5 points)   Material within:   1 - Sand and gravel, mixed grain size
     65.00     4818.00          70.00     4818.00          70.00     4775.00          65.00
     4775.00          65.00     4818.00

Slope Surface (4 points)
-------------
      1.00     4819.00         100.00     4819.00         217.00     4780.00         300.00
      4780.00

Phreatic Surface (2 points)
----------------
      0.00     4815.00          66.00     4815.00

Piezometric Surfaces (1 surface)
--------------------

Failure Surface
---------------
Initial circular surface for critical search defined by: XL,XR,R
  Intersects:  XL:      99.60      YL:    4819.00      XR:     216.30      YR:    4780.23
      Centre:  XC:     266.57      YC:    5126.60                  Radius:  R:     350.00

Variable Restraints
-------------------
Parameter descriptor:              XL         XR         R
Range of variation:             50.00      50.00      10.50
Trial positions within range:     20         20         10

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RESULTS: Analysis  3 - Reclaimed Condition

Bishop Simplified Method of Analysis - Circular Failure Surface
---------------------------------------------------------------
Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation:   3.029

There were: 2001 successful analyses from a total of 4001 trial surfaces
            2000 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety:  3.00
_____________________________________________

Results Summary - Lowest 99 Factor of Safety circles
----------------------------------------------------
Circle    X-Left      Y-Left     X-Right     Y-Right     X-Centre    Y-Centre      Radius
FoS
   1        98.28     4819.00      191.30     4788.57      254.21     5138.20      355.25
   2.998   <-- Critical Surface
   2        98.28     4819.00      191.30     4788.57      253.84     5137.08      354.08
   2.999
   3        98.28     4819.00      191.30     4788.57      253.48     5135.96      352.92
   2.999
   4        98.28     4819.00      191.30     4788.57      253.11     5134.84      351.75
   2.999
   5        98.28     4819.00      191.30     4788.57      252.74     5133.72      350.58
   2.999
   6        98.28     4819.00      191.30     4788.57      252.38     5132.60      349.42
   3.000
   7        98.28     4819.00      191.30     4788.57      252.01     5131.48      348.25
   3.000
   8        98.28     4819.00      191.30     4788.57      251.64     5130.36      347.08
   3.000
   9        98.28     4819.00      191.30     4788.57      251.28     5129.24      345.92
```

3.001
10 98.28 4819.00 191.30 4788.57 250.91 5128.12 344.75
3.001
11 100.92 4818.69 191.30 4788.57 257.43 5137.61 355.25
3.003
12 100.92 4818.69 191.30 4788.57 257.06 5136.49 354.08
3.003
13 100.92 4818.69 191.30 4788.57 256.69 5135.37 352.92
3.003
14 100.92 4818.69 191.30 4788.57 256.32 5134.26 351.75
3.003
15 100.92 4818.69 191.30 4788.57 255.94 5133.14 350.58
3.003
16 100.92 4818.69 191.30 4788.57 255.57 5132.02 349.42
3.004
17 100.92 4818.69 191.30 4788.57 255.20 5130.90 348.25
3.004
18 100.92 4818.69 191.30 4788.57 254.83 5129.79 347.08
3.004
19 100.92 4818.69 191.30 4788.57 254.45 5128.67 345.92
3.004
20 100.92 4818.69 191.30 4788.57 254.08 5127.55 344.75
3.004
21 100.92 4818.69 193.93 4787.69 258.69 5136.99 355.25
3.004
22 100.92 4818.69 193.93 4787.69 258.32 5135.87 354.08
3.005
23 98.28 4819.00 193.93 4787.69 255.51 5137.56 355.25
3.005
24 100.92 4818.69 193.93 4787.69 257.94 5134.75 352.92
3.005
25 98.28 4819.00 193.93 4787.69 255.15 5136.44 354.08
3.005
26 98.28 4819.00 193.93 4787.69 254.78 5135.32 352.92
3.005
27 100.92 4818.69 193.93 4787.69 257.57 5133.63 351.75
3.005
28 98.28 4819.00 193.93 4787.69 254.41 5134.20 351.75
3.005
29 100.92 4818.69 193.93 4787.69 257.20 5132.52 350.58
3.005
30 100.92 4818.69 193.93 4787.69 256.83 5131.40 349.42
3.006
31 98.28 4819.00 193.93 4787.69 254.05 5133.08 350.58
3.006
32 98.28 4819.00 193.93 4787.69 253.68 5131.96 349.42
3.006
33 100.92 4818.69 193.93 4787.69 256.45 5130.28 348.25
3.006
34 100.92 4818.69 193.93 4787.69 256.08 5129.16 347.08
3.006
35 98.28 4819.00 193.93 4787.69 253.31 5130.84 348.25
3.006
36 98.28 4819.00 196.56 4786.81 256.82 5136.92 355.25
3.006
37 98.28 4819.00 193.93 4787.69 252.95 5129.72 347.08
3.006
38 100.92 4818.69 193.93 4787.69 255.71 5128.04 345.92
3.006
39 98.28 4819.00 196.56 4786.81 256.45 5135.79 354.08
3.007
40 98.28 4819.00 193.93 4787.69 252.58 5128.60 345.92
3.007
41 100.92 4818.69 193.93 4787.69 255.34 5126.93 344.75
3.007
42 103.55 4817.82 191.30 4788.57 258.81 5137.34 355.25
3.007

43	98.28	4819.00	196.56	4786.81	256.08	5134.67	352.92
3.007							
44	98.28	4819.00	193.93	4787.69	252.21	5127.48	344.75
3.007							
45	103.55	4817.82	191.30	4788.57	258.43	5136.23	354.08
3.007							
46	103.55	4817.82	191.30	4788.57	258.06	5135.11	352.92
3.007							
47	98.28	4819.00	196.56	4786.81	255.71	5133.55	351.75
3.007							
48	103.55	4817.82	191.30	4788.57	257.69	5133.99	351.75
3.007							
49	98.28	4819.00	196.56	4786.81	255.35	5132.43	350.58
3.007							
50	103.55	4817.82	191.30	4788.57	257.32	5132.88	350.58
3.008							
51	100.92	4818.69	196.56	4786.81	259.94	5136.36	355.25
3.008							
52	103.55	4817.82	191.30	4788.57	256.95	5131.76	349.42
3.008							
53	98.28	4819.00	196.56	4786.81	254.98	5131.31	349.42
3.008							
54	100.92	4818.69	196.56	4786.81	259.57	5135.25	354.08
3.008							
55	103.55	4817.82	191.30	4788.57	256.57	5130.65	348.25
3.008							
56	98.28	4819.00	196.56	4786.81	254.61	5130.19	348.25
3.008							
57	100.92	4818.69	196.56	4786.81	259.20	5134.13	352.92
3.008							
58	103.55	4817.82	191.30	4788.57	256.20	5129.53	347.08
3.008							
59	103.55	4817.82	191.30	4788.57	255.83	5128.41	345.92
3.008							
60	100.92	4818.69	196.56	4786.81	258.82	5133.01	351.75
3.008							
61	98.28	4819.00	196.56	4786.81	254.25	5129.07	347.08
3.008							
62	103.55	4817.82	191.30	4788.57	255.46	5127.29	344.75
3.009							
63	100.92	4818.69	196.56	4786.81	258.45	5131.89	350.58
3.009							
64	98.28	4819.00	196.56	4786.81	253.88	5127.95	345.92
3.009							
65	100.92	4818.69	196.56	4786.81	258.08	5130.77	349.42
3.009							
66	98.28	4819.00	196.56	4786.81	253.51	5126.83	344.75
3.009							
67	100.92	4818.69	196.56	4786.81	257.71	5129.65	348.25
3.009							
68	100.92	4818.69	196.56	4786.81	257.33	5128.53	347.08
3.009							
69	103.55	4817.82	193.93	4787.69	260.06	5136.73	355.25
3.009							
70	100.92	4818.69	196.56	4786.81	256.96	5127.42	345.92
3.010							
71	103.55	4817.82	193.93	4787.69	259.69	5135.61	354.08
3.010							
72	98.28	4819.00	199.19	4785.94	258.11	5136.27	355.25
3.010							
73	103.55	4817.82	193.93	4787.69	259.32	5134.50	352.92
3.010							
74	100.92	4818.69	196.56	4786.81	256.59	5126.30	344.75
3.010							
75	103.55	4817.82	193.93	4787.69	258.95	5133.38	351.75
3.010							
76	98.28	4819.00	199.19	4785.94	257.75	5135.14	354.08

3.010							
77	103.55	4817.82	193.93	4787.69	258.58	5132.26	350.58
3.010							
78	98.28	4819.00	199.19	4785.94	257.38	5134.02	352.92
3.010							
79	103.55	4817.82	193.93	4787.69	258.20	5131.14	349.42
3.010							
80	100.92	4818.69	199.19	4785.94	261.19	5135.73	355.25
3.011							
81	103.55	4817.82	193.93	4787.69	257.83	5130.03	348.25
3.011							
82	98.28	4819.00	199.19	4785.94	257.01	5132.90	351.75
3.011							
83	103.55	4817.82	193.93	4787.69	257.46	5128.91	347.08
3.011							
84	100.92	4818.69	199.19	4785.94	260.82	5134.61	354.08
3.011							
85	98.28	4819.00	199.19	4785.94	256.64	5131.78	350.58
3.011							
86	103.55	4817.82	193.93	4787.69	257.09	5127.79	345.92
3.011							
87	100.92	4818.69	199.19	4785.94	260.45	5133.50	352.92
3.011							
88	98.28	4819.00	199.19	4785.94	256.28	5130.66	349.42
3.011							
89	103.55	4817.82	193.93	4787.69	256.71	5126.67	344.75
3.011							
90	100.92	4818.69	199.19	4785.94	260.08	5132.38	351.75
3.011							
91	106.18	4816.94	191.30	4788.57	260.18	5137.08	355.25
3.012							
92	106.18	4816.94	191.30	4788.57	259.81	5135.96	354.08
3.012							
93	100.92	4818.69	199.19	4785.94	259.70	5131.26	350.58
3.012							
94	98.28	4819.00	199.19	4785.94	255.91	5129.54	348.25
3.012							
95	106.18	4816.94	191.30	4788.57	259.44	5134.84	352.92
3.012							
96	100.92	4818.69	199.19	4785.94	259.33	5130.14	349.42
3.012							
97	106.18	4816.94	191.30	4788.57	259.06	5133.73	351.75
3.012							
98	103.55	4817.82	196.56	4786.81	261.32	5136.11	355.25
3.012							
99	98.28	4819.00	199.19	4785.94	255.54	5128.41	347.08
3.012							

Critical Failure Surface (circle 1)

Intersects: XL: 98.28 YL: 4819.00 XR: 191.30 YR: 4788.57
Centre: XC: 254.21 YC: 5138.20 Radius: R: 355.25

Generated failure surface: (20 points)

98.28	4819.00	102.94	4816.77	107.63	4814.60	112.36	4812.50
117.11	4810.47						
121.89	4808.51	126.70	4806.62	131.54	4804.80	136.40	4803.06
141.29	4801.38						
146.20	4799.77	151.13	4798.24	156.09	4796.77	161.06	4795.38
166.06	4794.06						
171.08	4792.82	176.11	4791.64	181.16	4790.54	186.22	4789.52
191.30	4788.57						

Slice Geometry and Properties - Critical Failure Surface (circle 1, 39 slices)

Slice	X-S	Base						PoreWater	Normal	Test
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	

	Force	Stress	Factor						
1	98.28	0.71	25.6	1.72	1.90	2	0.00	34.0	69.92
0.00	36.78	1.00							
2	100.00	3.06	25.6	2.94	3.26	2	0.00	34.0	302.52
0.00	92.76	1.00							
3	102.94	3.29	24.8	2.35	2.58	2	0.00	34.0	325.99
0.00	125.90	1.00							
4	105.29	4.00	24.8	2.35	2.58	2	0.00	34.0	395.95
0.00	152.92	1.00							
5	107.63	1.37	23.9	0.72	0.79	2	0.00	34.0	136.04
0.00	170.62	0.99							
6	108.36	4.09	24.0	2.00	2.19	1	0.00	45.0	414.65
0.00	180.68	0.95							
7	110.36	4.53	23.9	2.00	2.19	1	0.00	45.0	477.64
0.00	208.14	0.95							
8	112.36	4.76	23.1	1.93	2.10	1	0.00	45.0	517.10
0.00	234.73	0.95							
9	114.29	7.60	23.1	2.82	3.07	1	0.00	45.0	836.09
0.00	259.16	0.95							
10	117.11	6.97	22.3	2.39	2.58	1	0.00	45.0	766.57
0.00	282.10	0.95							
11	119.50	7.41	22.3	2.39	2.58	1	0.00	45.0	814.73
0.00	299.81	0.95							
12	121.89	7.84	21.5	2.40	2.58	1	0.00	45.0	862.53
0.00	317.12	0.95							
13	124.30	8.19	21.4	2.40	2.58	1	0.00	45.0	900.38
0.00	331.04	0.95							
14	126.70	8.53	20.6	2.42	2.58	1	0.00	45.0	938.26
0.00	344.75	0.95							
15	129.12	8.78	20.6	2.42	2.58	1	0.00	45.0	965.79
0.00	354.87	0.95							
16	131.54	9.03	19.8	2.43	2.58	1	0.00	45.0	993.60
0.00	364.91	0.95							
17	133.97	9.19	19.8	2.43	2.58	1	0.00	45.0	1010.57
0.00	371.14	0.95							
18	136.40	9.34	18.9	2.44	2.58	1	0.00	45.0	1027.69
0.00	377.35	0.95							
19	138.84	9.40	19.0	2.44	2.58	1	0.00	45.0	1034.39
0.00	379.79	0.95							
20	141.29	9.46	18.1	2.46	2.58	1	0.00	45.0	1040.73
0.00	382.14	0.95							
21	143.74	9.42	18.1	2.46	2.58	1	0.00	45.0	1036.64
0.00	380.62	0.95							
22	146.20	9.38	17.3	2.47	2.58	1	0.00	45.0	1031.97
0.00	378.97	0.95							
23	148.66	9.25	17.3	2.47	2.58	1	0.00	45.0	1017.12
0.00	373.52	0.95							
24	151.13	9.10	16.4	2.48	2.58	1	0.00	45.0	1001.25
0.00	367.85	0.95							
25	153.61	8.87	16.5	2.48	2.58	1	0.00	45.0	975.70
0.00	358.44	0.95							
26	156.09	8.62	15.6	2.49	2.58	1	0.00	45.0	948.48
0.00	348.67	0.95							
27	158.58	8.29	15.6	2.49	2.58	1	0.00	45.0	911.86
0.00	335.23	0.95							
28	161.06	7.94	14.8	2.50	2.58	1	0.00	45.0	873.24
0.00	321.28	0.95							
29	163.56	7.51	14.8	2.50	2.58	1	0.00	45.0	825.60
0.00	303.75	0.95							
30	166.06	7.05	14.0	2.51	2.58	1	0.00	45.0	775.33
0.00	285.55	0.95							
31	168.57	6.51	13.9	2.51	2.58	1	0.00	45.0	716.47
0.00	263.89	0.95							
32	171.08	5.95	13.1	2.52	2.58	1	0.00	45.0	654.68
0.00	241.41	0.95							
33	173.59	5.32	13.1	2.52	2.58	1	0.00	45.0	584.80
0.00	215.64	0.95							

```
 34      176.11      4.65    12.3     2.52     2.58     1       0.00    45.0       511.20
 0.00       188.79    0.95
 35      178.63      3.91    12.3     2.52     2.58     1       0.00    45.0       430.11
 0.00       158.83    0.95
 36      181.16      3.13    11.4     2.53     2.58     1       0.00    45.0       344.64
 0.00       127.49    0.96
 37      183.69      2.29    11.5     2.53     2.58     1       0.00    45.0       252.43
 0.00        93.38    0.96
 38      186.22      1.41    10.6     2.54     2.58     1       0.00    45.0       155.22
 0.00        57.53    0.96
 39      188.76      0.47    10.6     2.54     2.58     1       0.00    45.0        51.56
 0.00        19.11    0.96
                   --------                  -------                          ----------
     X-S Area:     246.63    Path Length:     98.18              X-S Weight:    26929.42
```

DATA: Analysis 4 - Reclaimed Condition

Material Properties (4 materials)

```
Material:  1 (Mohr-Coulomb Isotropic) - Sand and gravel, mixed grain size
   Cohesion   Phi   UnitWeight   Ru
      0.00   45.0     110.00    Auto
Material:  2 (Mohr-Coulomb Isotropic) - OB - loose sand, mixed grain size
   Cohesion   Phi   UnitWeight   Ru
      0.00   34.0      99.00    Auto
Material:  3 (Mohr-Coulomb Isotropic) - Bedrock - claystone
   Cohesion   Phi   UnitWeight   Ru
  20000.00   25.0     110.00    Auto
Material:  4 (Mohr-Coulomb Isotropic) - Slurry Wall
                  Cohesion   Phi   UnitWeight   Ru
    Unsaturated:      0.00    0.0     112.00    Auto
      Saturated:      0.00    0.0     115.00    Auto
```

Water Properties

```
Unit weight of water: 62.400          Unit weight of water/medium above ground:   0.000
```

Material Profiles (4 profiles)

```
Profile:  1 (2 points)   Material beneath:  2 - OB - loose sand, mixed grain size
      0.00     4820.00         300.00     4820.00
Profile:  2 (2 points)   Material beneath:  1 - Sand and gravel, mixed grain size
      0.00     4815.00         300.00     4813.00
Profile:  3 (2 points)   Material beneath:  3 - Bedrock - claystone
      0.00     4778.00         300.00     4778.00
Profile:  4 (5 points)   Material within:   1 - Sand and gravel, mixed grain size
     65.00     4818.00          70.00     4818.00          70.00     4775.00          65.00
     4775.00          65.00     4818.00
```

Slope Surface (4 points)

```
      1.00     4819.00         100.00     4819.00         217.00     4780.00         300.00
      4780.00
```

Phreatic Surface (2 points)

```
      0.00     4815.00          66.00     4815.00
```

Piezometric Surfaces (1 surface)

Failure Surface (Critical, from previous analysis)

```
Initial circular surface for critical search defined by: XL,XR,R
```

```
  Intersects:  XL:       98.28       YL:    4819.00      XR:     191.30      YR:    4788.57
      Centre:  XC:      254.21       YC:    5138.20                    Radius:  R:     355.25
```

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.050

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	50.00	50.00	10.50
Trial positions within range:	20	20	10

\- -

RESULTS: Analysis 4 - Reclaimed Condition

Bishop Simplified Method of Analysis - Circular Failure Surface
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Critical Failure Surface Search using Multiple Circle Generation Techniques

Factor of Safety for initial failure surface approximation: 2.563

There were: 4001 successful analyses from a total of 4001 trial surfaces

Critical (minimum) Factor of Safety: 2.52

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS
1	99.60	4819.00	166.30	4796.90	245.79	5148.53	360.50	2.515 <-- Critical Surface
2	99.60	4819.00	166.30	4796.90	245.43	5147.41	359.33	2.515
3	99.60	4819.00	166.30	4796.90	245.06	5146.30	358.17	2.516
4	99.60	4819.00	166.30	4796.90	244.69	5145.19	357.00	2.516
5	99.60	4819.00	166.30	4796.90	244.32	5144.07	355.83	2.516
6	99.60	4819.00	166.30	4796.90	243.95	5142.96	354.67	2.516
7	99.60	4819.00	166.30	4796.90	243.58	5141.85	353.50	2.516
8	99.60	4819.00	166.30	4796.90	243.21	5140.74	352.33	2.517
9	99.60	4819.00	166.30	4796.90	242.85	5139.62	351.17	2.517
10	99.60	4819.00	166.30	4796.90	242.48	5138.51	350.00	2.517
11	99.60	4819.00	168.93	4796.02	247.09	5147.95	360.50	2.522
12	99.60	4819.00	168.93	4796.02	246.72	5146.84	359.33	2.522
13	99.60	4819.00	168.93	4796.02	246.35	5145.72	358.17	2.523
14	99.60	4819.00	168.93	4796.02	245.98	5144.61	357.00	2.523
15	99.60	4819.00	168.93	4796.02	245.61	5143.50	355.83	2.523
16	99.60	4819.00	168.93	4796.02	245.24	5142.38	354.67	2.523
17	99.60	4819.00	168.93	4796.02	244.88	5141.27	353.50	2.523

18	99.60	4819.00	168.93	4796.02	244.51	5140.16	352.33
2.524							
19	99.60	4819.00	168.93	4796.02	244.14	5139.04	351.17
2.524							
20	99.60	4819.00	168.93	4796.02	243.77	5137.93	350.00
2.524							
21	96.97	4819.00	166.30	4796.90	240.56	5149.67	360.50
2.524							
22	96.97	4819.00	166.30	4796.90	240.20	5148.55	359.33
2.524							
23	96.97	4819.00	166.30	4796.90	239.85	5147.43	358.17
2.525							
24	96.97	4819.00	166.30	4796.90	239.49	5146.32	357.00
2.525							
25	96.97	4819.00	166.30	4796.90	239.14	5145.20	355.83
2.525							
26	96.97	4819.00	166.30	4796.90	238.78	5144.08	354.67
2.525							
27	96.97	4819.00	166.30	4796.90	238.42	5142.96	353.50
2.526							
28	96.97	4819.00	166.30	4796.90	238.07	5141.85	352.33
2.526							
29	96.97	4819.00	166.30	4796.90	237.71	5140.73	351.17
2.526							
30	96.97	4819.00	166.30	4796.90	237.35	5139.61	350.00
2.527							
31	99.60	4819.00	171.56	4795.15	248.38	5147.37	360.50
2.528							
32	99.60	4819.00	171.56	4795.15	248.01	5146.25	359.33
2.529							
33	99.60	4819.00	171.56	4795.15	247.64	5145.14	358.17
2.529							
34	99.60	4819.00	171.56	4795.15	247.28	5144.02	357.00
2.529							
35	99.60	4819.00	171.56	4795.15	246.91	5142.91	355.83
2.529							
36	99.60	4819.00	171.56	4795.15	246.54	5141.80	354.67
2.529							
37	99.60	4819.00	171.56	4795.15	246.17	5140.68	353.50
2.530							
38	99.60	4819.00	171.56	4795.15	245.80	5139.57	352.33
2.530							
39	99.60	4819.00	171.56	4795.15	245.43	5138.46	351.17
2.530							
40	99.60	4819.00	171.56	4795.15	245.06	5137.34	350.00
2.530							
41	102.23	4818.26	166.30	4796.90	247.77	5148.07	360.50
2.533							
42	102.23	4818.26	166.30	4796.90	247.40	5146.96	359.33
2.534							
43	102.23	4818.26	166.30	4796.90	247.03	5145.85	358.17
2.534							
44	96.97	4819.00	168.93	4796.02	242.00	5149.04	360.50
2.534							
45	102.23	4818.26	166.30	4796.90	246.65	5144.74	357.00
2.534							
46	99.60	4819.00	174.19	4794.27	249.67	5146.78	360.50
2.534							
47	102.23	4818.26	166.30	4796.90	246.28	5143.63	355.83
2.534							
48	96.97	4819.00	168.93	4796.02	241.64	5147.92	359.33
2.534							
49	102.23	4818.26	166.30	4796.90	245.91	5142.52	354.67
2.534							
50	99.60	4819.00	174.19	4794.27	249.30	5145.67	359.33
2.534							
51	96.97	4819.00	168.93	4796.02	241.28	5146.81	358.17

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2.534
52       102.23     4818.26      166.30     4796.90      245.54     5141.40      353.50
2.534
53        96.97     4819.00      168.93     4796.02      240.93     5145.69      357.00
2.534
54        99.60     4819.00      174.19     4794.27      248.93     5144.55      358.17
2.534
55       102.23     4818.26      166.30     4796.90      245.17     5140.29      352.33
2.534
56        96.97     4819.00      168.93     4796.02      240.57     5144.57      355.83
2.535
57        99.60     4819.00      174.19     4794.27      248.56     5143.44      357.00
2.535
58       102.23     4818.26      166.30     4796.90      244.80     5139.18      351.17
2.535
59        96.97     4819.00      168.93     4796.02      240.21     5143.45      354.67
2.535
60       102.23     4818.26      166.30     4796.90      244.43     5138.07      350.00
2.535
61        99.60     4819.00      174.19     4794.27      248.19     5142.32      355.83
2.535
62        96.97     4819.00      168.93     4796.02      239.86     5142.33      353.50
2.535
63        99.60     4819.00      174.19     4794.27      247.82     5141.21      354.67
2.535
64        96.97     4819.00      168.93     4796.02      239.50     5141.22      352.33
2.535
65        99.60     4819.00      174.19     4794.27      247.45     5140.09      353.50
2.535
66        96.97     4819.00      168.93     4796.02      239.14     5140.10      351.17
2.535
67        99.60     4819.00      174.19     4794.27      247.08     5138.98      352.33
2.535
68        96.97     4819.00      168.93     4796.02      238.78     5138.98      350.00
2.535
69        99.60     4819.00      174.19     4794.27      246.72     5137.87      351.17
2.536
70        99.60     4819.00      174.19     4794.27      246.35     5136.75      350.00
2.536
71        96.97     4819.00      171.56     4795.15      243.42     5148.41      360.50
2.537
72        96.97     4819.00      171.56     4795.15      243.06     5147.29      359.33
2.537
73        96.97     4819.00      171.56     4795.15      242.71     5146.18      358.17
2.538
74        96.97     4819.00      171.56     4795.15      242.35     5145.06      357.00
2.538
75        96.97     4819.00      171.56     4795.15      241.99     5143.94      355.83
2.538
76       102.23     4818.26      168.93     4796.02      249.04     5147.51      360.50
2.538
77        96.97     4819.00      171.56     4795.15      241.63     5142.82      354.67
2.539
78       102.23     4818.26      168.93     4796.02      248.67     5146.40      359.33
2.539
79       102.23     4818.26      168.93     4796.02      248.30     5145.29      358.17
2.539
80        96.97     4819.00      171.56     4795.15      241.28     5141.70      353.50
2.539
81       102.23     4818.26      168.93     4796.02      247.93     5144.17      357.00
2.539
82       102.23     4818.26      168.93     4796.02      247.56     5143.06      355.83
2.539
83        96.97     4819.00      171.56     4795.15      240.92     5140.58      352.33
2.539
84        99.60     4819.00      176.83     4793.39      250.96     5146.19      360.50
2.539
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85	102.23	4818.26	168.93	4796.02	247.19	5141.95	354.67	2.539
86	102.23	4818.26	168.93	4796.02	246.81	5140.84	353.50	2.539
87	99.60	4819.00	176.83	4793.39	250.59	5145.07	359.33	2.539
88	96.97	4819.00	171.56	4795.15	240.56	5139.47	351.17	2.539
89	102.23	4818.26	168.93	4796.02	246.44	5139.72	352.33	2.539
90	99.60	4819.00	176.83	4793.39	250.22	5143.96	358.17	2.540
91	102.23	4818.26	168.93	4796.02	246.07	5138.61	351.17	2.540
92	96.97	4819.00	171.56	4795.15	240.20	5138.35	350.00	2.540
93	99.60	4819.00	176.83	4793.39	249.85	5142.84	357.00	2.540
94	102.23	4818.26	168.93	4796.02	245.70	5137.50	350.00	2.540
95	99.60	4819.00	176.83	4793.39	249.48	5141.73	355.83	2.540
96	99.60	4819.00	176.83	4793.39	249.11	5140.61	354.67	2.540
97	99.60	4819.00	176.83	4793.39	248.74	5139.50	353.50	2.540
98	99.60	4819.00	176.83	4793.39	248.37	5138.38	352.33	2.541
99	99.60	4819.00	176.83	4793.39	248.00	5137.27	351.17	2.541

Critical Failure Surface (circle 1)

Intersects: XL: 99.60 YL: 4819.00 XR: 166.30 YR: 4796.90
Centre: XC: 245.79 YC: 5148.53 Radius: R: 360.50

Generated failure surface: (20 points)

99.60	4819.00	102.99	4817.52	106.40	4816.07	109.83	4814.65
113.26	4813.27						
116.71	4811.93	120.18	4810.62	123.66	4809.35	127.15	4808.11
130.65	4806.91						
134.17	4805.74	137.70	4804.61	141.24	4803.52	144.79	4802.47
148.35	4801.45						
151.92	4800.46	155.50	4799.52	159.09	4798.61	162.69	4797.74
166.30	4796.90						

Slice Geometry and Properties - Critical Failure Surface (circle 1, 41 slices)

Slice	X-S	Base						PoreWater	Normal	Test
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force
	Stress	Factor								
1	99.60	0.03	23.6	0.40	0.44	2	0.00	34.0	3.46	0.00
7.75	0.98									
2	100.00	0.38	23.6	1.50	1.63	2	0.00	34.0	37.48	0.00
22.41	0.98									
3	101.50	0.61	23.6	1.50	1.63	2	0.00	34.0	60.56	0.00
36.21	0.98									
4	102.99	0.96	23.0	1.70	1.85	2	0.00	34.0	95.40	0.00
50.24	0.98									
5	104.70	1.23	23.0	1.70	1.85	2	0.00	34.0	121.85	0.00
64.18	0.98									
6	106.40	1.49	22.4	1.71	1.85	2	0.00	34.0	147.20	0.00
77.42	0.97									
7	108.11	1.72	22.5	1.71	1.85	2	0.00	34.0	170.45	0.00
89.64	0.97									
8	109.83	1.07	21.9	0.97	1.05	2	0.00	34.0	106.38	0.00
98.94	0.97									

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 9      110.80      1.46    21.9     1.23     1.33     1        0.00    45.0       147.66
 0.00       103.25    0.93
10      112.03      1.56    21.9     1.23     1.33     1        0.00    45.0       164.45
0.00       114.98    0.93
11      113.26      1.37    21.3     1.02     1.10     1        0.00    45.0       148.46
0.00       125.70    0.93
12      114.29      1.70    21.3     1.21     1.30     1        0.00    45.0       186.89
0.00       133.26    0.93
13      115.50      1.78    21.3     1.21     1.30     1        0.00    45.0       196.02
0.00       139.75    0.93
14      116.71      2.67    20.7     1.73     1.85     1        0.00    45.0       293.42
0.00       147.24    0.93
15      118.45      2.80    20.7     1.73     1.85     1        0.00    45.0       307.94
0.00       154.54    0.93
16      120.18      2.93    20.1     1.74     1.85     1        0.00    45.0       321.92
0.00       161.59    0.93
17      121.92      3.03    20.1     1.74     1.85     1        0.00    45.0       332.75
0.00       167.01    0.93
18      123.66      3.12    19.5     1.75     1.85     1        0.00    45.0       342.89
0.00       172.16    0.93
19      125.40      3.18    19.5     1.75     1.85     1        0.00    45.0       350.11
0.00       175.79    0.93
20      127.15      3.24    18.9     1.75     1.85     1        0.00    45.0       356.45
0.00       179.07    0.93
21      128.90      3.27    18.9     1.75     1.85     1        0.00    45.0       359.56
0.00       180.61    0.93
22      130.65      3.29    18.3     1.76     1.85     1        0.00    45.0       362.01
0.00       181.96    0.93
23      132.41      3.29    18.3     1.76     1.85     1        0.00    45.0       361.36
0.00       181.62    0.93
24      134.17      3.27    17.7     1.76     1.85     1        0.00    45.0       359.93
0.00       181.02    0.93
25      135.93      3.23    17.7     1.76     1.85     1        0.00    45.0       355.38
0.00       178.73    0.93
26      137.70      3.18    17.2     1.77     1.85     1        0.00    45.0       350.07
0.00       176.19    0.93
27      139.47      3.10    17.2     1.77     1.85     1        0.00    45.0       341.51
0.00       171.88    0.93
28      141.24      3.02    16.6     1.78     1.85     1        0.00    45.0       332.09
0.00       167.30    0.93
29      143.01      2.91    16.6     1.78     1.85     1        0.00    45.0       319.69
0.00       161.05    0.93
30      144.79      2.78    16.0     1.78     1.85     1        0.00    45.0       306.12
0.00       154.36    0.93
31      146.57      2.63    16.0     1.78     1.85     1        0.00    45.0       289.77
0.00       146.11    0.93
32      148.35      2.48    15.4     1.79     1.85     1        0.00    45.0       272.28
0.00       137.44    0.93
33      150.13      2.29    15.4     1.79     1.85     1        0.00    45.0       251.86
0.00       127.13    0.93
34      151.92      2.09    14.8     1.79     1.85     1        0.00    45.0       230.15
0.00       116.32    0.94
35      153.71      1.87    14.8     1.79     1.85     1        0.00    45.0       205.81
0.00       104.01    0.94
36      155.50      1.64    14.2     1.80     1.85     1        0.00    45.0       179.94
0.00        91.06    0.94
37      157.30      1.38    14.2     1.80     1.85     1        0.00    45.0       151.49
0.00        76.65    0.94
38      159.09      1.10    13.6     1.80     1.85     1        0.00    45.0       121.43
0.00        61.53    0.94
39      160.89      0.81    13.6     1.80     1.85     1        0.00    45.0        89.04
0.00        45.12    0.94
40      162.69      0.50    13.0     1.80     1.85     1        0.00    45.0        54.75
0.00        27.79    0.94
41      164.50      0.17    13.0     1.80     1.85     1        0.00    45.0        18.22
0.00         9.25    0.94
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X-S Area: 84.62 Path Length: 70.38 X-S Weight: 9204.21