

RECEIVED
Sep. 25, 2026
DIVISION OF OIL, GAS AND MINING
M/049/0219
T-24606

FORM MR-LMO
(Revised January 2025)

FOR DIVISION USE ONLY
File #: M / 049 / 0219
Date Received: _____
DOGM Lead: _____
Permit Fee \$ _____ Ck # _____

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING
1594 West North Temple Suite 1210
Box 145801
Salt Lake City, Utah 84114-5801
Telephone: (801) 538-5291 Fax: (801) 359-3940

NOTICE OF INTENTION TO COMMENCE LARGE MINING OPERATIONS

The informational requirements in this form are based on provisions of the Mined Land Reclamation Act, Title 40-8, Utah Code Annotated 1953, General Rules and Rules of Practice and Procedures.

This form applies only to mining operations which disturb or will disturb more than five acres in an incorporated area or ten acres in an unincorporated area at any given time.

"MINING OPERATIONS" means those activities conducted on the surface of the land for the exploration for, development of, or extraction of a mineral deposit, including, but not limited to, surface mining and the surface effects of underground and in situ mining, on-site transportation, concentrating, milling, evaporation, and other primary processing.

"Mining operation" does not include: the extraction of sand, gravel, and rock aggregate; the extraction of oil and gas as defined in Chapter 6, Title 40; the extraction of geothermal steam; smelting or refining operations; off-site operations and transportation; or reconnaissance activities which will not cause significant surface resource disturbance or involve the use of mechanized earth-moving equipment such as bulldozers or backhoes.

Cultural Resources: To fulfill its obligations under Utah Code Annotated 9-8-404, the Division needs cultural resource (archaeology) information. The amount and type of information required will depend on the mine location, the history of previous disturbance, and other factors. Please contact the Division for further information.

PLEASE NOTE: *This form is to be used as a **guideline** in assembling the information necessary to satisfy the Large Mining Operations Notice of Intention requirements. The Permittee / Operator may submit this information on an alternate form, but the same or similar format should be used.*

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I. Rule R647-4-104 - Operator(s), Surface and Mineral Owners

Provide the name, address and telephone number of the individual or company who will be responsible for the proposed operation. **Business entities listed as the Permittee / Operator, must include names and titles of the corporate officers on a separate attachment.**

1. **Mine Name:** Grey Cliffs

2. Operator name: S&L Incorporated

Mailing Address: 935 W Center St.

City, State, Zip: Lindon, Utah, 84042

Phone: 801-420-1547 Fax: _____

E-mail Address: dan@sandlinc.com

Type of Business: Corporation (☒) LLC (☐) Sole Proprietorship (dba) (☐)
Partnership (☐) General _____ or _____ limited

Or:

Individual (☐)

Entity must be registered (and maintain registration) with the State of Utah, Division of Corporations (DOC) www.commerce.utah.gov.

Are you currently registered to do business in the State of Utah? (☒) Yes (☐) No

Entity # 908645-0142

If no, contact www.commerce.utah.gov to renew or apply.

Local Business License # _____ (if required)

Issued by: County Utah or City _____

Registered Utah Agent (as identified with the Utah Department of Commerce) (*Leave blank if the operator is an individual*):

Name: Stephen Larsen

Address: 935 W Center St.

City, State, Zip: Lindon, Utah, 84042

Phone: 801-785-8458 Fax: _____

E-mail Address: steve@sandlinc.com

3. **Permanent Address:** 935 W Center St.

Lindon, Utah, 84042

Phone: 801-785-8458 Fax: _____

4. **Contact Person(s)** *Please provide as many contacts as necessary.*

Name: Stephen Larsen Title: Manager

Address: 935 W Center St.

City, State, Zip: Lindon, Utah, 84042

Phone: 801-785-8458 Fax: _____

Emergency, Weekend, or Holiday Phone: 801-420-1547

E-mail Address: dan@sandlinc.com

Contact person to be notified for: Permitting (☐) Surety (☒) Notices (☐)
(please check all that apply)

5. **Location of Operation:**

County(ies) Utah
____ 1/4 of _____ 1/4, Section: 31&32 Township: 9S Range: 2E
____ 1/4 of _____ 1/4, Section: 6 Township: 10 S Range: 2E
____ 1/4 of _____ 1/4, Section: _____ Township: _____ Range: _____

The names of the surface and mineral owners for any areas which are to be affected by mining. This list should include all private, state and federal ownership and the owners of lands immediately adjacent to the project areas.

6. **Ownership of the land surface** (circle all that apply):

Private (Fee), Public Domain (BLM), National Forest (USFS), State of Utah (SITLA) or other:

Name: South Valley Holdings Address: 935 W Center St. Lindon, Utah, 84042
Name: _____ Address: _____
Name: _____ Address: _____
Name: _____ Address: _____

7. **Owner(s) of record of the minerals to be mined** (circle all that apply):

Private (Fee), Public Domain (BLM), National Forest (USFS), State of Utah (SITLA) or other:

Name: South Valley Holdings Address: 935 W Center St. Lindon, Utah, 84042
Name: _____ Address: _____
Name: _____ Address: _____
Name: _____ Address: _____

8. **BLM Lease or Project File Number(s) and/or USFS Assigned Project Number(s):** N/A

BLM Claim Numbers: _____ N/A

Utah State Lease Number(s): _____ N/A

Name of Lessee(s): _____ N/A

9. **Adjacent land owners:**

Name: _____ Address: _____
Name: _____ Address: _____
Name: _____ Address: _____
Name: _____ Address: _____

10. **Have the land, mineral and adjacent land owners been notified in writing?**

Yes X No _____

If no, why not? _____

11. **Does the Permittee / Operator have legal right to enter and conduct mining operations on the land covered by this notice?** Yes X No _____.

R647-4-105 - Maps, Drawings & Photographs

105.1 - Topographic base map, boundaries, pre-act disturbance

Please see figure 1.

105.2 - Surface facilities map

Current facilities shown in the Figure 2, as well as dust mitigation plans in Appendix C.

105.3 – Drawings or Cross Sections (slopes, roads, pads, etc.)

Please see appendix D.

105.4 - Photographs

Please see photos Appendix A

R647-4-106 - Operation Plan

106.1 - Minerals mined

Rock, Gravel, Topsoil

106.2 - Type of operations conducted, mining method, processing etc.

MINING (GRADING) OPERATIONS: Our Grading and processing operations will be conducted on weekdays. Our hours of operation are 7am-5pm during spring and summer. These hours will change in the autumn and winter to 7am -4:30pm, to coincide with daylight savings time. Grading operations consist of direct extraction of gravel and rock with excavators, loaders and dozers. Excavated materials will be either loaded from the working face by loader and transported directly to the crushing and screen plant for processing or passed only through a single screen and is loaded directly on trucks.

PROCESSING OPERATIONS: There is a temporary plant constructed as well as temporary offices. These structures can and will move as the development phasing begins.

Step 1: loose material is loaded directly into the processing plant KPI/JCI/Aztec 3050 Jaw crusher Step 2: material then travels to a stockpile that is gravity fed into 2 dozer traps.

The first dozer trap feeds the primary plant

The second dozer trap passes through a 2 deck screen with 2"+ rock delivered to primary plant via crossover conveyor. The 2"- material is belted to a stockpile ready for sale as 2"-A1A. Leftover material is conveyed to a 3 deck primary screen. Material is graded into 1"+, 3/4"+, and 5/8-. 1"-material cycles through the jaw crusher. It is then sorted into three stockpiles:

1.1"=1" finished gravel
2.5/8"= 3/4" gravel
3.5/8"=commercial
road base Please refer to Appendix C
for the pit diagram

Material stockpiles:

The processing area includes several stockpiles of products. Stockpiles will be moved as materials are exported and mining progresses. Fugitive dust control of the area will be by water truck.

Equipment:

Our site and processing operation uses the following Equipment Portable Crushers and Screens, Conveyor belts, Dozers, Loaders, Water Truck, Truck Scales, Service Trucks, Excavators.

106.3 - Estimated acreages disturbed, reclaimed, annually

Areas of actual mining: Mining in phases up to developable area of 142.57 acres. Phase 1 will be approved for 39.33 acres of active disturbance and covered by the current bond.

The total project boundary is 340.56 acres.

Overburden/waste dumps: None

Rock products stockpiles: As we process material for grading, rock and gravel products will be temporarily stockpiled to be hauled offsite and for grading uses on site.

Please see Appendix C

Access/haul roads: Access to the site is on the east side of SR 198 in Santaquin Utah. From the I15 take Santaquin main street exit, turn east, take a left at the light and it is on the east side past C.S Lewis Academy. This access will be closed as the development builds and two additional residential roads will replace it.

Appendix C page 7 will outline the haul roads in linear feet

Associated on-site processing facilities: We have temporary on-site processing facilities, the offices are temporary, movable storage container conversions.

Tailings disposal: N/A

Other-Describe: None

Total Acreage: 39.33

Please see Appendix C page 2-4 for reclamation already finished, and pages 6,8 for future grading and reclamation. Appendix C indicates all areas disturbed.

As this is a Residential Development all disturbed areas will be reclaimed, by the standards of zoning for Santaquin City.

106.4 - Nature of materials mined, waste and estimated tonnages

As a development operating on a grading permit, we are not mining ore or any other materials. We are processing excavated materials (from grading) to place onsite in the construction of the development, private lots, roads, utilities, parks etc. All excess processes material is hauled off site in the form of gravel and other rock products.

Please refer to the geotechnical study in Appendix F.

106.5 - Existing soil types, location, amount

Please see Appendix F for the geologic study provided by CMT

Also please refer to Appendix B for the soil type reports from the NRCS Web-based Custom Soil resource reports.

106.6 - Plan for protecting & re-depositing soils

Please see our site grading plan. Appendix D

Our material is either used in bringing the development to final grade, or processed into aggregates, so the excess may be removed from the site. These aggregates are piled close together near processing machinery. Which is protected by berms to keep separate from haul roads. All material is sprayed with water to keep the dust under control.

106.7 - Existing vegetation - species and amount

According to the USGS Website: This ecoregion is the irrigated, populated foothill/valley zone at the base of the Wasatch Range. It is fed by perennial streams and irrigation, and the land-use mosaic includes irrigated cropland and orchards in valley bottoms, riparian strips along streams, urban/developed areas, and natural shrub/grass communities on non-irrigated slopes and fan remnants. At higher or less altered foot slopes you typically find mountain-big sagebrush / mountain-shrub mixes and upland grasses; on cooler/moister aspects there are pockets of aspen and other montane trees.

Dominated vegetation types

Irrigated agriculture & orchards (valley floor) — alfalfa, pasture, fruit trees (orchards are common historically in Utah Valley).

Riparian/wetland strips (along streams/canals) — willow (*Salix* spp.), cattails/rushes, sedges in wet channels and relict marshes.

Sagebrush / shrub-steppe on drier slopes & benches — *Artemisia tridentata* (big sagebrush), rabbitbrush (*Ericameria/Chrysothamnus*), mountain mahogany in patches, and associated perennial bunchgrasses.

Upland grasses and forbs — native perennial grasses (bluegrasses/*Poa*, wheatgrasses, fescues) plus annual invasive grasses (e.g., cheatgrass *Bromus tectorum*) in disturbed areas.

Scattered trees / orchards / shelterbelts — where irrigated or on favorable microsites (populus/aspen, planted conifers, shade trees in urban/agr areas).

Ramsey, R. D., & West, N. E. (2022). Vegetation of Utah (as presented on the Central Wasatch Commission Environmental Dashboard). Central Wasatch Commission.

<https://cwc.utah.gov/environmental-dashboard/wp-content/uploads/2022/03/ramsey-west-vegetation-of-utah.pdf>

Please see Appendix F for the geotechnical study.

106.8 - Depth to groundwater, extent of overburden, geology

Please see our geotechnical study in Appendix F.

106.9 - Location & size of ore, waste, tailings, ponds

As we bring the site to final grade, all material stockpiles are temporary. As such all-product stockpiles and locations will vary as we process material and grade. As the site is brought to final grade all material either excavated and/or processed in stockpiles will be moved and placed to accommodate site regarding and reclamation.

There are no waste stockpiles, tailings, treatment ponds, or process discharges associated with the site grading process.

The project will not have waste dumps, or water storage ponds. However. A temporary water tank will be utilized to store water, for use in fugitive dust mitigation.

R647-4-108 - Hole Plugging Requirements

There are NO drill holes or blasting on site, we use only machinery for grading and development purposes.

R647-4-109 - Impact Assessment

109.1 - Impacts to surface & groundwater systems

Please see section 109.5 for the impact and mitigation of stormwater. Our geotechnical report (appendix F) states that the risk of liquefaction is low, as we are not near enough to a large body of water (Utah lake). No other bodies of water are contained or near our site. Also please see our grading permit plans in Appendix D, as we are filling more area with material than we are removing soil material.

As a development operating a grading permit there is no impact on ground water.

109.2 - Impacts to threatened & endangered wildlife/habitat

Please see Appendix G for IPaC Report.

109.3 - Impacts on existing soils resources

Please see Appendix F geotechnical study page 4-6 for the existing soil typology.

Refer to sections 110.5 and 109.4 for impact mitigation plans, and can be viewed In Appendix D.

109.4 - Slope stability, erosion control, air quality, safety

As we are a development operating under a grading permit, there will be minimal impact to the community, as well as public health and safety. We have worked with an engineer and have subdivision plans approved and bonded through the city of Santaquin. We will be stabilizing all slopes as references in our grading plan see Appendix D.

We are also currently working with the department of air quality on a fugitive dust mitigation plan. This is currently being reviewed. Our current methods for dust mitigation efforts involve having a water tank on site and regularly spraying area currently being graded as well as the machines moving material. Misters are also included in all transfer points along the belts. There is also a water truck onsite to regularly spray 'roads', trucks, and machines used to move material around the site.

Please see Appendix D

109.5 - Actions to mitigate any impacts

We have in place a fugitive dust plan as described in 109.4. All slopes will be hydroseeded for revegetation and stability as described in section 110.5. Also, all material used on site for grading will be from the excavated material on site. Please see Appendix C.

- Water Quality
 - Surface Water
The total volume of projected stormwater runoff will be contained onsite, through natural absorption in undisturbed areas, caught in the run of each engineered slope (as indicated on our grading plan) or contained in retention basins on site. All storm water management is contained in our SWPPP.

UPDES Permit Number:

UTRC11972 Project/Site

Name: Grey Cliffs

Project/Site Address: 544 N SR 198, Santaquin, UT

84655 Effective Date: 11/25/2025

Expiration Date: 11/24/2026

- We have trash pickup once a week through a county trash service
- portable toilets are placed on site to manage sanitary waste and are cleaned regularly.
- Air Quality
- Limiting hours of operations 7am-5pm. Hours are reduced in winter to 7am to 430pm, no augmented lighting systems are used that could disturb adjacent residents
- Land Use
 - Please refer to section 110.1

R647-4-110 - Reclamation Plan

110.1 - Current & post mining land use

Previous land use:

Our property was previously an operating gravel pit, before we purchased it, the pit had been closed for several years, leaving a scar on the landscape that served no purpose and over time became a blight to

the community. We have worked with governing authorities, who are anxious for us to restore this land to something useful and beautiful. We have proposed to the city a residential subdivision to have long term benefits for residents, commercial, and recreational property including but not limited to three new City parks, plus one planned natural park, as well as 109 acres of restored open space for the community.

Current land use:

We are currently engaged in phase 2 of 7 total phases of regrading procedures for this property. These efforts include re-grading the old pit, stabilizing previous conditions of steep slopes and drop-offs.

*To be noted the city has aggressive requirements for reclamation that are regularly bonded and inspected.

Please see Appendix C for reclaimed areas and Appendix D for site plans and grading. Our estimated current position- phase 1 is 80% complete and phase 2 is about 45% complete, no bonds have been released, and inspections are ongoing.

Post mining (grading) land use:

Please see attachment B for our current approved subdivision plat. This attachment identifies our parks, open space, identifies slope, proposed improved areas, and a completed subdivision plat.

Appendix C- Dust Mitigation plan, also shows the revegetation efforts of open space through hydroseeding. These open spaces, not labeled as parks in figure 1 labeled in red, will be revegetated to a natural state and will incorporate residential open space use such as hiking trails.

Please see Figure 1.1.

110.2 - Roads, highwalls, slopes, drainages, pits, etc., reclaimed

Please refer to section 110.1. There will be NO high walls, drainage, leach pads or dumps on the site. All slopes are illustrated in our grading plans as shown in Figure 1. As we are a development working on a grading permit we will not have any of the following to reclaim: highwalls, slopes, impoundments, drainages and natural drainage patterns, pits, ponds, dumps, shafts, adits, drill holes, and leach pads. We will also not have roads to reclaim as we are grading to create new roads for the subdivision.

110.3 - Description of facilities to be left (post mining use)

Please refer to our subdivision plat in figure 1 as 100% of the site will be reclaimed or reused. No structure currently in use will remain on site once grading is finished

110.4 - Description or treatment/disposition of deleterious or acid forming material

All organic or non-organic rock material will be processed for removal or used on site as per our grading plan. All organic material will be replaced and reseeded, through our reclamation plan.

110.5 - Revegetation planting program

Please see our grading and reclamation plan. All areas not included in parks private lots will be reclaimed, including protective slopes (gradual for drainage and stability), will be revegetated using an approved seed mix from granite seed, for our region.

Please see figure six for our seed mix from granite seed.

Our method of revegetation is hydroseeding as we re-grade our slopes for stability. Below is the ratio of hydroseeding per 1500 gal. tank, applying three tanks per acre.

1. Rye grass seed only. A portion of our phase 1 and 2 is hydroseeded with rye grass only.

This is a fast-growing grass that provides coverage as well as soil stability. This is to regulate dust as per our fugitive dust plan, this area will be disturbed again as the new 'Juniper Ridge Park' is graded and built out. This will happen as phase two is completed and phase three is close to completion. The mixture is below:

A. 15.6 lbs. fertilizer

5 lbs rye grass seed

13 bales of nature's own

fiber mulch 50lbs tacifier

2. Cabin Mix with Rye grass seed: all other areas of revegetation listed on our grading and reclamation plans are hydroseeded as well, this process has started already for slopes at finished grade and will continue in the spring as more phases come to finish grade. The mixture is listed below and attached in figure 3

B. 15.6 lbs fertilizer

7lbs cabin mix seed +2lbs

rye grass seed 13 bales of

nature's own fiber mulch

50lbs tacifier

The operator will use, as directed by the site/ project/ pit manager, appropriate machinery to conduct reclamation procedures laid out previously, appropriate growth materials will be used in conjunction with the final grading, and hydroseeding projects, (Overburden materials from aggregate processing. Section 106.3 states that we have no overburden stockpiles- as a grading project this material is not stockpiled but immediately reused to bring to grade or to reclaim grade)

We are currently bonded with the City of Santaquin, the requirements of which exceed the bond requirements with the mining department.

R647-4-112 – Variance

None requested at this time.

R647-4-113 – Surety

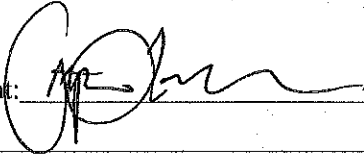
Per R647-4-113-3, The Division may accept surety estimates based upon the Minerals Reclamation Program's average dollars per acre reclamation costs, if comparable to site specific cost estimates for similar operations. The following tables from the Division 2026 Small Mine Cost Estimates have been utilized to calculate the remaining bond for Grey Cliff Mine."

The bonded area as described in Section 106.3 at the mine is 40 acres where the following is required
 $\$11,600 + 39 * \$7300 = \$296,300$

The Posted Bond, held by Santaquin City, is \$453,176.39 and issued by Central bank where OGM is named a benefactor. This is greater than the surety amount required.

XI. **SIGNATURE REQUIREMENT**

I hereby certify that the foregoing is true and correct. (Note: This form must be signed by the owner or officer of the company/corporation who is authorized to bind the company/corporation).

Signature of Permittee / Operator/Applicant: 

Name (typed or print): Stephen Larsen

Title/Position (if applicable): Managing Member

Date: 9/16/2026

PLEASE NOTE:

Section 40-8-13(2) of the Mined Land Reclamation Act provides for maintenance of confidentiality concerning certain portions of this report. Please check to see that any information desired to be held confidential is so labeled and included on separate sheets or maps.

Only information relating to the location, size or nature of the deposit may be protected as confidential.

Confidential Information Enclosed: () Yes (X) No

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Appendix A

Figures

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Figure 1

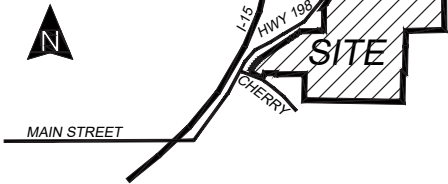
Base map

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Figure 1.2

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DIVISION OF LAND AND MINING
VICINITY MAP
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BOUNDARY DESCRIPTION

BEGINNING AT A POINT WHICH IS EAST 1355.49 FEET & NORTH 20.34 FEET FROM THE SOUTHWEST CORNER OF SECTION 31, T9S, R2E, SLB&M;

S 89°08'25" W 9.85 FT; N 23°37'50" W 48.38 FT; N 00°18'56" W 285.16 FT; N 00°44'28" E 176.28 FT; N 00°51'53" W 289.12 FT; N 56°40'0" E 430.20 FT; N 55°31'46" E 335.01 FT; N 51°33'02" E 153.10 FT; N 89°08'25" E 605.18 FT; N 02°09'27" W 15.10 FT; N 89°08'25" E 118.44 FT; NORTH 679.39 FT; WEST 37.79 FT; N 34°13'11" E 1028.84 FT; EAST 535.81 FT; SOUTH 181.50 FT; EAST 129.01 FT; S 00°40'05" E 39.18 FT; N 89°31'08" E 724.44 FT; SOUTH 209.38 FT; EAST 280.50 FT; NORTH 211.73 FT; N 89°31'08" E 330.01 FT; S 00°41'06" E 2.53 FT; N89°08'16" E 1344.96 FT; S00°45'44" E 1303.88 FT; S 89°14'18" W 1346.74 FT; SOUTH 487.61 FT; N 78°14'30" W 69.74 FT; S 00°59'42" W 826.98 FT; S 89°08'42" W 62.12 FT; S 00°57'58" W 895.70 FT; N 89°01'35" W 3000.00 FT; N 00°58'24" E 800.01 FT; S 89°08'25" W 856.23 TO THE POINT OF BEGINNING.

CONTAINS: 298.64 AC

HALES
LAND LLC

COOK'S
PRIVATE PROPERTY

CATOOR PRIVATE
PROPERTY

APEX
STORAGE

DEPEW PRIVATE
PROPERTY

STRAWBERRY CANAL

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Figure 2
Current facilities



Figure 3

Granite Seed Company's Native Grass Blend

SPECIES	PLS/acre
Mountain brome (<i>Bromus marginatus</i>)	7.50
Slender wheatgrass (<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>)	6.25
Sandberg bluegrass (<i>Poa secunda</i> ssp. <i>sandbergii</i>)	1.25
Big bluegrass (<i>Poa secunda</i> ssp. <i>ampla</i>)	1.25
Sheep fescue (<i>Festuca ovina</i>)	1.25
Western wheatgrass (<i>Pascopyrum smithii</i>)	5.00
Bluebunch wheatgrass (<i>Pseudoroegneria spicata</i> ssp. <i>spicata</i>)	2.50
TOTAL:	25.00

Appendix B

Soil Typology report NRCS

Utah County, Utah - Central Part

KOD—Kilburn stony sandy loam, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: j6xr
Elevation: 4,600 to 5,700 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 150 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Kilburn and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kilburn

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Colluvium and/or slope alluvium derived from granite and quartzite

Typical profile

A11 - 0 to 8 inches: stony sandy loam
A12 - 8 to 15 inches: very stony sandy loam
A12 - 15 to 36 inches: very stony sandy loam
C1 - 36 to 40 inches: extremely stony sandy loam
C2ca - 40 to 60 inches: extremely stony sandy loam

Properties and qualities

Slope: 3 to 15 percent
Surface area covered with cobbles, stones or boulders: 12.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 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: 15 percent
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A

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Sep. 25, 2026

Map Unit Description: Kilbuck stony sandy loam, 3 to 15 percent slopes---Utah County, Utah -
Central Part

M/049/0219

T-24606

Ecological site: R028AY306UT - Upland Gravelly Loam (Bonneville
Big Sagebrush)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Utah County, Utah - Central Part
Survey Area Data: Version 18, Aug 27, 2025



Utah County, Utah - Central Part

HKG—Henefer-Rake association, 35 to 70 percent slopes

Map Unit Setting

National map unit symbol: j6xc
Elevation: 5,100 to 7,100 feet
Mean annual precipitation: 15 to 25 inches
Mean annual air temperature: 41 to 47 degrees F
Frost-free period: 80 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Henefer and similar soils: 35 percent
Rake and similar soils: 30 percent
Henefer and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Henefer

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium and/or slope alluvium derived from mixed sources

Typical profile

A11 - 0 to 3 inches: loam
A12 - 3 to 7 inches: loam
B11 - 7 to 15 inches: clay loam
B21t - 15 to 25 inches: cobbly clay
B22t - 25 to 33 inches: cobbly clay
B23t - 33 to 43 inches: cobbly clay
B3 - 43 to 58 inches: very cobbly clay
C - 58 to 65 inches: very cobbly clay

Properties and qualities

Slope: 35 to 70 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water
(Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: C

Ecological site: R047XA430UT - Mountain Loam (mountain big sagebrush)

Hydric soil rating: No

Description of Rake

Setting

Landform: Ridges, mountain slopes

Landform position (two-dimensional): Summit

Landform position (three-dimensional): Mountain flank, interfluve, crest

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Colluvium derived from limestone and quartzite

Typical profile

A1 - 0 to 6 inches: stony loam

B2t - 6 to 13 inches: extremely cobbly clay loam

C1cam - 13 to 32 inches: indurated

C2ca - 32 to 37 inches: extremely stony sandy loam

Properties and qualities

Slope: 35 to 70 percent

Surface area covered with cobbles, stones or boulders: 6.0 percent

Depth to restrictive feature: 10 to 20 inches to petrocalcic

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.07 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 70 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 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: D

Ecological site: R047XA446UT - Mountain Shallow Loam (mountain big sagebrush)

Hydric soil rating: No

Description of Henefer

Setting

Landform: Ridges

Landform position (two-dimensional): Summit

Landform position (three-dimensional): Interfluvial, crest

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Colluvium and/or slope alluvium derived from mixed sources

Typical profile

A11 - 0 to 3 inches: cobbly loam

A11 - 3 to 7 inches: cobbly loam

B11 - 7 to 15 inches: cobbly clay loam

B21t - 15 to 25 inches: cobbly clay

B22t - 25 to 33 inches: cobbly clay

B23t - 33 to 43 inches: cobbly clay

B3 - 43 to 58 inches: extremely cobbly clay

C - 58 to 65 inches: extremely cobbly clay

Properties and qualities

Slope: 35 to 50 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Capacity of the most limiting layer to transmit water

(Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: C

Ecological site: R047XA430UT - Mountain Loam (mountain big sagebrush)

Hydric soil rating: No

Minor Components

Picayune

Percent of map unit: 10 percent

Data Source Information

Soil Survey Area: Utah County, Utah - Central Part

Survey Area Data: Version 18, Aug 27, 2025

Utah County, Utah - Central Part

HNG—Hillfield-Layton complex, 30 to 60 percent slopes

Map Unit Setting

National map unit symbol: j6xd
Elevation: 4,500 to 5,200 feet
Mean annual precipitation: 12 to 17 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 150 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Hillfield and similar soils: 60 percent
Layton and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hillfield

Setting

Landform: Escarpments, lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from mixed sources

Typical profile

Ap - 0 to 4 inches: silt loam
AC - 4 to 12 inches: silt loam
C1ca - 12 to 26 inches: silt loam
C2ca - 26 to 35 inches: loam
C3ca - 35 to 40 inches: loam
IIC4 - 40 to 60 inches: sandy loam

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
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: 50 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Description of Layton

Setting

Landform: Escarpments, lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits derived from sandstone and quartzite

Typical profile

A11 - 0 to 2 inches: loamy fine sand
A12 - 2 to 7 inches: loamy fine sand
AC - 7 to 14 inches: loamy fine sand
C1 - 14 to 26 inches: loamy fine sand
C2ca - 26 to 39 inches: loamy fine sand
C3ca - 39 to 60 inches: fine sand

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R028AY330UT - Upland Sand (Black Greasewood, Indian Ricegrass)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Utah County, Utah - Central Part
Survey Area Data: Version 18, Aug 27, 2025

Utah County, Utah - Central Part

PoC—Pleasant Vale loam, extended season, 3 to 6 percent slopes

Map Unit Setting

National map unit symbol: j6z8
Elevation: 4,500 to 5,200 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Pleasant vale and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pleasant Vale

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from limestone, sandstone, quartzite, and shale

Typical profile

Ap - 0 to 6 inches: loam
A1 - 6 to 12 inches: loam
C1 - 12 to 24 inches: very fine sandy loam
C2 - 24 to 40 inches: very fine sandy loam
C3,C4 - 40 to 60 inches: very fine sandy loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
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: 30 percent
Maximum salinity: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 30.0
Available water supply, 0 to 60 inches: High (about 9.1 inches)

Interpretive groups

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

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Sep. 25, 2026

Map Unit Description: Pleasant Valley loam, extended season, 3 to 6 percent slopes--Utah
County, Utah - Central Part

M/049/0219

T-24606

Hydrologic Soil Group: C

Ecological site: R028AY310UT - Upland Loam (Bonneville Big
Sagebrush) North

Other vegetative classification: Upland Loam (Mountain Big
Sagebrush) (028AY310UT)

Hydric soil rating: No

Data Source Information

Soil Survey Area: Utah County, Utah - Central Part

Survey Area Data: Version 18, Aug 27, 2025



Utah County, Utah - Central Part

CsD—Cleverly gravelly fine sandy loam, 6 to 15 percent slopes

Map Unit Setting

National map unit symbol: j6x1
Elevation: 4,650 to 5,580 feet
Mean annual precipitation: 14 to 20 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 150 to 170 days
Farmland classification: Farmland of unique importance

Map Unit Composition

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

Description of Cleverly

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Slope alluvium derived from quartzite and/or sandstone

Typical profile

Ap - 0 to 7 inches: gravelly fine sandy loam
A1 - 7 to 16 inches: gravelly loam
B21 - 16 to 29 inches: gravelly loam
B3 - 29 to 42 inches: gravelly loam
Cca - 42 to 60 inches: very gravelly sandy loam

Properties and qualities

Slope: 6 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 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: 3 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): 3e

RECEIVED
Sep. 25, 2026

DIVISION OF SOIL, WATER AND MINING
Map Unit Description: Upland Gravelly Loam, 6 to 15 percent slopes---Utah County,

Utah - Central Part

049/0219

T-24606

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: B

*Ecological site: R028AY306UT - Upland Gravelly Loam (Bonneville
Big Sagebrush)*

Hydric soil rating: No

Minor Components

Kilburn

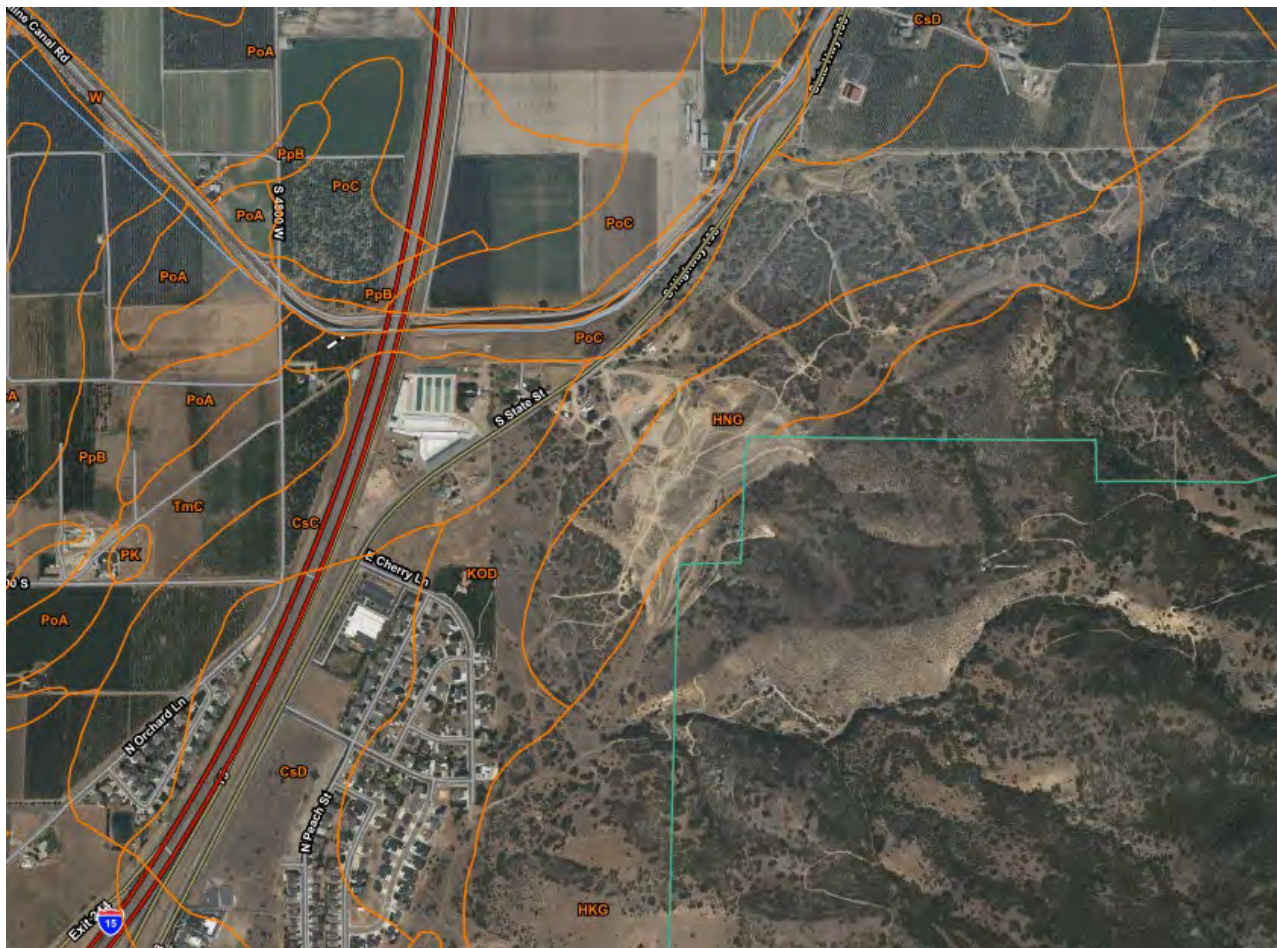
Percent of map unit: 5 percent

Data Source Information

Soil Survey Area: Utah County, Utah - Central Part

Survey Area Data: Version 18, Aug 27, 2025



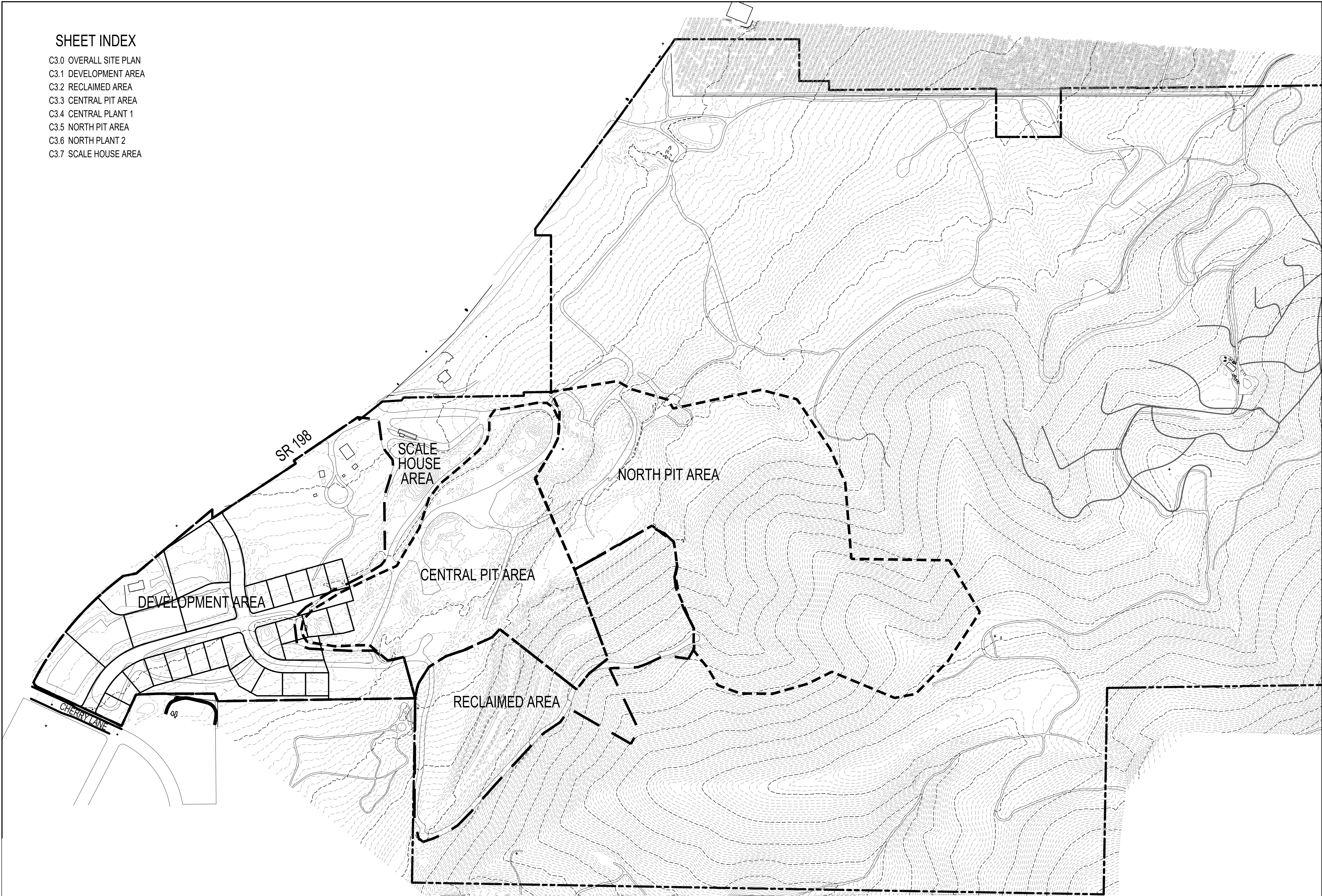


Appendix C

Dust Mitigation Plans

SHEET INDEX

- C3.0 OVERALL SITE PLAN
- C3.1 DEVELOPMENT AREA
- C3.2 RECLAIMED AREA
- C3.3 CENTRAL PIT AREA
- C3.4 CENTRAL PLANT 1
- C3.5 NORTH PIT AREA
- C3.6 NORTH PLANT 2
- C3.7 SCALE HOUSE AREA



DEVELOPMENT

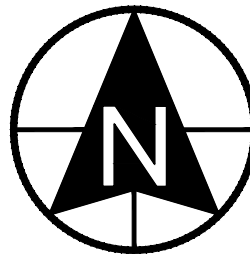


700 N SR198
SANTAQUIN, UTAH COUNTY, UT

DEVELOPER

GREY
CLIFFS
LLC.

935 W. CENTER
LINDON, UT 84042
801.785.8458



0 100 200 400 600
SCALE: 1"= 200'



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Alpine, UT, 84004
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REVISIONS			SEAL
NO.	DATE	DESCRIPTION	
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ACTION			DATE
FINAL			5-29-2025

PROJECT



DESCRIPTION

FUGITIVE
DUST
PLAN

SHEET NAME

GRADING

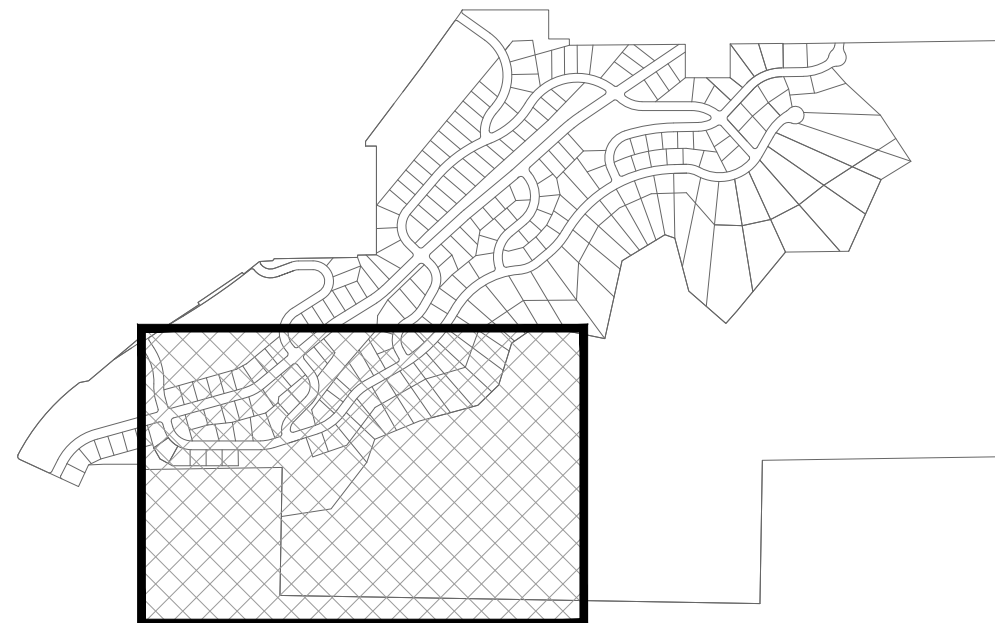
SHEET NUMBER

C3.0

C3.1

RECLAIMED AREA = 14.80 AC

MAP KEY



DEVELOPMENT AREA

CENTRAL PIT

COMPLETED
GRADED SLOPE

RECLAIMED AREA

COMPLETED
GRADED SLOPE

FUTURE PARK
HYDRO-SEEDED

COMPLETED
GRADED SLOPE

ACCESS ROAD

DEVELOPMENT

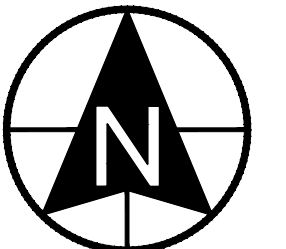


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0 40 80 160 240

SCALE: 1" = 80'



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DESCRIPTION

*FUGITIVE
DUST
PLAN*

SHEET NAME

COMPLETED
GRADING

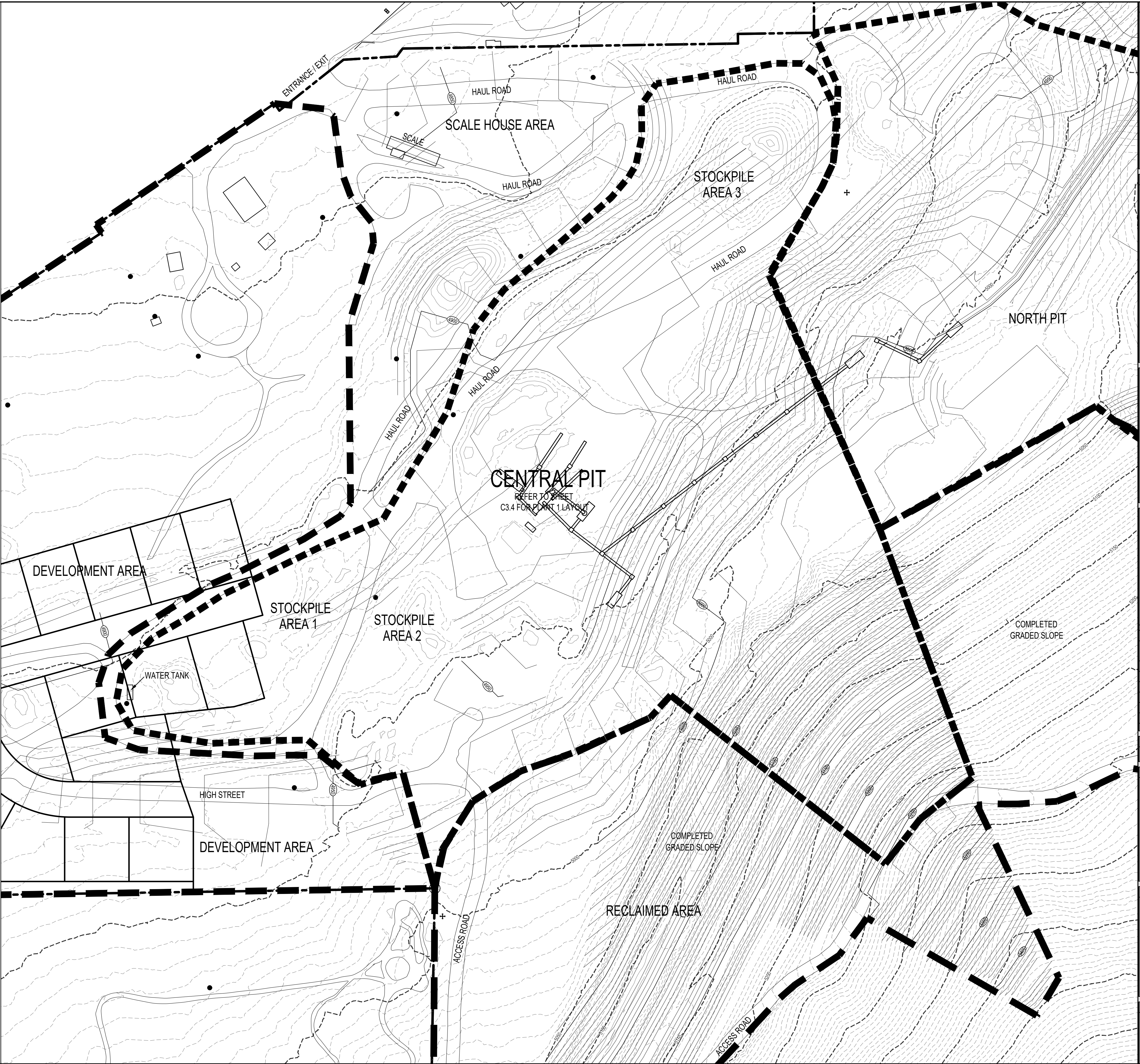
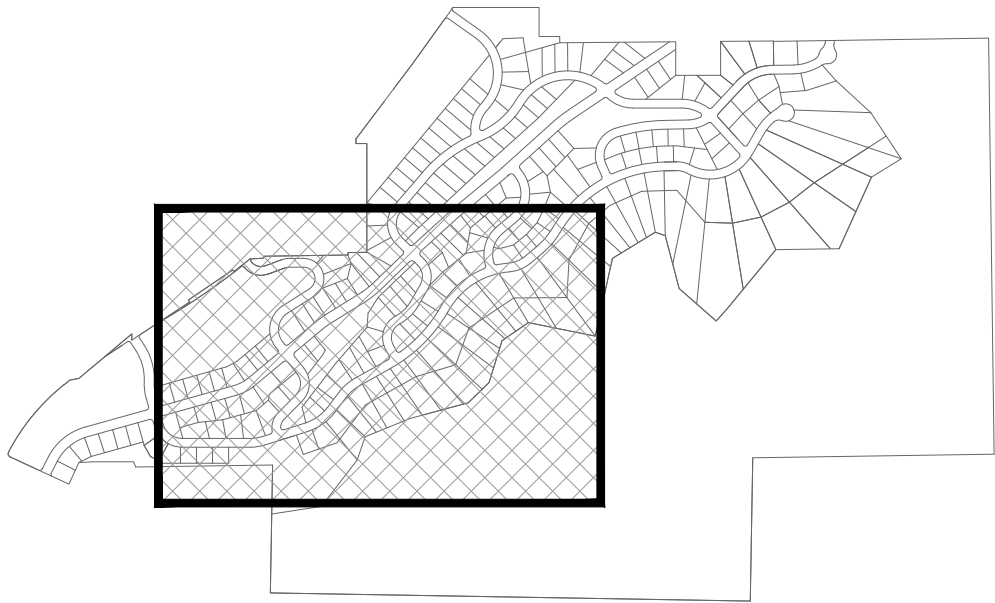
SHEET NUMBER

C3.2

GREY CLIFFS ESTATES
PHASE 1 GRADING PERMIT

CENTRAL PIT AREA = 17.62 AC
STOCKPILE AREA 1 = 0.60 AC
STOCKPILE AREA 2 = 0.77 AC
STOCKPILE AREA 3 = 1.76 AC

MAP KEY



DEVELOPMENT

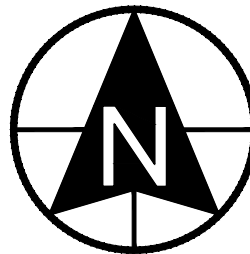


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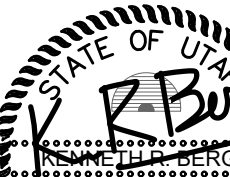
935 W. CENTER
LINDON, UT 84042
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0 40 80 160 240
SCALE: 1"= 80'



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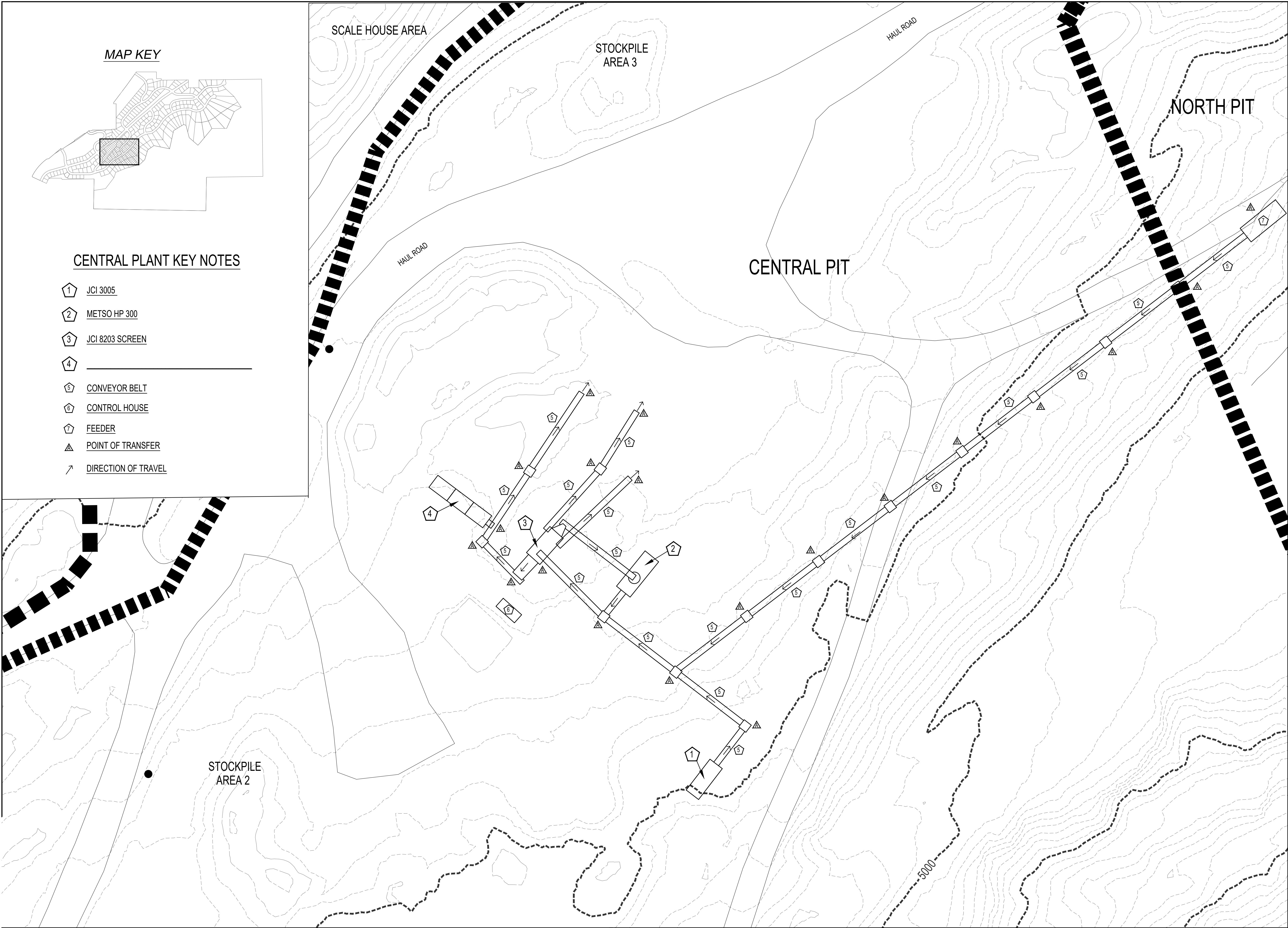
PROJECT



DESCRIPTION

FUGITIVE
DUST
PLAN

SHEET NAME	SHEET NUMBER
CENTRAL PIT AREA	C3.3

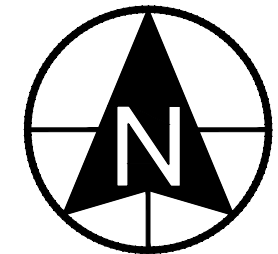


DEVELOPMENT

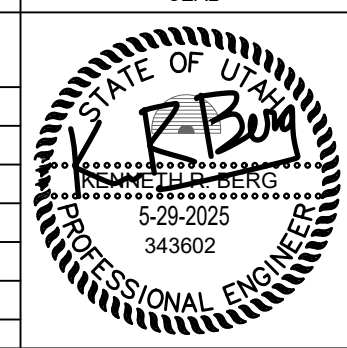

700 N SR198
SANTAQUIN, UTAH COUNTY, UT

DEVELOPER

GREY CLIFFS LLC.
935 W. CENTER
LONDON, UT 84042
801.785.8458


0 15 30 60 90
SCALE: 1"= 30'


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DESCRIPTION

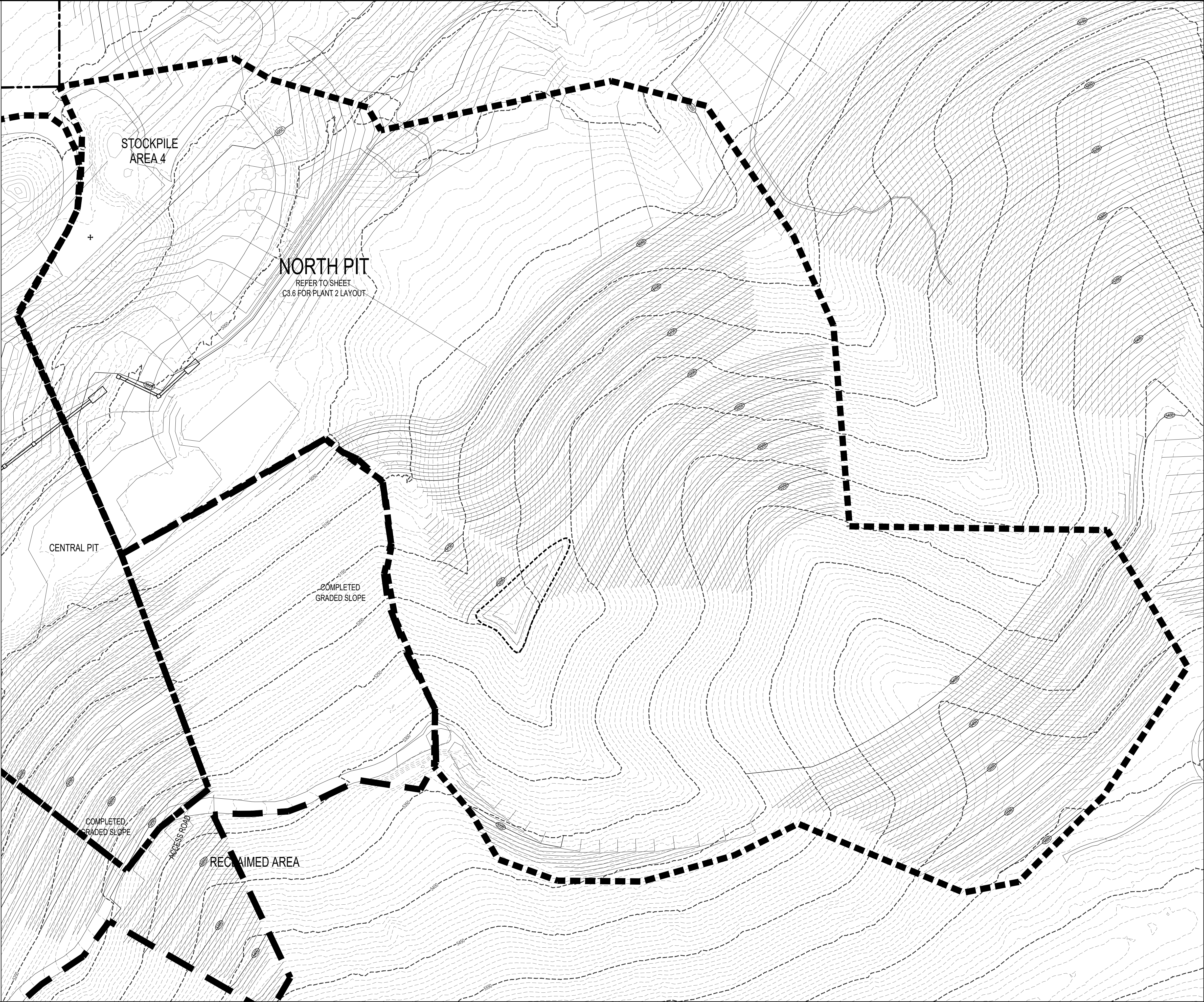
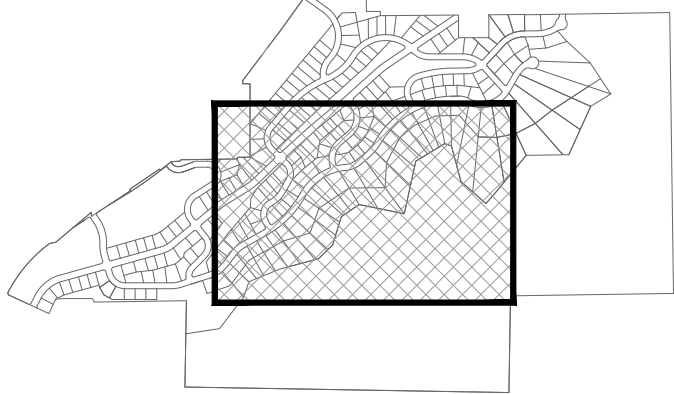
FUGITIVE DUST PLAN

SHEET NAME	SHEET NUMBER
CENTRAL PLANT 1	C3.4

GREY CLIFFS ESTATES
PHASE 2 GRADING PERMIT

NORTH PIT AREA = 34.32 AC
STOCKPILE AREA 4 = 1.56 AC

MAP KEY



DEVELOPMENT

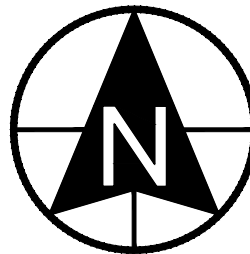


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DEVELOPER

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LLC.

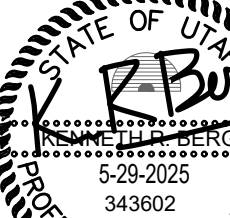
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801.785.8458



0 40 80 160 240
SCALE: 1"= 80'



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FINAL			5-29-2025

PROJECT



DESCRIPTION

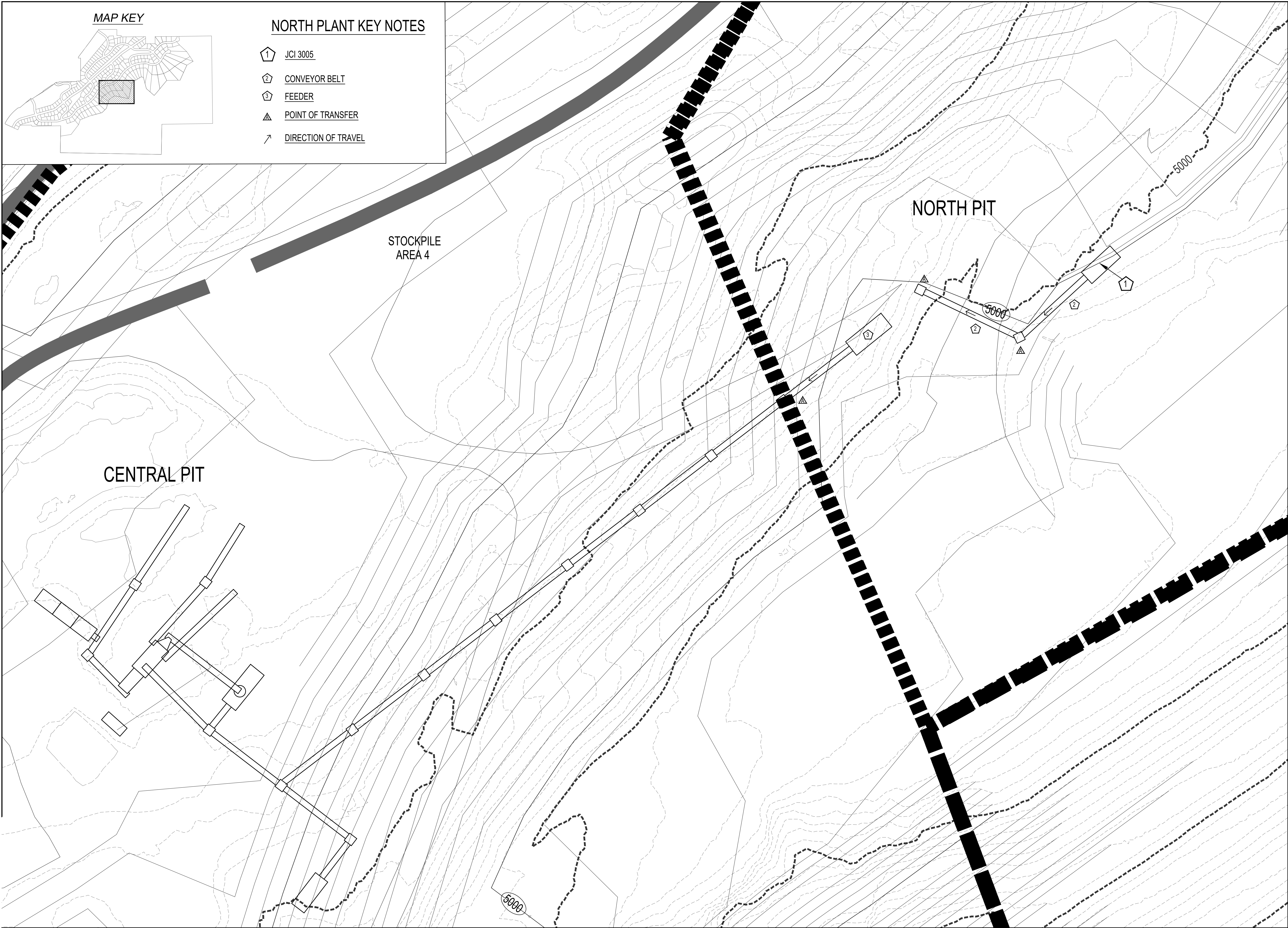
FUGITIVE
DUST
PLAN

SHEET NAME

NORTH PIT
AREA

SHEET NUMBER

C3.5



DEVELOPMENT

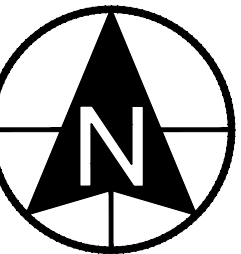


700 N SR198
SANTAQUIN, UTAH COUNTY, UT

DEVELOPER

GREY CLIFFS LLC.

935 W. CENTER
LONDON, UT 84042
801.785.8458

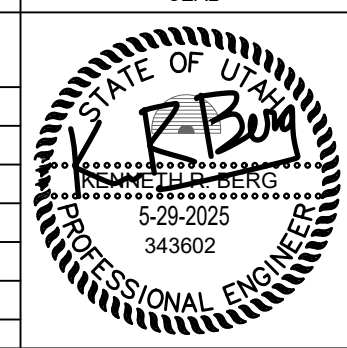


0 15 30 60 90

SCALE: 1"= 30'



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REVISIONS			SEAL
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PROJECT



DESCRIPTION

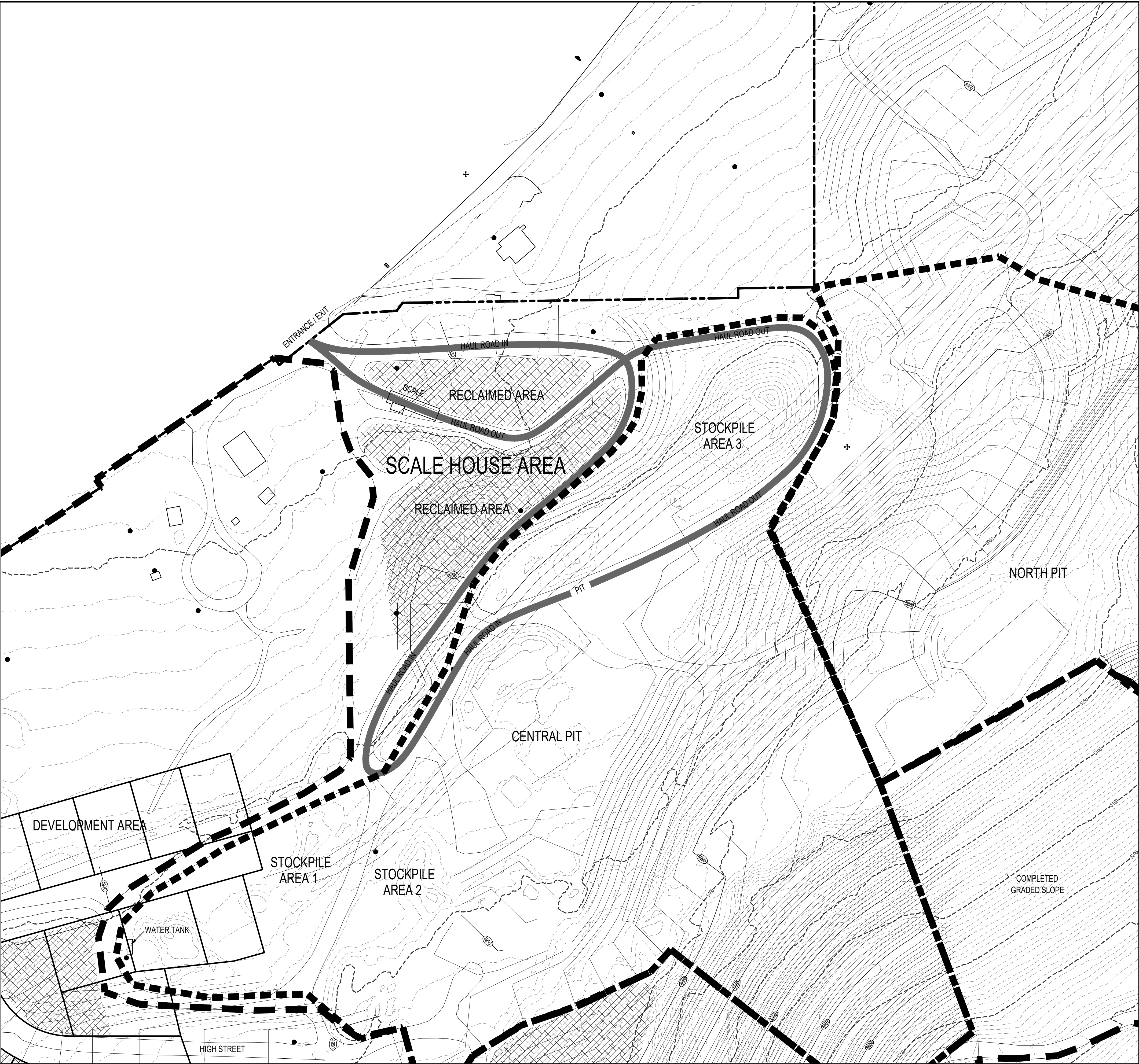
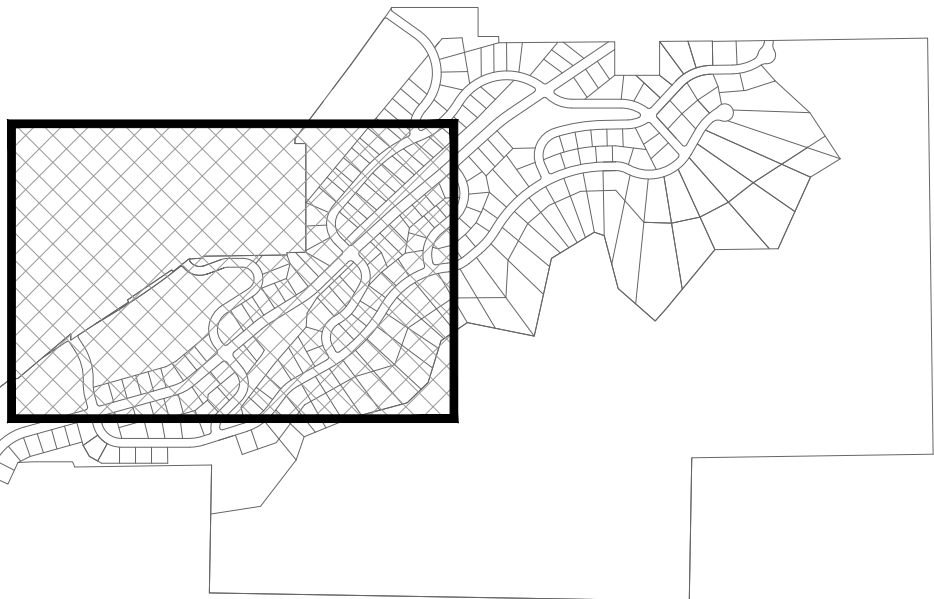
FUGITIVE DUST PLAN

SHEET NAME	SHEET NUMBER
NORTH PLANT 2 AREA	C3.6

GREY CLIFFS ESTATES
PHASE 1 GRADING PERMIT

SCALE HOUSE AREA = 3.45 AC
HAUL ROAD IN = 1730 LF
HAUL ROAD OUT = 1460 LF

MAP KEY



DEVELOPMENT

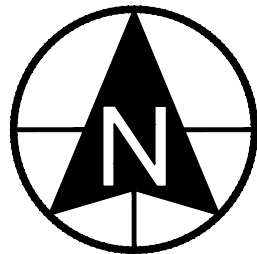


700 N SR198
SANTAQUIN, UTAH COUNTY, UT

DEVELOPER

GREY
CLIFFS
LLC.

935 W. CENTER
LINDON, UT 84042
801.785.8458



0 40 80 160 240
SCALE: 1"= 80'



1018 N Deer Crest Lane
Alpine, UT, 84004
office: (801) 492-1277
cell: (801) 616-1677

REVISIONS			SEAL
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ACTION		DATE	
FINAL		5-29-2025	

PROJECT



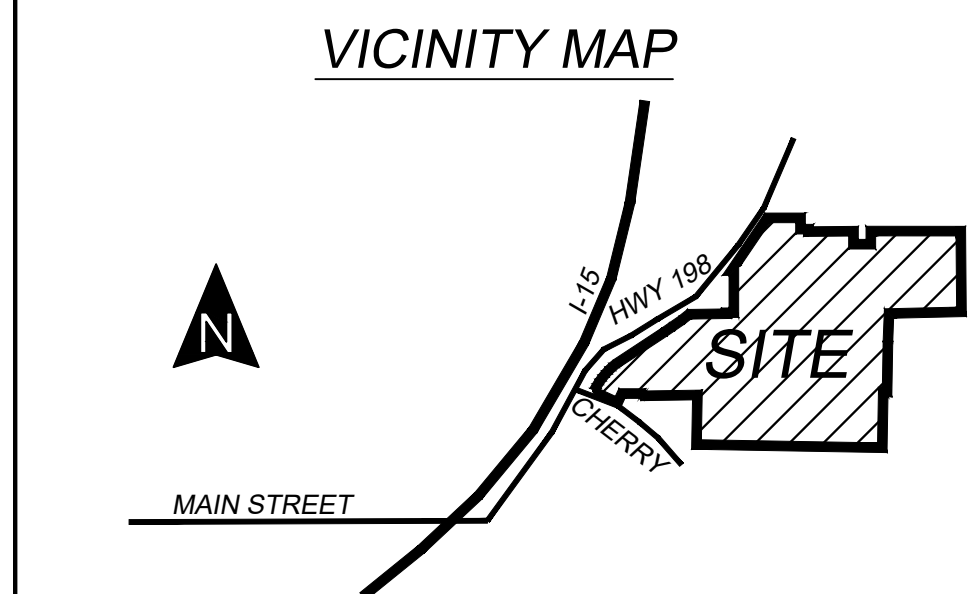
DESCRIPTION

FUGITIVE
DUST
PLAN

SHEET NAME	SHEET NUMBER
SCALE HOUSE AREA	C3.7

Appendix D

Site & Grading plans

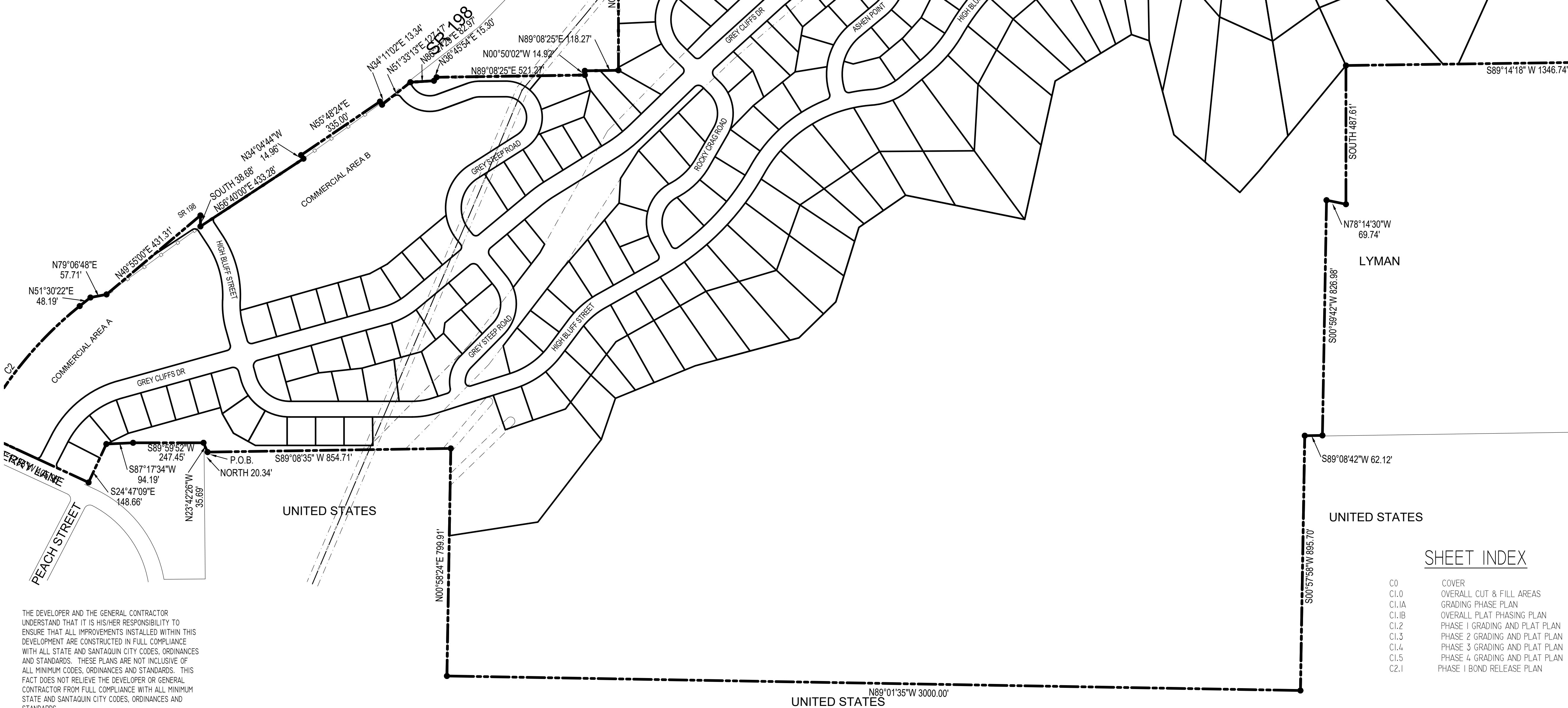


BOUNDARY DESCRIPTION

BEGINNING AT A POINT WHICH IS EAST 1355.49 FEET & NORTH 20.34 FEET FROM THE SOUTHWEST CORNER OF SECTION 31, T9S, R2E, S1B&M:

S.89°08'25" W 65.45' FT. to N.23°30' W 48.38' FT. to N.01°56' W 285.16' FT. to N.00°44' 28" E 176.28' FT. to N.00°51' 53" W 289.12' FT. to S.89°08' E 430.20' FT. to N.53°14' E 335.01' FT. to S.51°33'02" E 153.01' FT. to S.89°08'25" E 605.18' FT. to N.02°09'27" W 15.10' FT. to N.89°08'25" E 118.41' FT. to N.07°16' 39" FT. to WEST 37.79' FT. to S.14°13'11" E 1028.84' FT. to EAST 555.81' FT. to N.230°15' 50" E 122.00' FT. to N.03°40'05" E 39.18' FT. to N.89°08'25" E 724.44' FT. to N.230°08' 36" E 280.50' FT. to N.230°11' 73" FT. to N.89°08'19" E 330.01' FT. to S.00°41'06" E 23.36' FT. to N.89°08'16" E 1344.96' FT. to S.00°45'44" E 1303.38' FT. to S.89°14'19" W 1346.74' FT. to N.230°48' 61" FT. to N.78°14'30" W 64.74' FT. to S.00°52'42" E 826.98' FT. to S.89°08'42" W 62.12' FT. to S.00°57'58" E 85.70' FT. to N.89°01'35" W 300.00' FT. to N.00°58'24" E 800.01' FT. to S.89°08'25" W 856.23' FT. to the POINT OF BEGINNING.

CONTAINS: 298.64 AC



THE DEVELOPER AND THE GENERAL CONTRACTOR UNDERSTAND THAT IT IS HIS/HER RESPONSIBILITY TO ENSURE THAT ALL IMPROVEMENTS INSTALLED WITHIN THIS DEVELOPMENT ARE CONSTRUCTED IN FULL COMPLIANCE WITH ALL STATE AND SANTIQUIN CITY CODES, ORDINANCES AND STANDARDS. THESE PLANS ARE NOT INCLUSIVE OF ALL MINIMUM CODES, ORDINANCES AND STANDARDS. THIS FACT DOES NOT RELIEVE THE DEVELOPER OR GENERAL CONTRACTOR FROM FULL COMPLIANCE WITH ALL MINIMUM STATE AND SANTIQUIN CITY CODES, ORDINANCES AND STANDARDS.

CW AND CW LIMITED PARTNERSHIP

DEVELOPMENT

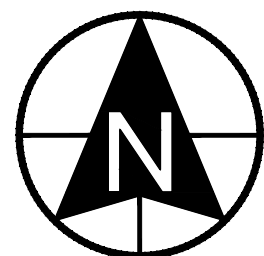


700 N SR198
SANTAQUIN, UTAH COUNTY, UT

DEVELOPER

GREY
CLIFFS
LLC.

935 W. CENTER
LINDON, UT 84042
801.785.8458



0 100 200 400 600

SCALE: 1"= 200'



CIVIL ENGINEERING
11038 N Highland Blvd Suite 400
Highland Ut, 84003
office (801) 492-1277
cell (801) 616-1677

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ACTION	DATE
GRADING PERMIT	02/15/2024

PROJECT



DESCRIPTION

GRADING PERMIT PLANS

SHEET NAME	SHEET NUMBER
COVER	C0

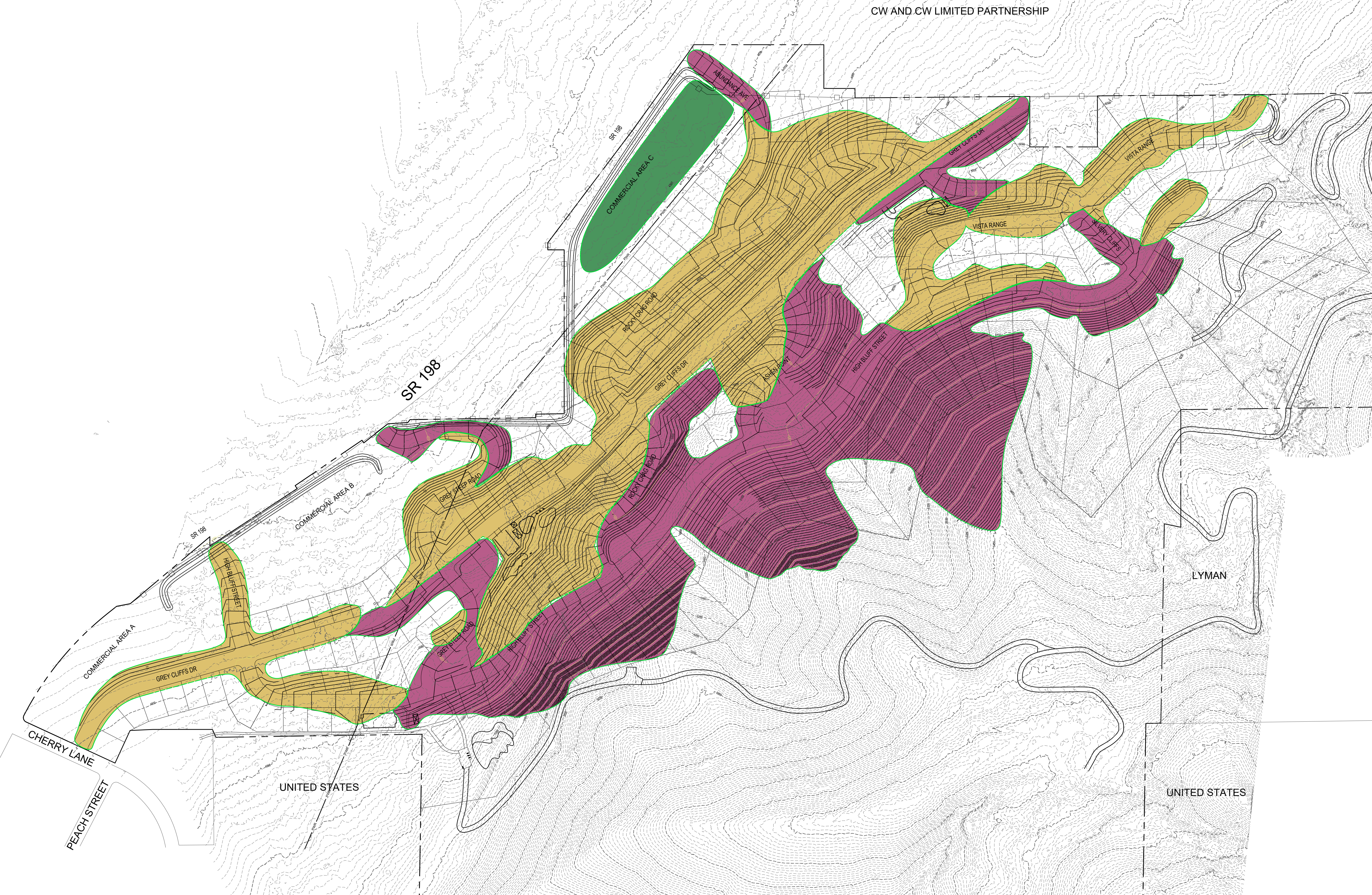
clausen@conedrive-borg.de
engineering@borg.de
grey@borg.conedrive-borg.de

c:\users\karionedrive - berg civil engineering\berg civil2021\gr
civil\module 1\exam1 - on 02.09.2021

c:\users\karionedrive - berg civil engineering\berg civil2021\gr
civil\module 1\exam1 - on 02.09.2021

GRADING LEGEND

- CUT AREA
- FILL AREA
- TOPSOIL STOCKPILE AREA



DEVELOPMENT

700 N SR198
SANTAQUIN, UTAH COUNTY, UT

DEVELOPER

GREY CLIFFS LLC.

935 W. CENTER
LINDON, UT 84042
801.785.8458

SCALE: 1"= 200'

Berg
CIVIL ENGINEERING
11038 N Highland Blvd Suite 400
Highland Ut, 84003
office (801) 492-1277
cell (801) 616-1677

REVISIONS			SEAL
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ACTION	DATE
GRADING PERMIT	02/15/2024

PROJECT

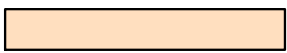
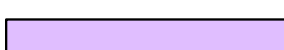
DESCRIPTION

GRADING PERMIT PLANS

SHEET NAME	SHEET NUMBER
OVERALL CUT & FILL	C1.0

USER: C:\Users\bergh\OneDrive\Documents\Berg and Berg Engineering\Berg and Berg Engineering\Projects\2024\02152024\GreyCliffs Estates\Grading\Grading Plans\Overall Cut & Fill.dwg
DATE: 02/15/2024
TIME: 10:00 AM

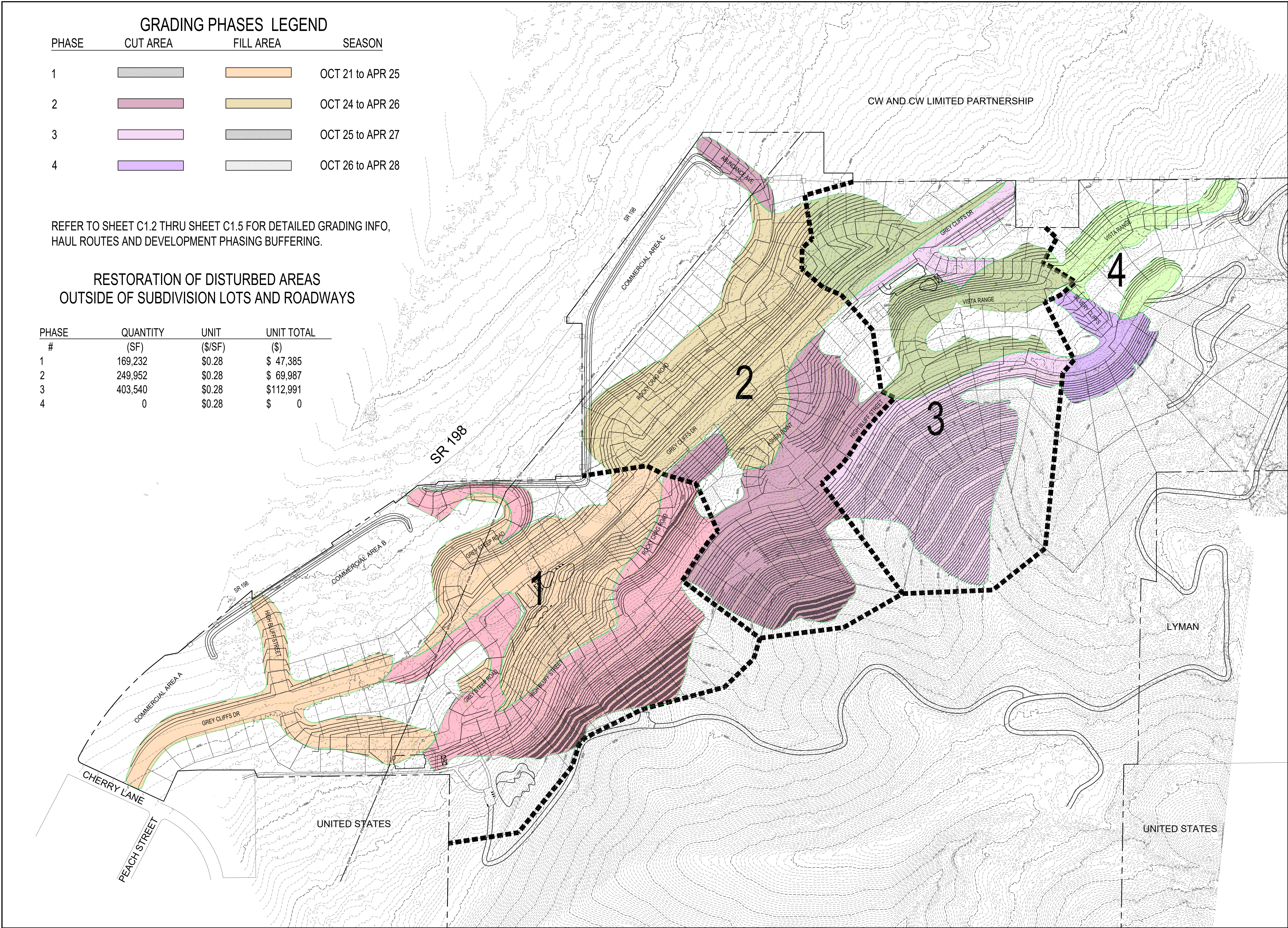
GRADING PHASES LEGEND

PHASE	CUT AREA	FILL AREA	SEASON
1			OCT 21 to APR 25
2			OCT 24 to APR 26
3			OCT 25 to APR 27
4			OCT 26 to APR 28

REFER TO SHEET C1.2 THRU SHEET C1.5 FOR DETAILED GRADING INFO,
HAUL ROUTES AND DEVELOPMENT PHASING BUFFERING.

RESTORATION OF DISTURBED AREAS
OUTSIDE OF SUBDIVISION LOTS AND ROADWAYS

PHASE	QUANTITY	UNIT	UNIT TOTAL
#	(SF)	(\$/SF)	(\$)
1	169,232	\$0.28	\$ 47,385
2	249,952	\$0.28	\$ 69,987
3	403,540	\$0.28	\$112,991
4	0	\$0.28	\$ 0



DEVELOPMENT

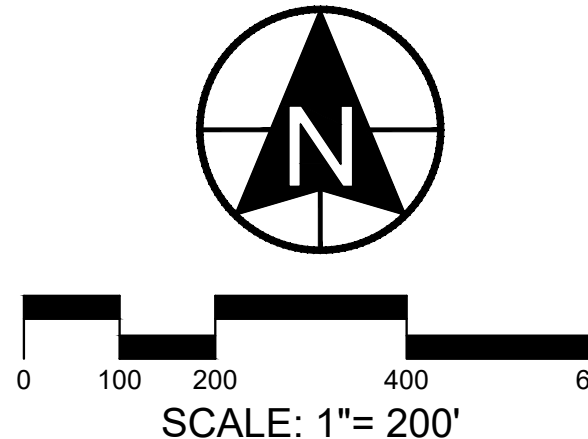


700 N SR198
SANTAQUIN, UTAH COUNTY, UT

DEVELOPER

GREY CLIFFS LLC.

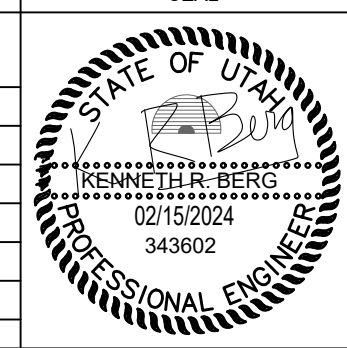
935 W. CENTER
LINDON, UT 84042
801.785.8458



SCALE: 1"= 200'



CIVIL ENGINEERING
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Highland Ut, 84003
office (801) 492-1277
cell (801) 616-1677

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ACTION	DATE
GRADING PERMIT	02/15/2024

PROJECT

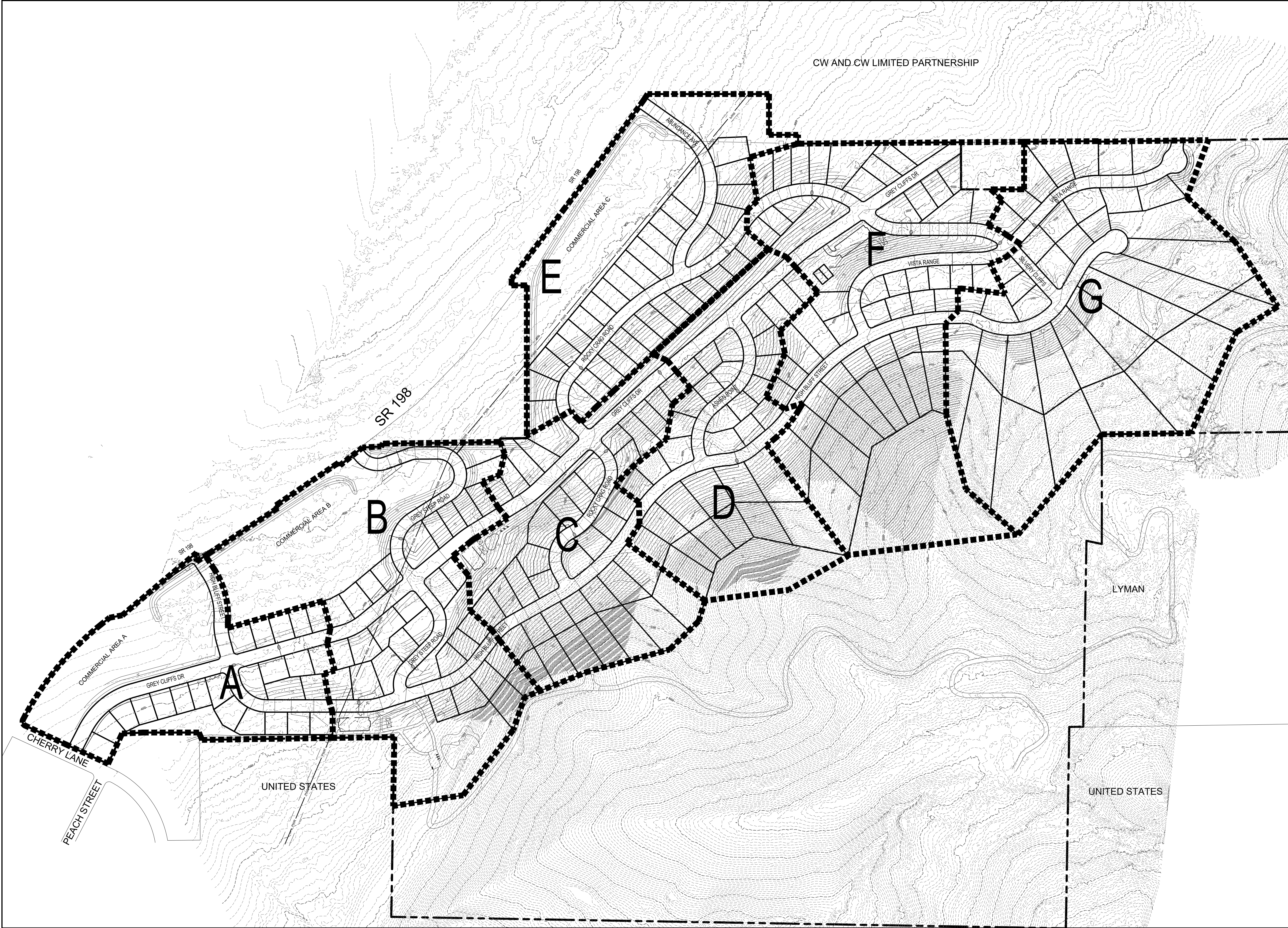


DESCRIPTION

**GRADING
PERMIT
PLANS**

SHEET NAME	SHEET NUMBER
CUT & FILL PHASING	C1.1A

owner/contractor - Berg and engineering/grading plan/02/15/2024
design/grading permit/02/15/2024/grading plan/02/15/2024



DEVELOPMENT

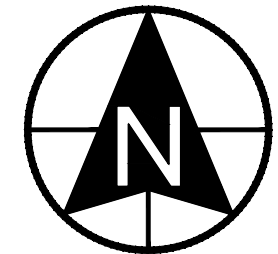


700 N SR198
SANTAQUIN, UTAH COUNTY, UT

DEVELOPER

GREY CLIFFS LLC.

935 W. CENTER
LINDON, UT 84042
801.785.8458

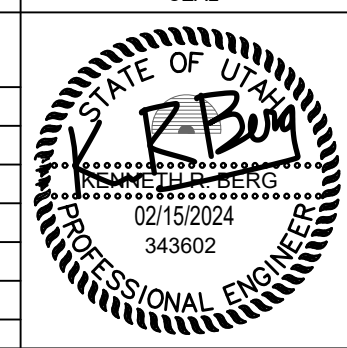


SCALE: 1"= 200'



Berg
CIVIL ENGINEERING

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Highland Ut, 84003
office (801) 492-1277
cell (801) 616-1677

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GRADING PERMIT	02/15/2024

PROJECT



DESCRIPTION

GRADING PERMIT PLANS

SHEET NAME	SHEET NUMBER
OVERALL PHASING PLAN	C1.1B

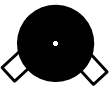
GRADING LEGEND

- CUT AREA
FILL AREA
TOPSOIL STOCKPILE AREA

- GRADING HAUL ROUTES
WATER HAUL ROUTE

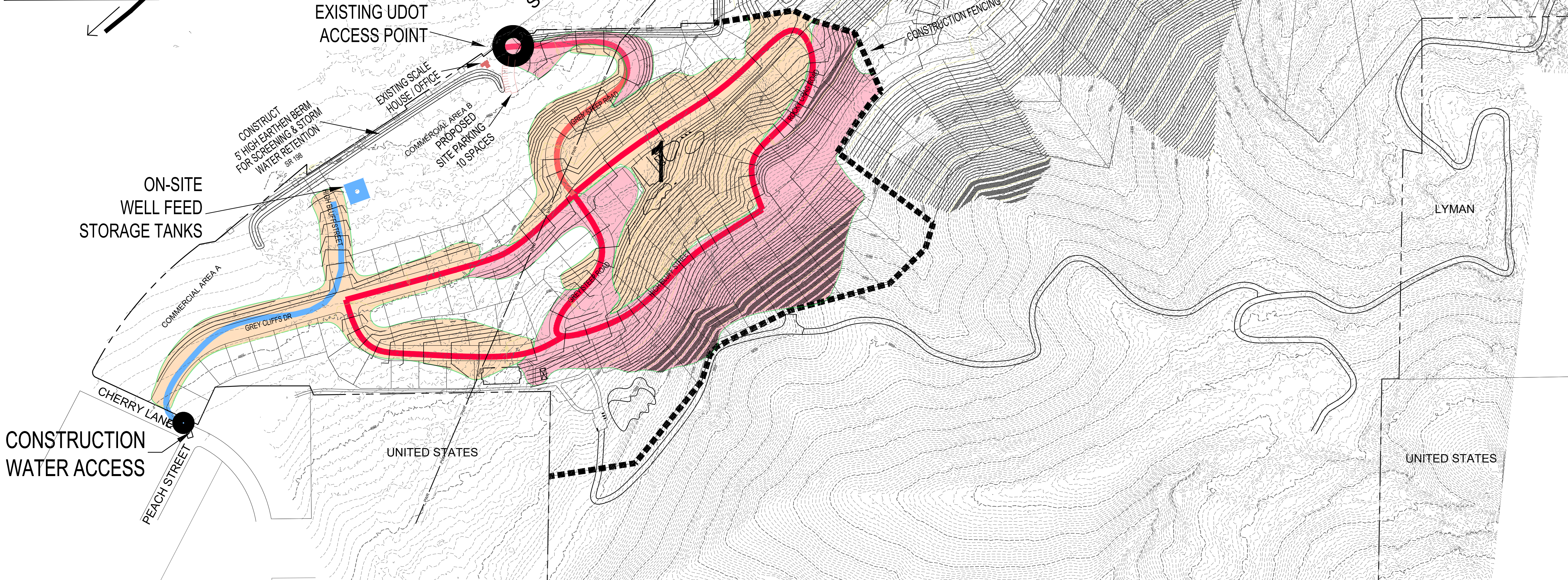
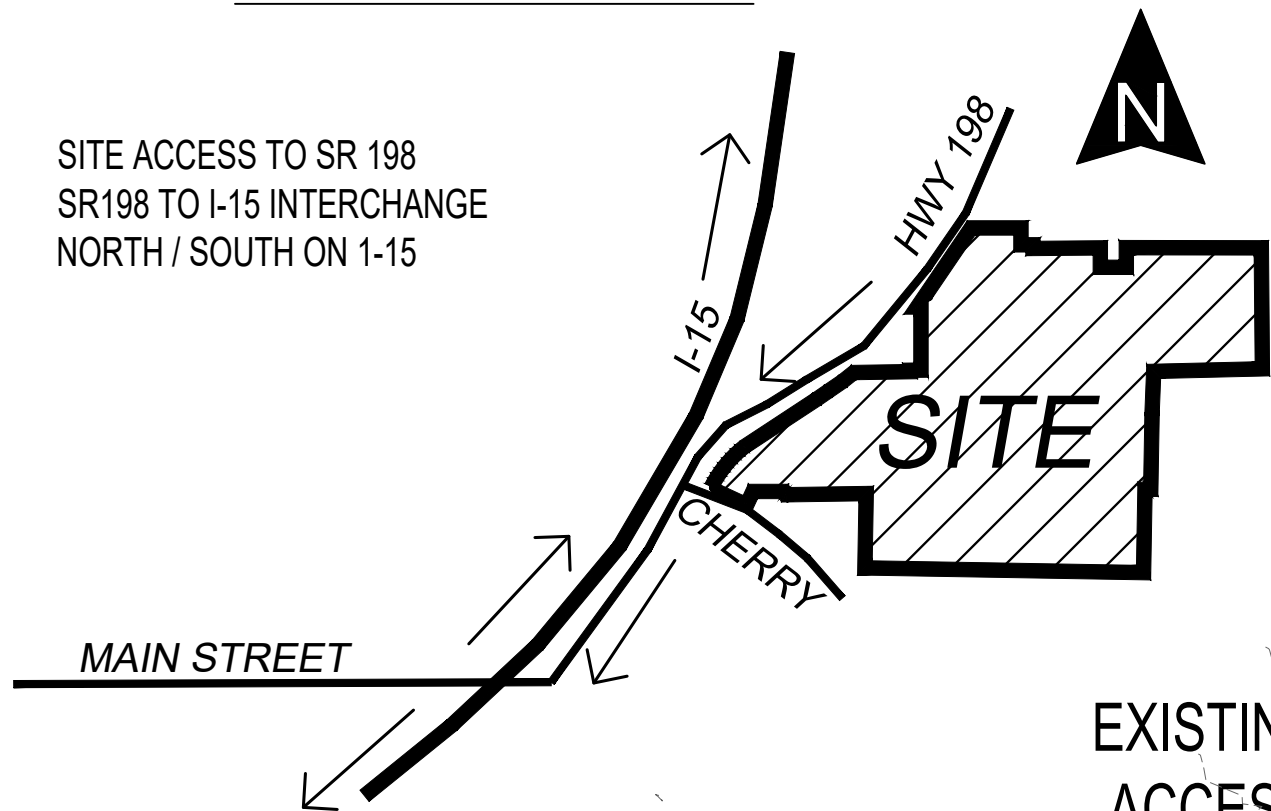


SITE ACCESS POINT
A 40' WIDE TRACK PAD MUST BE PLACED AT ALL ACCESS POINTS
TO MINIMIZE MATERIALS FROM BEING TRACKED ONTO SR 198



WATER CONNECTION

HAUL ROUTE



DEVELOPMENT

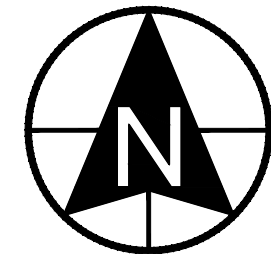


700 N SR198
SANTAQUIN, UTAH COUNTY, UT

DEVELOPER

GREY
CLIFFS
LLC.

935 W. CENTER
LONDON, UT 84042
801.785.8458



0 100 200 400 600
SCALE: 1"= 200'



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Highland Ut, 84003
office (801) 492-1277
cell (801) 616-1677

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ACTION	DATE
GRADING PERMIT	02/15/2024

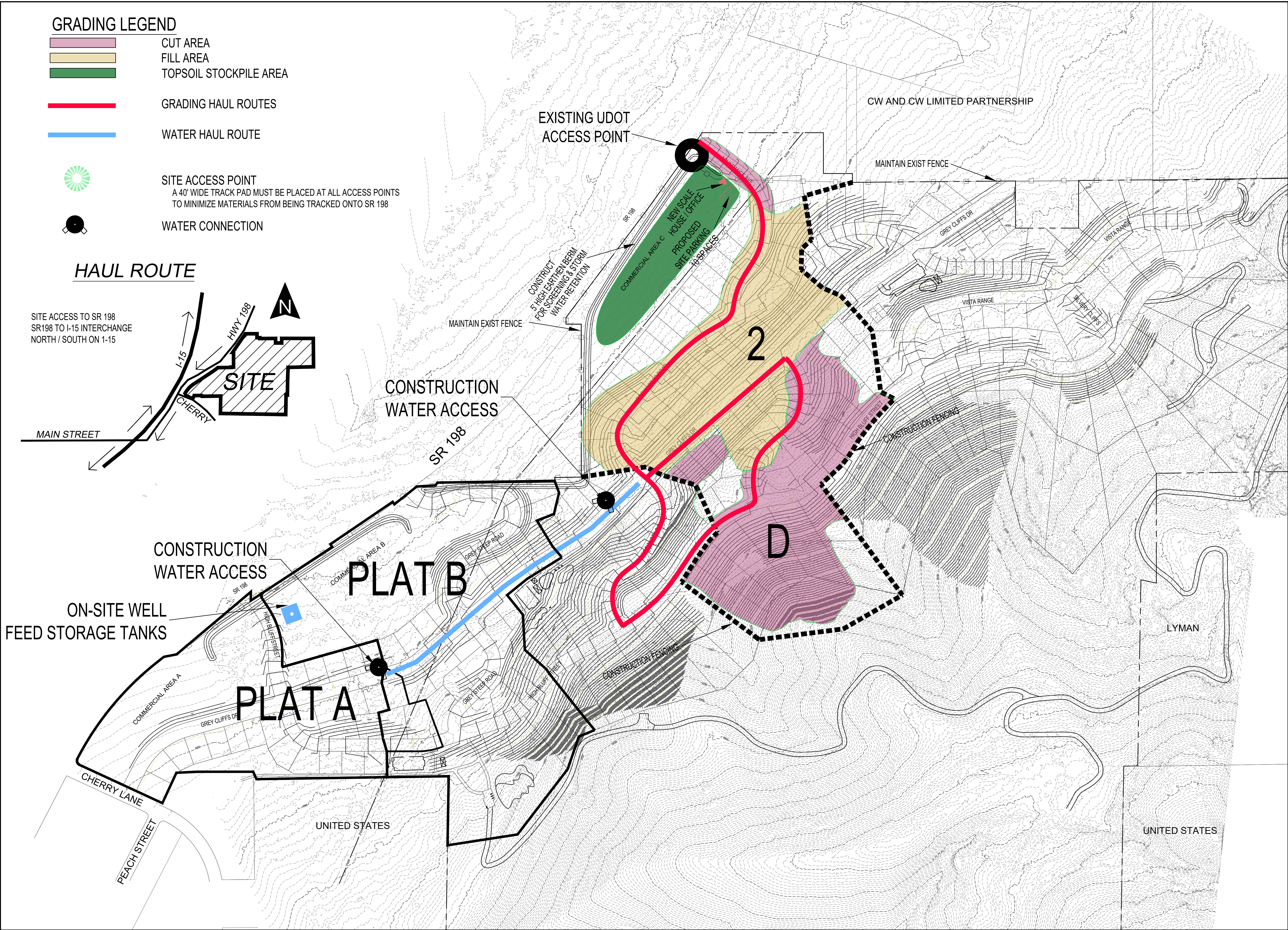
PROJECT



DESCRIPTION

GRADING
PERMIT
PLANS

SHEET NAME	SHEET NUMBER
PHASE 1 GRADING	C1.2



DEVELOPMENT

GreyCliffs ESTATES

700 N SR198
SANTAQUIN, UTAH COUNTY, UT

DEVELOPER

GREY CLIFFS LLC.

935 W. CENTER
LONDON, UT 84042
801.785.8458

North Arrow

Scale: 1"= 200'

berg CIVIL ENGINEERING

11038 N Highland Blvd Suite 400
Highland Ut, 84003
office: (801) 492-1277
cell: (801) 616-1677

REVISIONS			SEAL
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ACTION	DATE
GRADING PERMIT	02/15/2024

PROJECT

GreyCliffs ESTATES

DESCRIPTION

GRADING PERMIT PLANS

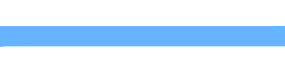
SHEET NAME	SHEET NUMBER
PHASE 2 GRADING	C1.3

client: kberg@kberg-engineering.com kberg and engineering@kberg-engineering.com 02/15/2024 343602

GRADING LEGEND

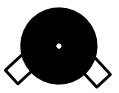
-  CUT AREA
 FILL AREA
 TOPSOIL STOCKPILE AREA

 GRADING HAUL ROUTES

 WATER HAUL ROUTE



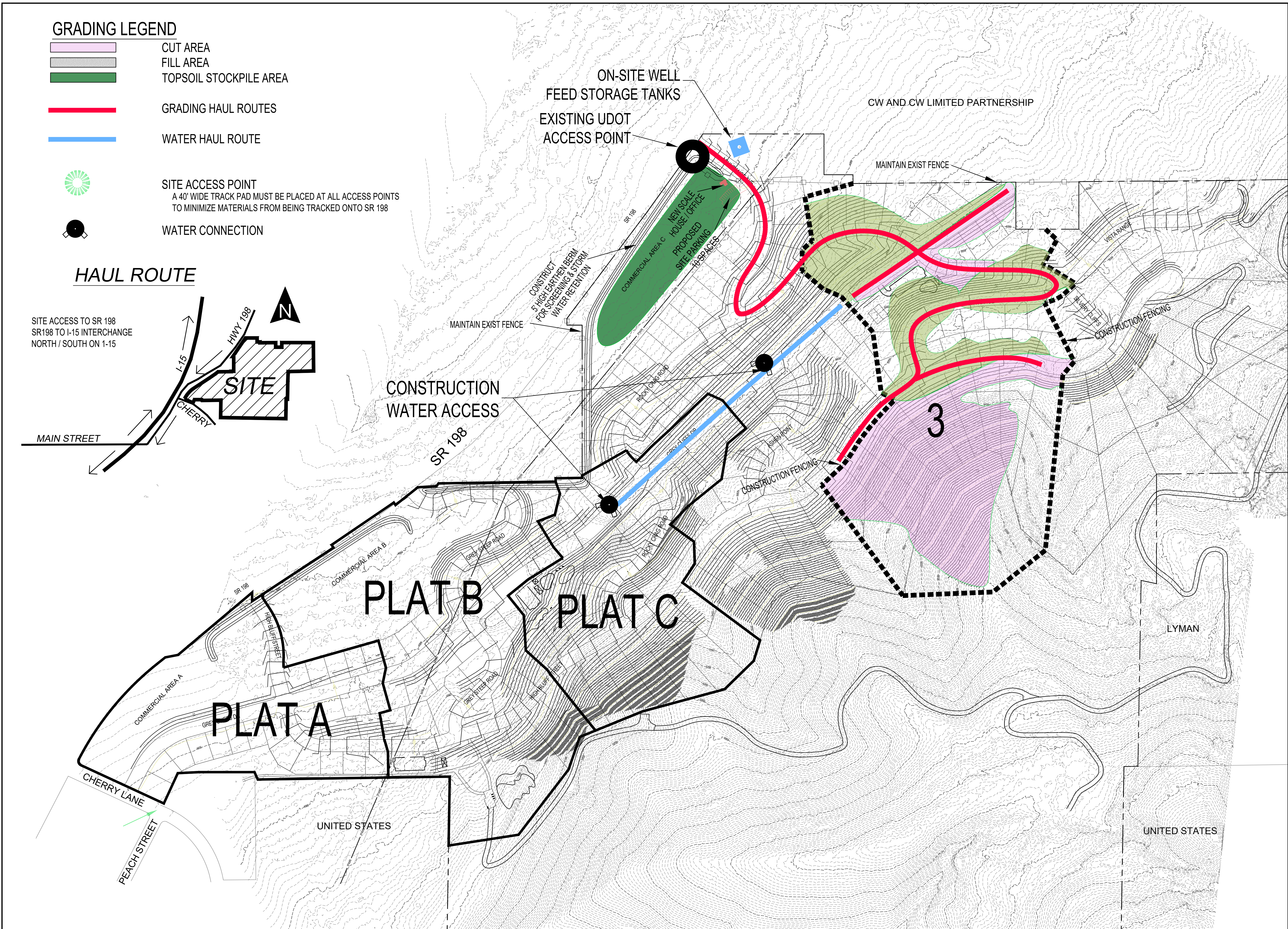
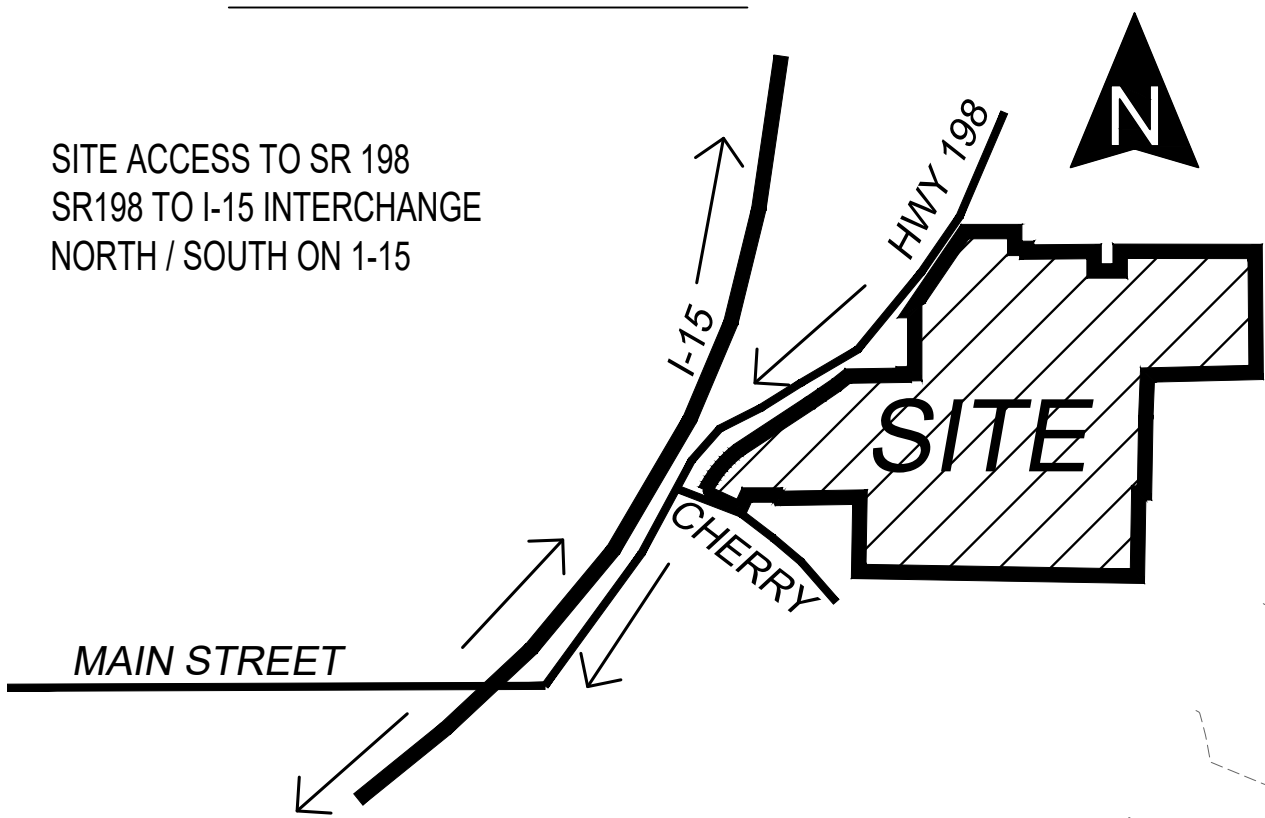
SITE ACCESS POINT
A 40' WIDE TRACK PAD MUST BE PLACED AT ALL ACCESS POINTS
TO MINIMIZE MATERIALS FROM BEING TRACKED ONTO SR 198



WATER CONNECTION

HAUL ROUTE

SITE ACCESS TO SR 198
SR198 TO I-15 INTERCHANGE
NORTH / SOUTH ON I-15



DEVELOPMENT

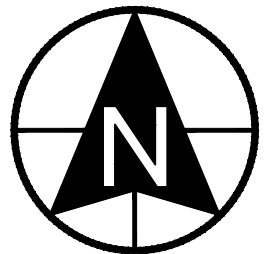


700 N SR198
SANTAQUIN, UTAH COUNTY, UT

DEVELOPER

GREY
CLIFFS
LLC.

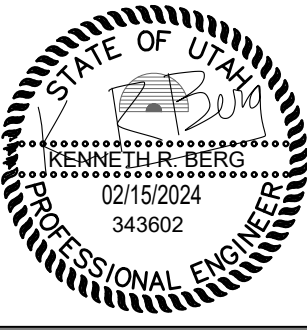
935 W. CENTER
LONDON, UT 84042
801.785.8458



0 100 200 400 600
SCALE: 1"= 200'



11038 N Highland Blvd Suite 400
Highland Ut, 84003
office: (801) 492-1277
cell: (801) 616-1677

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ACTION	DATE
GRADING PERMIT	02/15/2024

PROJECT



DESCRIPTION

GRADING
PERMIT
PLANS

SHEET NAME	SHEET NUMBER
PHASE 3 GRADING	C1.3

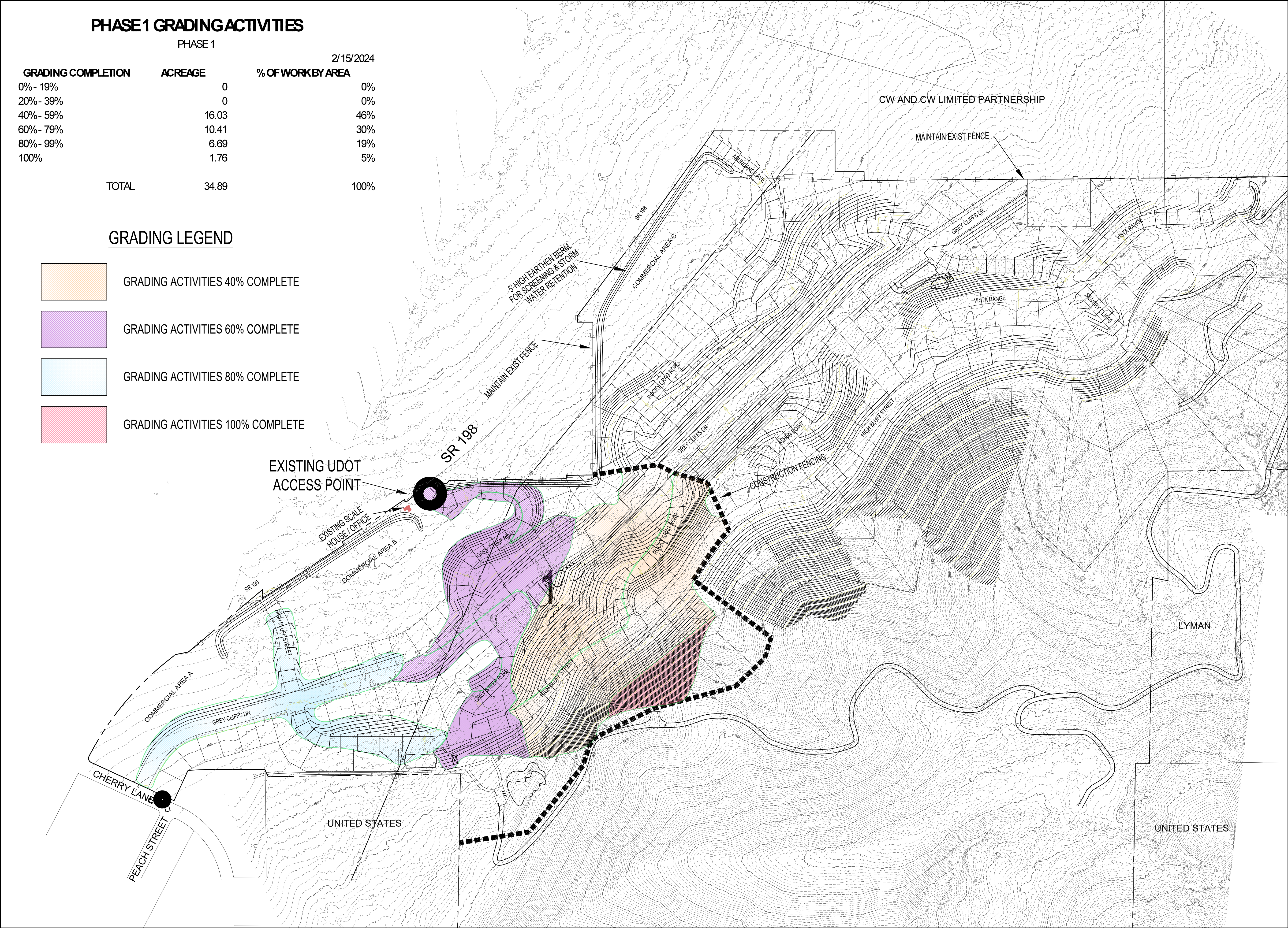
client: kberg@grey-cliffs.com berg: berg@engineeringberg.com 02/15/2024
design: kberg@engineeringberg.com 02/15/2024

PHASE 1 GRADING ACTIVITIES

PHASE 1			2/15/2024
GRADING COMPLETION	ACREAGE	% OF WORK BY AREA	
0% - 19%	0	0%	
20% - 39%	0	0%	
40% - 59%	16.03	46%	
60% - 79%	10.41	30%	
80% - 99%	6.69	19%	
100%	1.76	5%	
TOTAL	34.89	100%	

GRADING LEGEND

- GRADING ACTIVITIES 40% COMPLETE
- GRADING ACTIVITIES 60% COMPLETE
- GRADING ACTIVITIES 80% COMPLETE
- GRADING ACTIVITIES 100% COMPLETE



DEVELOPMENT

700 N SR198
SANTAQUIN, UTAH COUNTY, UT

DEVELOPER

GREY CLIFFS LLC.

935 W. CENTER
LINDON, UT 84042
801.785.8458

SCALE: 1"= 200'

11038 N Highland Blvd Suite 400
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office (801) 492-1277
cell (801) 616-1677

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GRADING PERMIT		02/15/2024		

PROJECT

DESCRIPTION

GRADING PERMIT PLANS

SHEET NAME	SHEET NUMBER
PHASE 1 BOND RELEASE 1	C2.1

RECEIVED
Sep. 25, 2026
DIVISION OF OIL, GAS AND MINING
M/049/0219
T-24606

Appendix E

Air Quality Application Narrative

RECEIVED
Sep. 25, 2026
DIVISION OF OIL, GAS AND MINING
M/049/0219
T-24606

Grey Cliffs LLC

**Additional Information (Division of Air Quality), 16257: Grey
Cliffs LLC- Santaquin Aggregate Pit Air Quality Permit
Application**

Introduction Grey Cliffs LLC is leading the transformation of a former sand and gravel pit into a dynamic residential community at 700 North SR 198, Santaquin, Utah. This planned 215-lot subdivision has received full approval from Santaquin City managers, who have underscored the importance of reclaiming and restoring the site to ensure sustainable development. The property, which spans hillside elevations and features unpaved access roads for recreational use, provides a unique opportunity to harmonize responsible development with environmental stewardship.

To align with the city's restoration priorities, Grey Cliffs LLC has developed a detailed reclamation plan. This initiative includes re-grading hillside areas and filling cuts created by historical mining activities. The plan employs a phased approach: new areas are actively worked on, while completed sections are reseeded, vegetated, and preserved through restricted access. This strategy embodies the company's dedication to balancing redevelopment with environmental care.

The city has outlined a specific process for this initiative, requiring a city-approved grading permit. As part of this framework, Grey Cliffs LLC is seeking a State Air Quality Permit to facilitate certain sand and gravel pit operations necessary for the site's reclamation and development.

Process Description The reclamation and residential development of the former gravel pit site involves substantial re-sloping of existing hillside contours to ensure structural stability. These adjustments adhere to specific maximum slope requirements and incorporate carefully designed erosion control measures. Given the steepness of the slopes, the project follows a "one-pass" grading strategy, as additional grading of completed sections would be highly challenging.

Revegetation will be carried out in phases, with each area being completed before moving to the next. The process begins with creating access roads and flat work areas for future development, followed by systematic re-grading from the top down. The regraded slopes are designed with consistent benches that include drainage channels for effective water flow management. This phased approach continues until all disturbed areas are addressed.

The site contains a substantial amount of naturally occurring rock, including exposed solid rock faces. Due to city restrictions on blasting, rock removal relies on alternative methods, such as jackhammers, grinders, and heavy machinery designed to rip and extract large boulders. While not all areas consist of solid rock, a significant portion reflects the "Grey Cliff" element of the project's identity. Using the city required methodology requires significantly increased time in the rocky areas. The disturbed status on portions of rock face will be longer because of the methods required.

Material removed from the mountainside is processed on-site using crushers and screens to produce gravel, road base, and structural fill. A large portion of the processed material is repurposed to fill onsite cuts as part of the reclamation and development process, with any surplus material being sold and transported off-site.

Fugitive Dust Impacts

1. Emission Sources Gravel pit operations, particularly those involving crushers, screens, haul roads, loaders, and bulldozers, generate emissions from various sources. The primary concern is fugitive dust containing PM10 and PM2.5, which can impact air quality. Notably, our site has access to city power, allowing most aggregate processing equipment to operate via line power rather than generators, reducing exhaust emissions. The main potential sources of emissions are as follows:

1. Crushers and Screens

- o **Particulate Matter (PM):** Dust produced during the crushing and screening of materials.
- o **Fugitive Dust:** Emissions released when materials are transferred between equipment or stockpiled.

2. Haul Roads

- o **Dust Emissions:** Dust generated by vehicle movement on unpaved or poorly maintained roads.
- o **Exhaust Emissions:** Emissions from diesel-powered vehicles, including nitrogen oxides (NOx), carbon monoxide (CO), and particulate matter.

3. Loaders and Bulldozers

- o **Fugitive Dust:** Dust generated during material handling, such as loading and moving gravel.

4. Stockpiles

- o **Windblown Dust:** Dust emitted from exposed material stockpiles, particularly during windy conditions.

5. General Site Operations

- o **Dust due to Erosion:** Dust generated by disturbed soil and exposed areas.

Based on the worksheet provided by the Utah Division of Air Quality and the scaled drawing from Berg Engineering, the estimated potential fugitive dust emissions are as follows:

Worksheet Summary PM 10, Annual totals			
Source	PM10	PM 2.5	
Aggregate Processing	2.92	0.53	
Disturbed Area	9.88	1.48	
Dozer Operations	2.97	1.69	
Haul Roads	3.42	0.34	
Loader Routes	0.94	0.09	
Storage Areas	1.83	0.95	
Material Handling	0.27	0.04	
Sub- Totals	22.23	5.12	
Total	27.35		

Source	PM10 (tons/year)	PM2.5 (tons/year)
Aggregate Processing	1.39	0.27
Disturbed Area	9.88	1.48
Dozer Operations	2.97	1.60
Haul Roads	3.42	0.34
Loader Routes	0.94	0.09
Storage Areas	1.83	0.95
Engine: Crusher	0.01	0.53

Totals

PM	22.24	5.65
----	-------	------

Total Particulate 27.89

See attached Worksheets provided by Utah Division of Air Quality

Best Available Control Plan

2. Best Available Control Technology:

The following represents BACT plan specific to the operations at Grey Cliffs' gravel pit. It focuses on minimizing fugitive dust and emissions using a combination of strategies. Key points include:

1. **Dust Suppression Techniques:** The most available resource to control fugitive dust is water. Water is applied in a variety of different methods to prevent the migration of dust particles.
 1. Water sprays are used at dust release points to capture and contain dust at the points of transfer. These transfer points include conveyor belt transfer points as well as loading and dispersion points of screens and some of the crushing equipment.

2. Water trucks are used to apply water to all access and haul roads. In addition to the roads water trucks maintain moisture content on stockpiles and areas surrounding stockpiles.
3. Independent misting machines are used in specified areas on especially dry or windy conditions.
2. **Infrastructure Investment:** Grey Cliffs employs two large water trucks and a 15,000-gallon storage tank to ensure sufficient water supply for dust control. In 2024 alone, 13,432,999.99 gallons of water were used for this purpose, sourced from Santaquin City.
3. **Preventative Measures:** Efforts like hydroseed mulch for revegetation and applying road base to haul roads are designed to reduce dust generation.
4. **Seasonal Adjustments:** During the growing season, more stringent measures are enforced, including shutting down areas inaccessible to water trucks. Wind speed is also monitored to adjust during high winds. The overall site of the development is significantly larger than the mining site. Restricted travel in the buffer area between mine operations and property lines is attempted but not complete. Historical access must be maintained, there are potential dust generating dirt roads that have historically provided access to higher elevation properties that must be allowed for public access. This portion of the fugitive dust near agricultural areas is problematic.

Our plan highlights a strong commitment to environmental standards and compliance with EPA and Utah Division of Air Quality regulations. It balances operational needs with environmental stewardship effectively.

Specific BACT techniques to various aspects of Grey Cliff operations:

1. **Storage Pile Control**
 - o **Moisture Control:** Regularly spray water to maintain a minimum moisture content of 4% for sand and 1% for gravel.
2. **Crushing and Screening Operation Control**
 - o **Water Sprays:** Install water spray systems at all crushing and screening points to suppress dust.
 - o **Conveyor Belt Transfer Points:** Implement water sprays at selected transfer points on conveyor belts as necessary to further minimize dust emissions.
 - o **Misting Equipment.** Moveable and placed as required for changing conditions
3. **Loading and Hauling Control**
 - o **Minimize Drop Heights:** Reduce the height from which materials are dropped during loading and unloading to limit dust dispersion.

- o **Watering Roads:** Regularly water haul roads to suppress dust generated by vehicle movement.
 - o **Road Base Maintenance:** Cover all roads with a layer of road base and maintain them in a well-graded condition to reduce dust and wear.
 - o **Reduce Travel Routes and Speed:** Posting 5 mph speed limits and maintain constant reminders of controlled travel speed. Care is taken to design the most efficient travel routes to reduce the length of travel. Temporary road closures to areas not requiring travel will also be implemented.
4. **Disturbed Areas Control**
- o **Vegetative Cover:** Establish vegetation on long-term inactive areas to stabilize soil and prevent erosion.
 - o **Soil Stabilizers:** Apply soil stabilizers or tackifiers to disturbed areas to protect against wind erosion.
 - o **Erosion Control Measures:** Utilize silt fences, straw wattles, or other erosion control devices to minimize water erosion.
5. **Monitoring and Maintenance**
- o **Dust Monitoring:** Implement a dust monitoring program to measure PM10 and PM2.5 levels, ensuring compliance with air quality standards.
 - o **Equipment Maintenance:** Perform regular inspections and maintenance of dust control equipment to ensure it operates efficiently.
 - o **Employee Training:** Train employees on dust control techniques and emphasize the importance of compliance with the BACT plan.
 - o **Wind Speed and Weather:** Work schedules and activities will be determined upon wind speed.

Economic Considerations.

Due to the progression of the development of our project, our work locations are generally temporary in nature. All our dust emission measures need to be temporary and moveable. Any semi-permanent road capping or water applicators would prove to be extremely temporary in nature and cause an undue burden on both installation and removal. As portions of roadways are completed in many cases they can be closed to mine traffic and removed from the mine site. The portion of the work that can be permanently treated, such as the revegetation of slopes and hillsides, is completed as soon as seasonal temperatures and climate allows.

Supporting Documentation

6. List of Aggregate Processing Equipment

List of aggregate processing equipment used in the material handling process. As detailed on page C3.3 of supporting plan documentation

1-KPI/JCI 3055 Jaw Crusher (Electric powered by line power)

Peak to Peak Closed Side Setting - Approximate Capacity						
Crusher Setting in. mm	3"	3 1/2"	4"	5"	6"	7"
	76	89	102	127	152	178
* Tons per Hour mt/h	265	300	334	402	471	528
	240	272	302	365	428	479

* Based on material weighing 2700 lb per cubic yard
 Capacity may vary depending on material characteristics

2-Superior P 400 Cone Crusher (Electric powered by line power)

The Superior P400 Patriot cone crusher has a capacity of 200-640 tons per hour (tph), a 400 hp engine, and a setting range of 5/16" to 2".



Here's a more detailed breakdown of the Superior P400 Patriot cone crusher specifications:

3-Astec KPI 8203 Screening Plant (Electric powered by line power)

SCREEN SIZE	1200 RPM (HP)	BASKET WEIGHT LBS/ (KG)	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"I"
5142-24LP	25	11,500 (5,215)	61-1/2" (1,562)	74" (1,880)	34-1/4" (870)	168" (4,267)	55" (1,397)	4-7/8" (124)	N/A	29-7/8" (759)	42-1/8" (1,070)
5143-32LP	25	14,000 (6,350)	61-1/2" (1,562)	74" (1,880)	34-1/4" (870)	168" (4,267)	73-1/2" (1,867)	5-3/8" (137)	33-3/8" (848)	48-3/8" (1,254)	62" (1,574)
5162-32LP	25	13,809 (6,264)	61-1/2" (1,562)	74" (1,880)	35" (889)	192" (4,877)	58" (1,473)	4-7/8" (124)	N/A	32-7/8" (835)	45-1/8" (1,147)
5163-32LP	30	15,600 (7,076)	61-1/2" (1,562)	74" (1,880)	37" (940)	192" (4,877)	74" (1,880)	4-7/8" (124)	32-7/8" (835)	48-7/8" (1,241)	61-1/8" (1,553)
6162-32LP	30	15,100 (6,849)	76" (1,930)	88-1/2" (2,248)	37" (940)	192" (4,877)	58" (1,473)	4-7/8" (124)	N/A	32-7/8" (835)	45-1/8" (1,147)
6163-32LP	40	18,969 (8,600)	76" (1,930)	88-1/2" (2,248)	38" (966)	192" (4,877)	74" (1,880)	4-7/8" (124)	32-7/8" (835)	48-7/8" (1,241)	61-1/8" (1,553)
6202-32LP	40	19,900 (9,026)	76" (1,930)	88-1/2" (2,248)	38" (965)	240" (6,096)	58" (1,473)	4-7/8" (124)	N/A	32-7/8" (835)	45-1/8" (1,147)
6203-32LP	40	22,150 (10,047)	76" (1,930)	88-1/2" (2,248)	38" (965)	240" (6,096)	74" (1,880)	4-7/8" (124)	32-7/8" (835)	48-7/8" (1,241)	61-1/8" (1,553)
7202-38LP	50	21,800 (9,797)	88" (2,235)	100-1/2" (2,553)	41" (1,041)	240" (6,096)	62-3/8" (1,584)	5-5/16" (135)	N/A	37" (940)	49-5/8" (1,260)
7203-38LP	50	25,700 (11,657)	88" (2,235)	100-1/2" (2,553)	41" (1,041)	240" (6,096)	80-3/8" (2,042)	5-5/16" (135)	37" (940)	55" (1,397)	67-5/8" (1,718)
8202-38LP	50	25,400 (11,500)	100" (2,540)	112-1/2" (2,858)	41" (1,041)	240" (6,096)	62-3/8" (1,584)	5-5/16" (135)	N/A	37" (940)	49-5/8" (1,260)
8203-38LP	50	31,900 (14,470)	100" (2,540)	112-1/2" (2,858)	41" (1,041)	240" (6,096)	80-3/8" (2,042)	5-5/16" (135)	37" (940)	55" (1,397)	67-5/8" (1,718)

4- North Pit Astec Mobile Jaw Crusher (3055 see previous 3055) (Diesel Power)

2024 FT2650 specs; CAT C9.3 300hp Tier 4

Peak to Peak Closed Side Setting - Approximate Capacity						
Crusher Setting in.	3"	3 1/2"	4"	5"	6"	7"
mm	76	89	102	127	152	178
* Tons per Hour	265	300	334	402	471	528
mt/h	240	272	302	365	428	479

* Based on material weighing 2700 lb per cubic yard
 Capacity may vary depending on material characteristics

1-Excel Worksheets

1-Aggregate Processing

2-Disturbed Area

3-Dozer

4-Haul Roads

5-Loader Routes

6-Storage Piles

7-Material Handling

8-Diesel Fired Engine- Multi-quip Generator

9-Diesel Fired Engine-Astec FT2650 Mobile Jaw Crusher

10-Diesel Fired Engine-McCluskey R105 Portable Screening Plant

Plan Set Sheets

1-3.0

2-3.1

3-3.2

4-3.3

5-3.4

6-3.5

7-3.6

8-3.7

Aggregate Processing Equipment

Production Rates		
Hourly Rates	528	tons/hour
Annual Production	1,250,000	tons/year

Emission Unit	Number of Emission Units	PM ₁₀ Emission Factor (lb/ton)	PM _{2.5} Emission Factor (lb/ton)	Reference
Crushers	3	0.00054	0.00010	AP-42 Table 11.19.2-2
Screens	2	0.00074	0.00005	
Conveyor Transfer Points	34	4.6E-05	1.3E-05	

Pollutant	Emission Rate (lbs/hr)	Emission Total (tons/year)
PM ₁₀	2.46	2.92
PM _{2.5}	0.44	0.53

Emission Unit	PM ₁₀ Emission Rate (lbs/hr)	PM ₁₀ Emission Total (tons/year)	PM _{2.5} Emission Rate (lbs/hr)	PM _{2.5} Emission Total (tons/year)
Crushers	0.86	1.01	0.16	0.19
Screens	0.78	0.93	0.05	0.06
Conveyors	0.83	0.98	0.23	0.28

Disturbed Ground

Wind Erosion of Exposed Area	
Total Area of Disturbed Ground	52 acres

Emission Factors & Distribution	Reference
TSP Emission Factor	0.38
PM ₁₀ Content	50%
PM _{2.5} Content	7.5%

Pollutant	Emission Factor (tons/acre-year)	Emission Rate (lbs/hr)	Emission Total (tons/year)
PM ₁₀	0.19	2.26	9.88
PM _{2.5}	0.03	0.34	1.48

Bulldozing

Bulldozer Hours of Operation		
Hours operated per year	3,850	hours/year

Variables for Bulldozing Overburden		
Material Silt Content	5.9	%
Material Moisture Content	4.0	%

Pollutant	Emission Factor (lb/hr)	Emission Rate (lbs/hr)	Emission Total (tons/year)	Reference
PM ₁₀	1.54332	1.54	2.97	AP-42 11.9 Table 11.9-1
PM _{2.5}	0.83063	0.83	1.60	

Haul Roads

Production Rates	
Hourly Rates	420 tons/hour
Annual Production	750,000 tons/year

Truck Information	
Empty Truck Weight	17 tons
Weight of Load	32 tons
Loaded Truck Weight	49 tons

Haul Road Information	
Haul Road One-Way Length	1,595 feet
Hourly Vehicle Miles Traveled	7.9 miles
Annual Vehicle Miles Traveled	14,160 miles
Type of Control	Road Base with Watering - (75% control)

Pollutant	Uncontrolled Emission Factor (lb/VMT)	Controlled Emission Factor (lb/VMT)	Emission Rate (lbs/hr)	Emission Total (tons/year)	Reference
PM ₁₀	1.93	0.48	3.84	3.42	AP-42 13.2.2 & DAQ Haul Road Guidance
PM _{2.5}	0.193	0.048	0.38	0.34	

Loader Routes

Production Rates					
Hourly Rates	420	tons/hour			
Annual Production	750,000	tons/year			
Loader Information					
Empty Loader Weight	32	tons			
Weight of Load	16	tons			
Loaded Loader Weight	48	tons			
Loader Route\ Information					
Loader Route One-Way Length	200	feet			
Hourly Vehicle Miles Traveled	2.0	miles			
Annual Vehicle Miles Traveled	3,551	miles			
Type of Control	Road Base with Watering - (75% control)				
Pollutant	Uncontrolled Emission Factor (lb/VMT)	Controlled Emission Factor (lb/VMT)	Emission Rate (lbs/hr)	Emission Total (tons/year)	Reference
PM ₁₀	2.11	0.53	1.05	0.94	AP-42 13.2.2 & DAQ
PM _{2.5}	0.211	0.053	0.10	0.09	Haul Road Guidance

Storage Piles

Storage Pile Area	
Total Area of Storage Piles	5 acres

Control Efficiency		Reference
PM ₁₀ Control Efficiency	66%	AP-42 Appendix B.2
PM _{2.5} Control Efficiency	40%	Tables B.2-2 & B.2-3

Pollutant	Uncontrolled Emission Factor (lb/acre-day)	Controlled Emission Factor (lb/acre-day)	Emission Rate (lbs/hr)	Emission Total (tons/year)	Reference
PM ₁₀	6.30	2.14	0.42	1.83	AP-42 Fourth Edition Table 8.19.1-1
PM _{2.5}	1.85	1.11	0.22	0.95	AP-42 Appendix B.2 Table B.2-2

Material Handling

Production Rates

Hourly Rates	420	tons/hour
Annual Production	750,000	tons/year

Variables

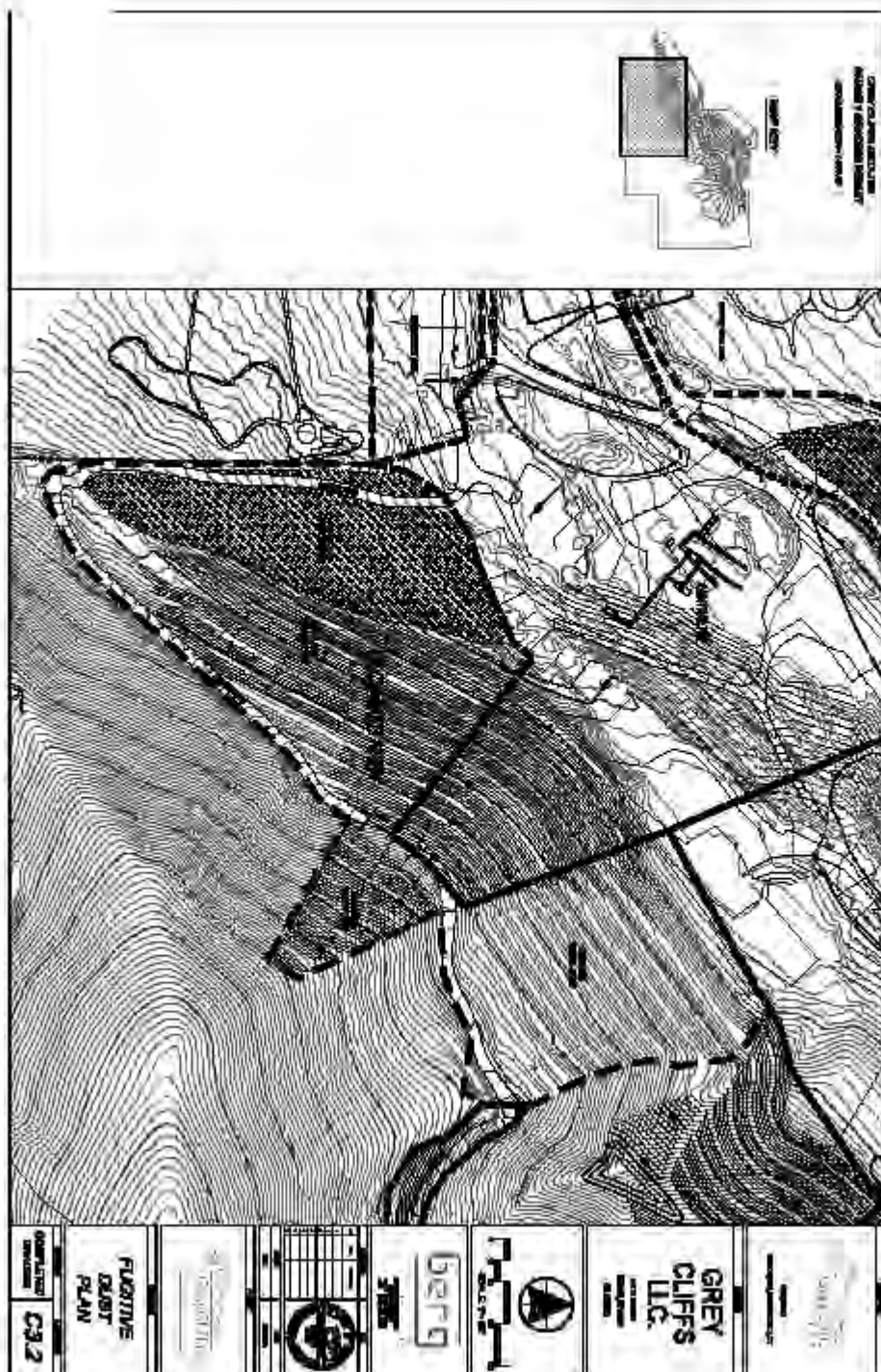
Number of Transfer Points	1	
Mean Wind Speed	8	mph
Moisture Content	4	%

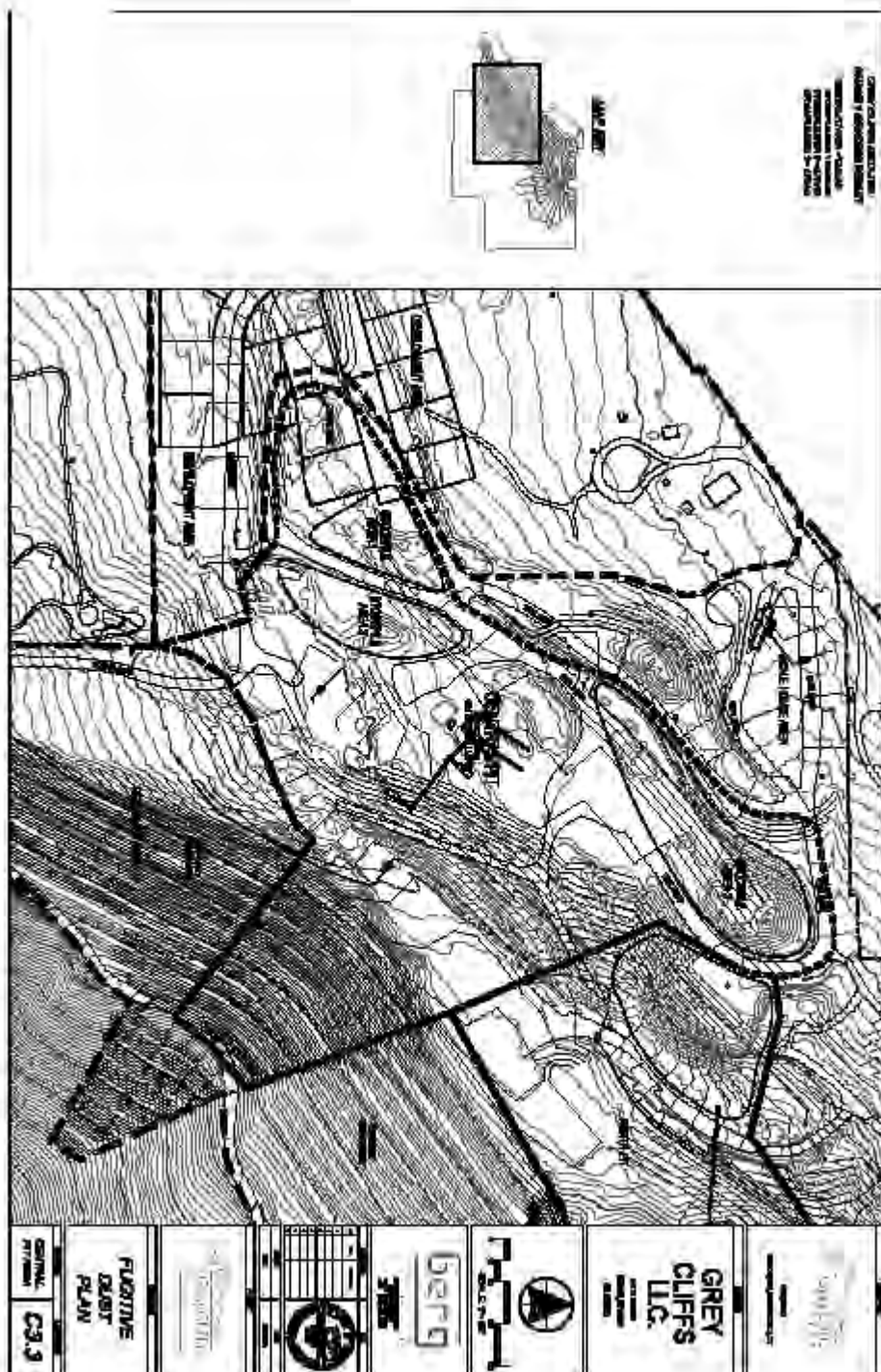
Pollutant	Emission Factor (lb/ton)	Emission Rate (lbs/hr)	Emission Total (tons/year)	Reference
PM ₁₀	0.00072	0.30	0.27	AP-42 13.2.4.3 Equation #1
PM _{2.5}	0.00011	0.05	0.04	

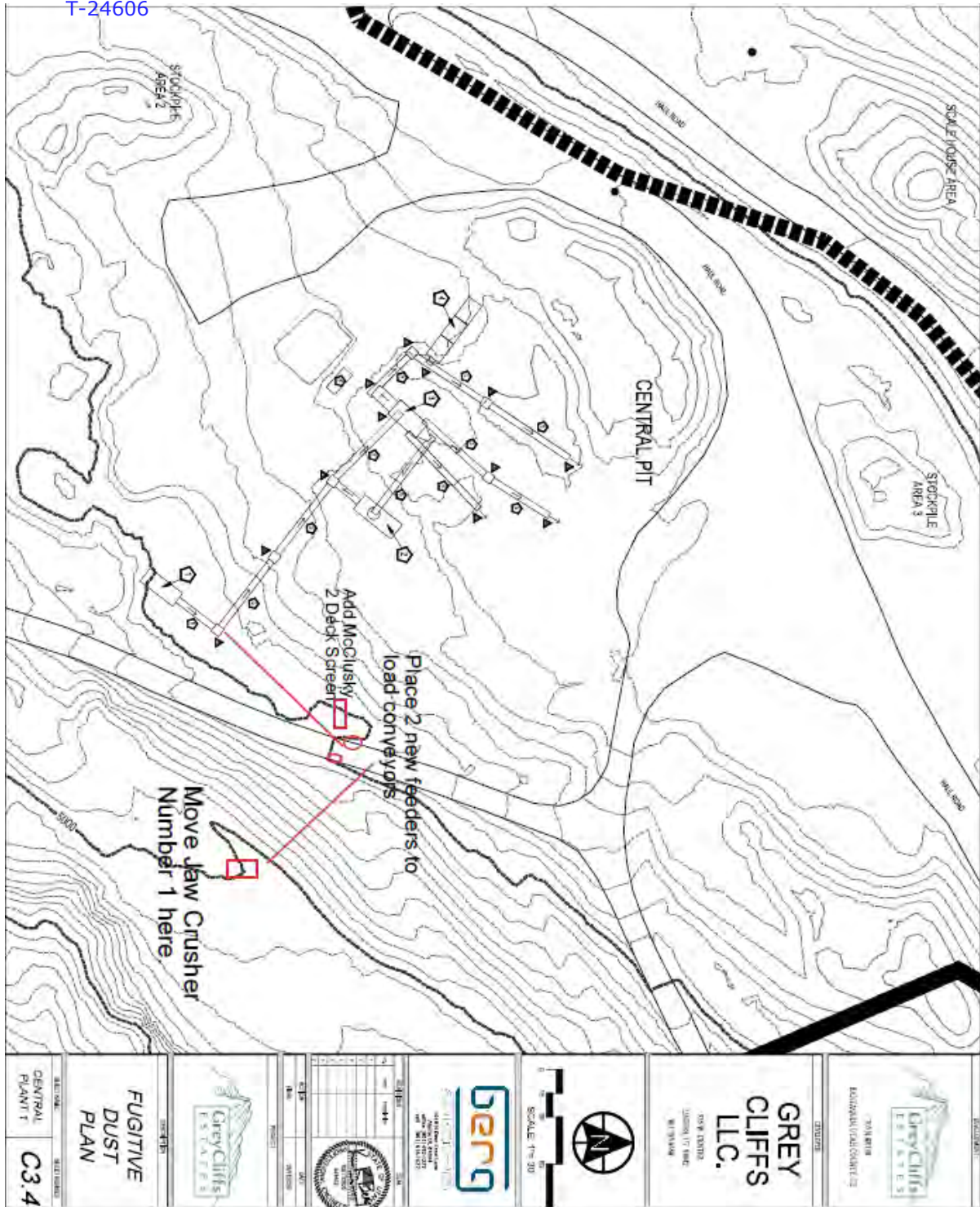
Diesel-Fired Engines

Equipment Details					
Rating	300	hp = (223.9 kw)	Emergency Engines should equal 100 hours of operation per year		
Operational Hours	1,600	hours/year			
Sulfur Content	15	ppm or 0.0015%			
Criteria Pollutant	Emission Standards (g/hp-hr)	Emission Factor (lb/hp-hr)	Emission Rate (lbs/hr)	Emission Total (tons/year)	Reference
NO _x	0.3		0.20	0.16	Manufacturer Data, AP-42 Table 3.3-1, & Table 3.4-1
CO	0		0.00	0.00	
PM ₁₀	0.01		0.01	0.01	
PM _{2.5}		2.20E-03	0.66	0.53	
VOC		2.51E-03	0.75	0.60	AP-42 Table 3.4-1
SO ₂		1.21E-05	0.00	0.00	
HAP			0.01	0.01	See Below
Green House Gas Pollutant	Global Warming Potential	Emission Factor (lb/hp-hr)	Emission Rate (lbs/hr)	Emission Total (tons/year)	Reference
CO ₂ (mass basis)	1	1.15	345	276	AP-42 Table 3.3-1 & Table 3.4-1
Methane (mass basis)	25		0	0	
CO ₂ e				276	
Hazardous Air Pollutant	Emission Factor (lb/MMBtu)		Emission Rate (lbs/hr)	Emission Total (tons/year)	Reference
Benzene		9.33E-04	1.96E-03	1.57E-03	AP-42 Table 3.3-2, Table 3.4-3, & Table 3.4-4 (1,3-Butadiene will not populate if the engine size is ...)
Toluene		4.09E-04	8.59E-04	6.87E-04	
Xylenes		2.85E-04	5.99E-04	4.79E-04	
1,3-Butadiene		3.91E-05	8.21E-05	6.57E-05	
Formaldehyde		1.18E-03	2.48E-03	1.98E-03	
Acetaldehyde		7.67E-04	1.61E-03	1.29E-03	
Acrolein		9.25E-05	1.94E-04	1.55E-04	
Naphthalene		8.48E-05	1.78E-04	1.42E-04	
Acenaphthylene		5.06E-06	1.06E-05	8.50E-06	
Acenaphthene		1.42E-06	2.98E-06	2.39E-06	
Fluorene		2.92E-05	6.13E-05	4.91E-05	
Phenanthrene		2.94E-05	6.17E-05	4.94E-05	
Anthracene		1.87E-06	3.93E-06	3.14E-06	

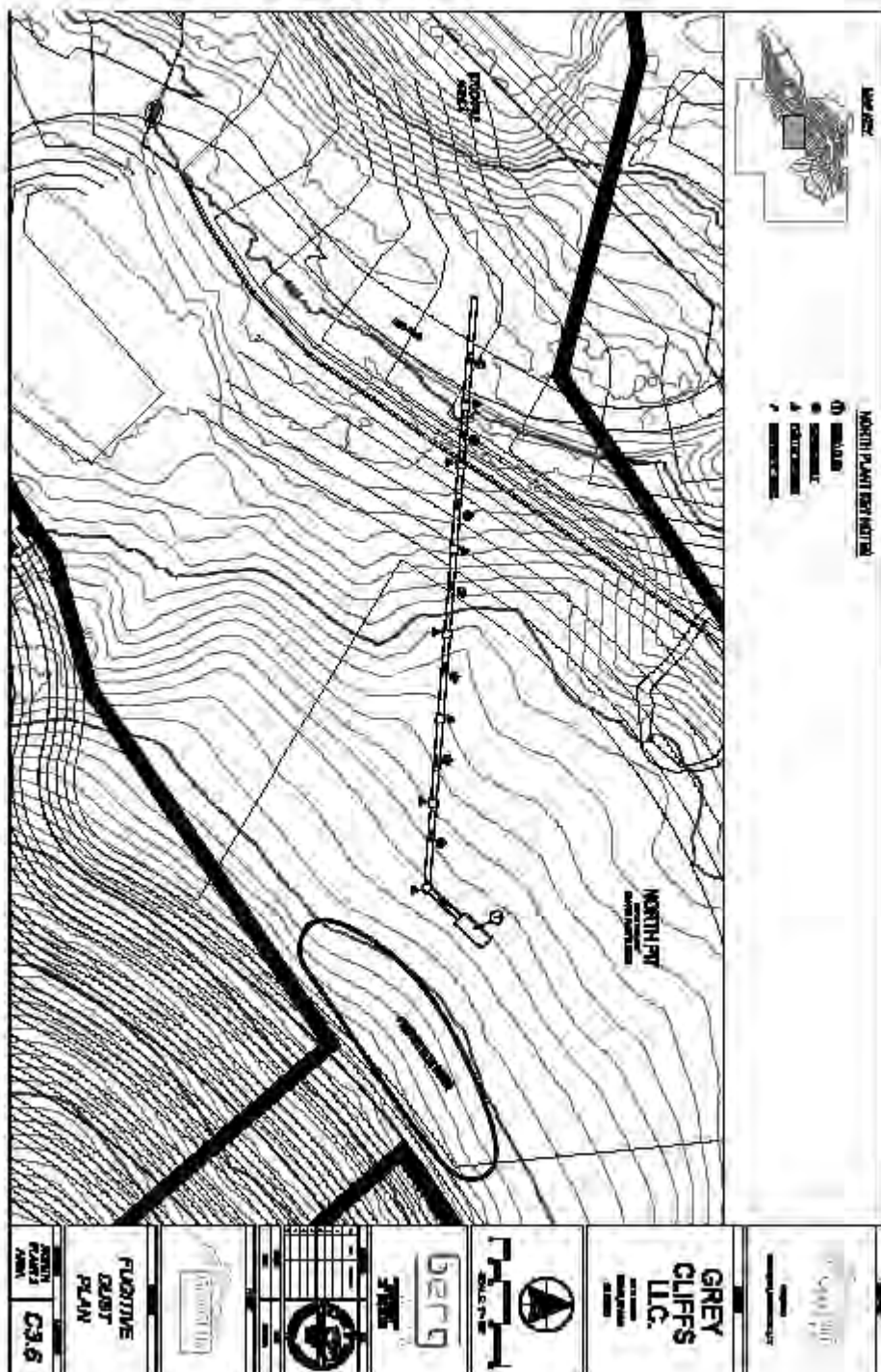


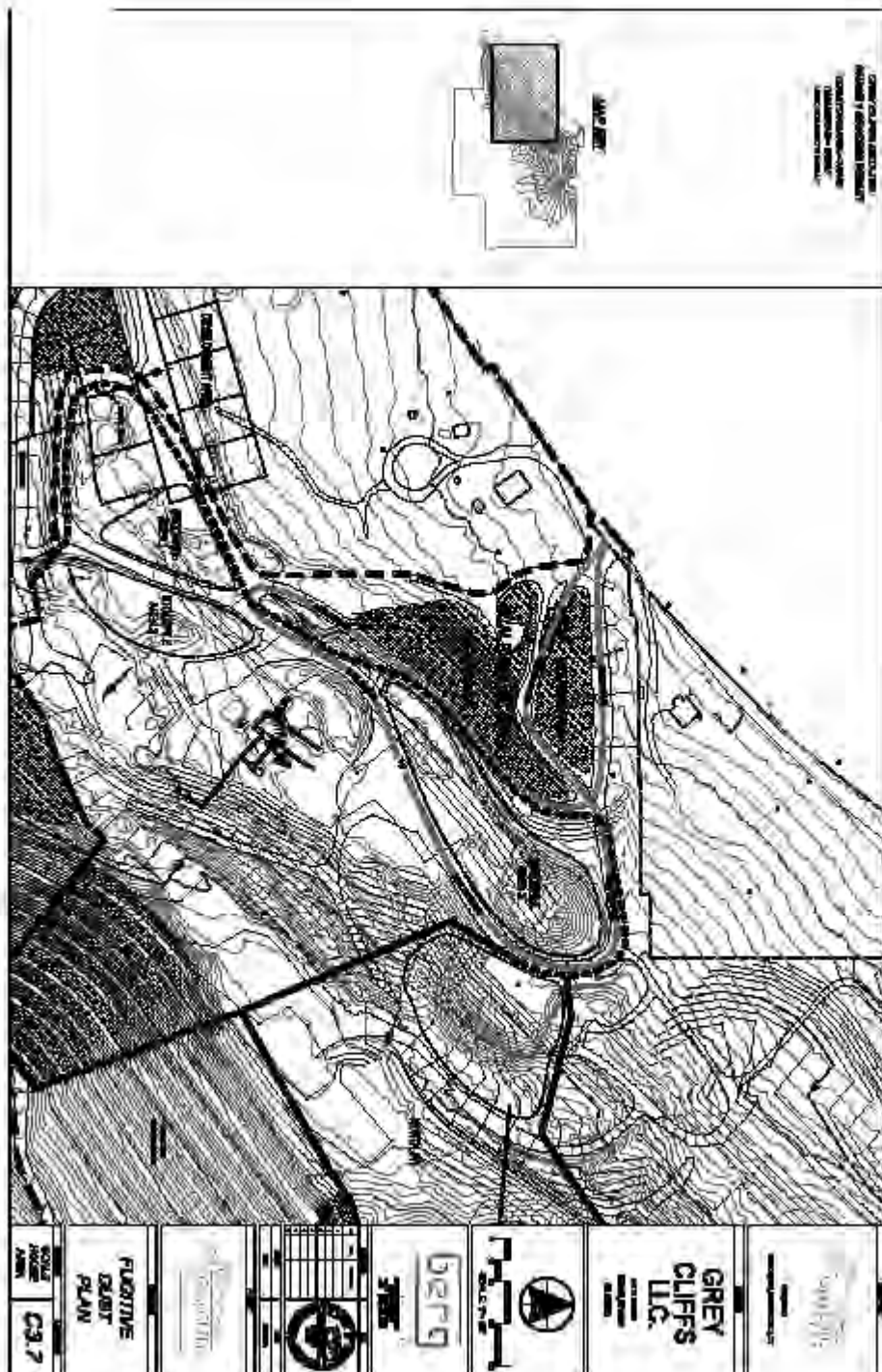












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Appendix F

Geotechnical study



Engineering
Geology
Environmental (ESA I & II)
Organic Chemistry
Materials Testing
Special Inspections

GEOLOGIC HAZARDS INVESTIGATION

Santaquin Heights

Approximately 650 North S.R. 198
Santaquin, Utah

Prepared For:
South Valley Holdings, LLC
935 West Center Street
Lindon, Utah 84042

CMT Project No. 12330
August 29, 2019

August 29, 2019

South Valley Holdings, LLC
Attn: Mr. Stephen Larsen
935 West Center Street
Lindon, UT 84042

Subject: Geologic Hazards Investigation
Santaquin Heights
Approximately 650 North State Road 198
Santaquin, Utah
CMT Project Number: 12330

Mr. Larsen,

Submitted herewith is the report of our geologic hazards investigation for the subject site. This report contains the results of our findings and our geologic interpretations with respect to the available project characteristics. It also contains recommendations for mitigation of potential geologic hazards at the site, as warranted.

Between February and May, 2019, CMT Engineering Laboratories (CMT) geologists were on-site and supervised the excavation of eight (8) exploration trenches and 17 test pits to support our investigation of potential geologic hazards that could impact proposed development at the site. A side wall of each exploration trench was cleaned and logged at a scale of 1 inch equals 5 feet by an experienced and State-of-Utah licensed geologist. Representative logs of the trench walls were produced and are included at the end of this report.

Our investigation confirmed that a zone of faulting associated with past earthquakes on the Nephi Segment of the Wasatch Fault Zone crosses the area of proposed development at the site from southwest to northeast. Buildings designed for human occupancy cannot be constructed across or immediately adjacent to active faults per current Utah County ordinance and existing building codes. This report provides appropriate building setback recommendations from the mapped faults at the site. Other potential geologic hazards at the location include debris flows and alluvial fan flooding, rock fall, and potential slope instability related to existing and planned steep slopes.

We appreciate the opportunity to work with you at this stage of the project. CMT offers a full range of Geotechnical Engineering, Geological, Material Testing, Special Inspection services, and Phase I and II Environmental Site Assessments. With offices throughout Northern Utah, Idaho and Arizona, our staff is capable of efficiently serving your project needs. If we can be of further assistance or if you have any questions regarding this project, please do not hesitate to contact us at (801) 492-4132.

Sincerely,

CMT Engineering Laboratories



Mark C. Larsen, P.G.
Engineering Geologist

Reviewed By:

A handwritten signature in blue ink, appearing to read "William G. Turner".

William G. Turner, P.E.
Senior Geotechnical Engineer

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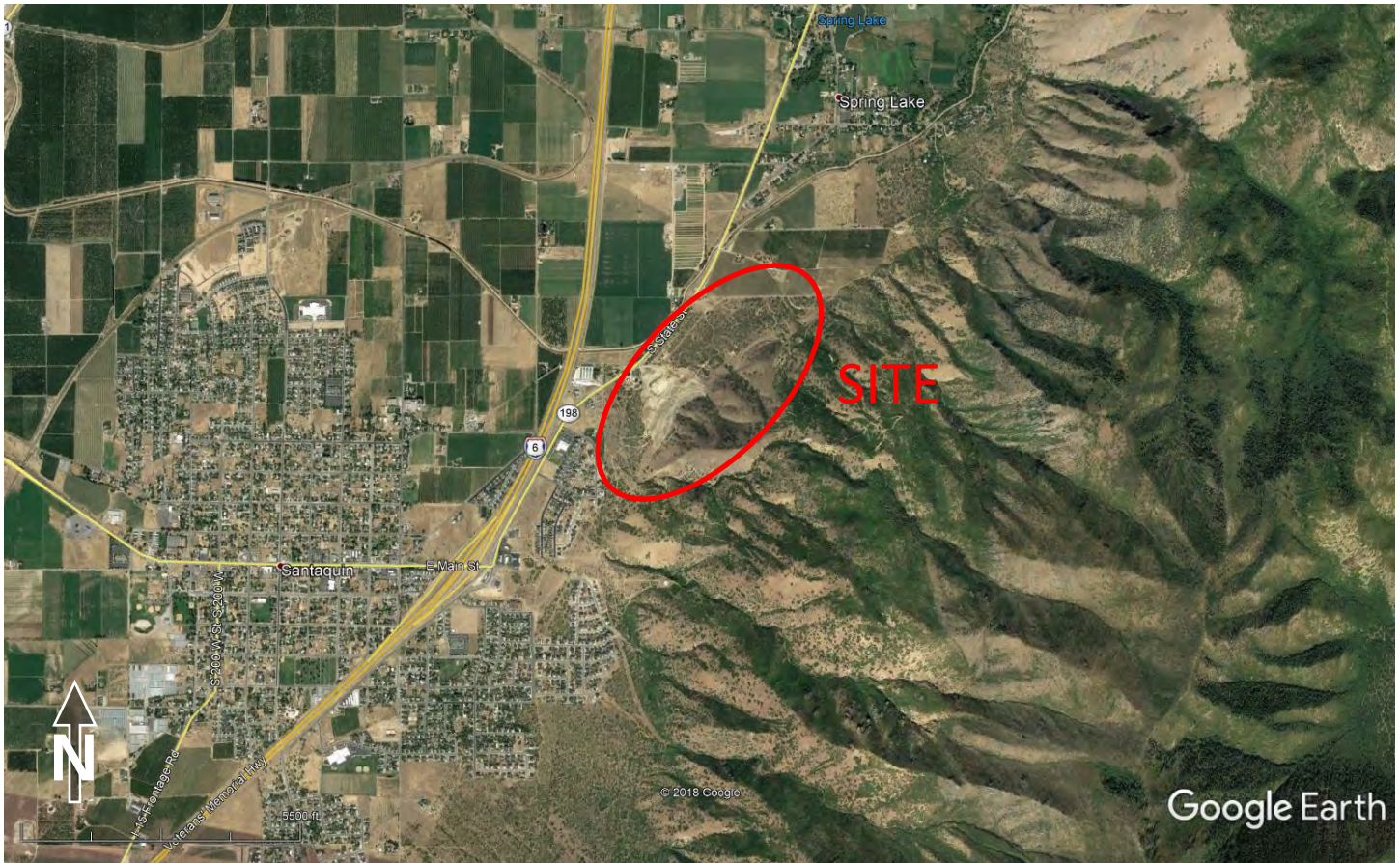
APPENDIX

Figure 1: Site Plan
Figure 2: Locations of Explorations
Figure 3: Geologic Map
Figure 4: DEM Image
Figures 5 - 12: Trench Logs
Figure 13: Trench Log Legend
Figure 14: Fault and Setback Map
Figure 15: Debris Flow Hazard Map

1.0 INTRODUCTION

1.1 General

This report presents the results of a geologic hazards investigation for the subject site located in Santaquin, Utah County, Utah. The site is located at approximately 650 North S.R. 198 in Santaquin. The location of the subject site with respect to existing roadways is shown on the **Vicinity Map** below.



VICINITY MAP

1.2 Objectives, Scope and Authorization

The objectives and scope of our study were originally planned in discussions between Mr. Steve Larsen with South Valley Holdings, LLC and Mr. Mark Larsen of CMT Engineering Laboratories (CMT). In general, the objectives of this study were to identify, quantify as much as possible, and map potential geologic hazards that could impact proposed development at the subject site. Based on the findings of this investigation, appropriate hazard mitigation recommendations are provided as warranted.

In accomplishing these objectives, our scope of work has included performing field exploration, which consisted of conducting a surficial geologic reconnaissance of the site, the excavation and logging of eight (8) exploration trenches and seventeen (17) test pits at the site, and conducting an office program which consisted of researching and analyzing previous reports of similar studies in the vicinity, geologic and topographic maps, aerial photography, LiDAR imagery, and preparing this summary report. The original scope of work was authorized via agreements between South Valley Holdings, LLC and CMT dated January 15, 2019 and executed on January 16, 2019.

It is our understanding that the City of Santaquin does not have a geologic or natural hazards ordinance as part of its land use and development management code. As such, our investigation was completed in accordance with Chapter 5, Section 5 *NHO Natural Hazards Overlay Zone*, of the Utah County Land Use Ordinance last amended on January 24, 2018. Guidelines for investigating geologic hazards in Utah as published by the Utah Geological Survey (UGS) (Bowman and Lund, 2016) were also referenced and followed. The specific scope of work completed for this study included the following:

- A field reconnaissance of the subject site and adjacent areas.
- A review of available, published geologic and topographic maps showing the location of the subject site and surrounding areas.
- A review of available aerial photographs and LiDAR imagery including the subject site and surrounding areas.
- A search of previous reports of similar studies in the area, as available.
- A subsurface exploration consisting of excavating and logging eight (8) exploration trenches and seventeen (17) test pits at the site.
- Geologic analysis of maps, photographs, LiDAR imagery, and our site observations.
- The preparation of this report summarizing our findings, conclusions, and recommendations.

1.3 Description of Proposed Construction

We understand that the subject site is proposed for residential development with primarily single family home lots. Portions of the western margin of the site adjacent to Highway 198 may also be developed as commercial properties. The development will include surface streets, utilities, and open space. A site development concept plan prepared by Berg Civil Engineering was provided and is included as **Figure 1, Site Plan**, in the Appendix of this report.

1.4 Executive Summary

The most significant geological hazards aspects regarding site development include the following:

1. The subject site is located within a surface fault rupture special study area related to the active northern strand of the Nephi Segment Wasatch Fault Zone. Published geologic maps generally show a single trace of the fault crossing the proposed area of development at the site in a southwest to northeast

orientation. Portions of the fault at the site are mapped to be concealed by younger alluvial fan deposits or surface disturbance related to sand and gravel mining activity.

2. The fault was encountered in the exploration trenches at the site at multiple locations. The fault strand was manifest within the subsurface generally as a zone of faulting several feet to several tens of feet wide with one or more primary faults and, in areas, several adjacent subsidiary faults within the zone. The overall sense of displacement across the fault zone was observed to be in a normal fashion and down to the northwest, as mapped by Solomon (2010, 2010). On the northeast portion of the subject site, the fault strand appears to branch into two distinct traces which extend off-site to the northeast. Up to approximately 9 feet of net vertical displacement across the entire zone of faulting was observed at the site and previously by the Utah Geological survey in a previous study just south of the site.
3. Buildings designed for human occupancy cannot be constructed across or immediately adjacent to active faults per current Utah County Ordinance and existing building codes. This report provides appropriate building setback recommendations from the identified faulting at the site.
4. Existing or planned steeper slopes at the site are subject to potential instability. This poses a risk to development on the slopes or at the crests or toes of the slopes.
5. Several bedrock outcrops and areas of loose boulders on the steeper slopes immediately southeast and up-slope from the proposed areas of development at the site pose a rock fall risk to development at the base of the slopes. Pieces of the outcrops and loose boulders on the surface can dislodge through natural weathering processes or from ground shaking during an earthquake event and roll or bounce down the slope and impact development at and beyond the base of the slope in the run-out zone.
6. Five unnamed drainages in the higher terrain to the southeast of the proposed development have the potential for debris flow initiation and flooding that could impact development on the fans and in the drainage channels at the mouths of the drainages.

2.0 FIELD EXPLORATION

The northern strand of the active Nephi Segment of the Wasatch Fault Zone (WFZ) has been mapped crossing the subject site through areas where future development is proposed (see Section 4.0). For residential development the UGS typically defines a surface fault rupture special study area to be all areas within 500 feet of a mapped, Holocene fault on the down-thrown side of the fault and all areas within 250 feet on the up-thrown side of the fault. To observe the subsurface deposits within these areas at the site in relation to previously mapped Holocene faulting for evidence of surface fault rupture and/or related ground deformation, eight (8) exploration trenches were excavated at the site between February and May 2019. Weather conditions and excavation equipment availability largely controlled the timing of the field exploration work. The trenches were designated as ET-1 through ET-8. The locations of the trenches, as surveyed by the client, are shown on **Figure 2, Locations of Explorations**, at the end of this report.

A side wall of each trench was cleaned and logged at a scale of 1 inch equals 5 feet by an experienced and licensed geologist who meets the qualifications of the previously referenced Utah County Land Use Ordinance. The trenches were cleaned and logged using standard tools and techniques. Representative logs of the trench walls were produced and are included at the end of this report as **Figures 5 through 12, Trench Logs**. The various symbols and representations used on the logs are defined on **Figure 13, Trench Log Legend**.

Seventeen (17) test pits were also excavated on portions of the subject site to aid in our analysis of potential debris flow and alluvial flood hazards at the site. The approximate locations of the test pits are also shown on **Figure 2**. The findings of the test pits with regards to potential debris flow hazards at the site are discussed in Section 4.7.

The trenches and test pits were excavated using a track-mounted backhoe and were backfilled upon completion of the field work. To our knowledge, when backfilling the trenches and test pits, only minimal effort was made to compact the backfill and no compaction testing was performed. Thus, settlement of the backfill in the trenches and pits over time should be anticipated.

3.0 LABORATORY TESTING

No soil samples were collected for laboratory testing from the site as part of the scope of this investigation. A geotechnical engineering investigation to determine the engineering properties of the site soils will likely be required prior to any new development and would include soil sampling and laboratory testing. CMT can provide this work upon request.

4.0 GEOLOGIC & TECTONIC SETTING

4.1 Surface Conditions

The subject site is located in variable terrain on the west side of the southern Wasatch Range. The northwestern margin of the site near State Road 198 generally has the most gentle slopes with the terrain steepening to the southeast as the site extends upward into the steeper mountain slopes and drainages on the west side of Dry Mountain. Most of the site proposed for development is located on gentle to moderately sloping terrain at the base of the steeper mountain front. Drainage swells and ravines extending from the steeper drainages to the southeast have been cut into the surface in several areas where development is proposed. Much of the southwest portion of the site at the base of the steeper slopes has been altered by sand and gravel mining activity and several steepened cut and fill slopes are present. The topography of the site is shown on **Figure 2**. Vegetation consists of grass, weeds, sage brush, and stands of gamble oak. A house and several out buildings are located on the southwest portion of the site adjacent to SR 198. The site is crisscrossed by several unpaved roads and trails. There are several locations in the steeper terrain of the southeast portion of the site where past mining activity (prospects) have left cuts and fills on the slopes. No surface water was observed throughout the site during the course of our investigation.

The subject site is bordered on the north by fruit tree orchards, on the east and south by steep, undeveloped mountainous terrain, on the southwest by residential subdivisions, a city park, open fields, and a parcel with a house and several out buildings. An undeveloped triangular-shaped parcel and State Road 198 border the site on the northwest.

4.2 Subsurface Soils

As discussed in Section 2.0 and shown on Figure 2, eight (8) exploration trenches designated as Trenches ET-1 through ET-8 and 17 test pits were excavated at the subject site between February 2019 and May 2019. In general, the subsurface soils encountered in the explorations were consistent with the geologic mapping of the site (Section 4.4) and consisted of lacustrine deposits related to the Bonneville lake cycle overlain in portions of the site by alluvial fan deposits. Generally, the lacustrine deposits consisted of thin to thick-bedded sands, silts and minor clays with varying amounts of gravel and interbedded gravel layers/lenses comprised of rounded to subrounded pebble to small boulder-sized gravels. The alluvial fan deposits at the site generally consisted of gravelly silts and clays to clayey or silty gravels with varying amounts of sand. Rock clasts in the alluvial fan deposits were generally angular to subangular and ranged in size from pebbles to small boulders. The alluvial fan deposits also varied from matrix to clast supported. Bedding, where observed within the alluvial fan deposits, was generally formed by individual depositional events (typically debris flows) with no distinct bedding observed within individual flow event deposits.

More detailed descriptions of the subsurface soils encountered at the site are provided on the logs of the exploration trenches included in the Appendix as **Figures 5 through 12, Trench Logs**. **Figure 13** is the legend for the trench logs.

4.3 General Geology

The subject site is located in the southern portion of the Utah Valley at the base of Dry Mountain in the Wasatch Mountain Range. The Wasatch Range forms the eastern boundary of the Basin and Range physiographic province. The north trending Wasatch Fault Zone (WFZ) generally lies at the base of the Wasatch Range and separates the Basin and Range to the west from the Middle Rocky Mountain and Colorado Plateau physiographic provinces to the east. Regional tectonic extension and resultant displacement within the WFZ during the Tertiary and Quaternary geologic periods has resulted in the uplift of the Wasatch Range and relative down drop of the adjacent valleys to the west, including Utah Valley. The Utah Valley is a deep basin that has been partially filled by a thick sequence of primarily unconsolidated lacustrine and alluvial sediments eroded from the surrounding mountains.

The WFZ is considered to be an “active” fault zone. An active fault zone is defined locally as one that has shown evidence of displacement during Holocene time (past 10,000 years). The WFZ runs in a southerly direction from southern Idaho to central Utah and is comprised of ten separate segments. The subject site is located on the northern strand of the Nephi Segment of the WFZ. The Nephi segment extends approximately 26 miles from Nephi on the south to Benjamin on the north, and is comprised of a 15.5-mile-long southern strand and a 10.6-mile-long northern strand. The two strands are separated by a 3.1 mile right step and connected by a 3.7-mile-long, northeast-striking cross-fault in the area of Santaquin Canyon.

The WFZ typically displays a “normal” sense of movement with the hanging wall blocks (valleys) dropping vertically in relation to the foot wall blocks (mountains). A number of studies have been completed on the WFZ, including studies by Swan and others (1980), Schwartz and Coppersmith (1984), Lund and others (1991), Machette and others (1991, 1992), McCalpin and others (1994), and Black and others (1995). Evidence of

multiple surface rupture events on the five central segments of the WFZ during the late Pleistocene and Holocene has been documented. A technical paper by DuRoss (2008) discussing Holocene vertical displacement on the central segments of the WFZ, and which cites many of these previous studies, cites three documented ground-rupturing earthquake events on the Nephi Segment of the WFZ during the last 6,000 years. These surface rupture events have been estimated to be associated with paleo-earthquakes of surface wave magnitude (Ms) 6.5 to 7.5 (Machette, 1992; McCalpin and Nishenko, 1996).

In addition to the WFZ, the area has also been influenced geologically by Lake Bonneville, an ancient (Pleistocene) fresh water lake which formerly covered the valleys of western Utah. The shoreline of the lake reached a maximum elevation of between approximately 5,160 and 5,200 feet above sea level. Evidence of this shoreline, known as the Bonneville Level, and several others which formed as the lake level fluctuated or dropped, are visible at places along the foothills of the Wasatch Range. A study completed by Benson and others (2011) concludes, based on radiometric dating and paleomagnetic studies, that Lake Bonneville, after attaining its high-stand elevation (Bonneville level), incised its basin and fell to the Provo level at 17.0 ka. The lake then remained at the Provo Level between 17.0 ka and 15.2 ka, after which generally drier climatic conditions resulted in the overall continued drop of the lake to the current level of the Great Salt Lake. Much of the sediment at the surface and subsurface throughout Utah Valley is comprised of lacustrine deposits that settled on the bed of the ancient lake and previous older inter-basin lakes.

4.4 Geologic Mapping

The surficial geology of the USGS “Santaquin” and “Payson Lakes” 7.5 Minute Quadrangles, which include the location of the subject site, have been mapped by Solomon (2010, 2010) at a scale of 1:24,000. Portions of the Solomon (2010) maps which include the area of the subject site are attached as **Figure 3, Geologic Map**.

The referenced 7.5 minute geologic maps show the following unconsolidated surficial geologic units on the lower portions of the subject site where development is planned. The maps do not show the bedrock geology of the steeper hillslopes on the southeastern portions of the site.

Qaf₁ - Level-1 alluvial-fan deposits (upper Holocene) – Poorly to moderately sorted, weakly to non-stratified, pebble to cobble gravel with a matrix of sand, silt, and minor clay; clasts commonly well-rounded, derived from Lake Bonneville gravel; medium to very thick bedded. Deposited by debris flows, debris floods, and streams at the mouths of several mountain canyons and lower gradient streams on valley floors; equivalent to the younger part of young alluvial-fan deposits (Qafy) but differentiated because these small, active, discrete fans are not incised by younger channels and can be mapped separately. Exposed thickness less than 10 feet (3 m).

Qaf₂ - Level-2 alluvial-fan deposits (middle Holocene to upper Pleistocene) – Poorly sorted pebble and cobble gravel, locally bouldery, with a matrix of sand, silt, and minor clay; clasts angular to subrounded, with sparse well-rounded clasts derived from Lake Bonneville gravel; medium to very thick bedded. Deposits are scattered throughout the quadrangle, but the largest deposits are east of Santaquin, emanating from canyons in Dry Mountain and commonly overlapped by younger alluvial-fan deposits (Qaf₁, Qafy); no Lake Bonneville shorelines are found on these alluvial fans; equivalent to the older part of Qafy, but differentiated where

deposits are graded to slightly above modern stream level and can be mapped separately. Exposed thickness less than 15 feet (5 m).

Qafy - Young alluvial-fan deposits, undivided (Holocene to upper Pleistocene) – Poorly to moderately sorted, pebble to cobble gravel with boulders near bedrock sources, with a matrix of sand, silt, and clay, grading to mixtures of sand, silt, and clay on gentler slopes. Deposited by debris flows, debris floods, and streams at the mouths of mountain canyons throughout the quadrangle; young alluvial-fan deposits are mapped more extensively than by Harty and others (1997) west of Wash Canyon and west of Dry Mountain, where shallow channels and vegetation indicate the presence of active fan surfaces; west of Dry Mountain, the debris

Qlsb - Lacustrine sand and silt (upper Pleistocene) – Moderately to well-sorted, subrounded to rounded, fine to coarse sand and silt with minor pebbly gravel. Thick to very thick bedded; commonly has ripple marks and scour features; gastropods locally common. Deposited in relatively shallow water near Santaquin in Utah Valley and north of Mona Reservoir in Juab Valley; much of this unit was mapped as transgressive silt and clay by Harty and others (1997), but soil surveys (Swenson and others, 1972; Trickler and Hall, 1984) indicate a significant component of sand, and silt and clay deposits (Qlmb) are restricted to the areas in 18 that unit's description; overlies coarse-grained beach gravel (Qlgb), implying deposition in increasingly deeper water of a transgressing lake. Exposed thickness less than 15 feet (5 m).

Qlgb - Lacustrine gravel and sand (upper Pleistocene) – Moderately to well-sorted, clast-supported pebble to cobble gravel with a matrix of sand and silt; locally interbedded with thin to thick beds of silt and pebbly sand; clasts commonly subrounded to rounded, but some deposits consist of poorly sorted, angular gravel derived from nearby bedrock outcrops; gastropods locally common in sandy lenses; gravel locally cemented with calcium carbonate (tufa); thin to thick bedded. Most transgressive gravel and sand deposits are veneers over bedrock and older alluvial-fan deposits (Qlgb/R, Qlgb/Qafo), typically forming wave-cut benches close to the Bonneville shoreline that are commonly partly covered by colluvium derived from adjacent oversteepened slopes, although thicker accumulations of transgressive lacustrine gravel and sand are west of Mona Reservoir and in Little Valley; a wave-built bench of transgressive gravel and sand east of Santaquin extends to the southwest into a series of prograding spits constructed at successively higher levels as the lake rose to the Bonneville shoreline, and longshore currents converging from Utah and Juab Valleys near Cedar Hollow built a cusped v-bar of transgressive gravel and sand; bedding ranges from horizontal to primary dips of 10 to 15 degrees on steeper slopes; interbedded with or laterally gradational to lacustrine sand and silt of the transgressive phase (Qlsb). Exposed thickness less than 30 feet (10 m).

Unit Qaf₁ mapped by Solomon (2010, 2010) represents the most recently (upper Holocene) active portions of alluvial fans at the site. These fan deposits were primarily deposited as debris flows emanating from several small drainages in the steeper terrain to the southeast and deposited on the alluvial fans at the mouths of the drainages. These alluvial fans cover portions of the site proposed for development. Potential hazards related to alluvial fan processes, including debris flows and fan flooding, are discussed in greater detail in **Section 4.7**.

Solomon (2010, 2010) mapped the northern stand of the Nephi Segment of the WFZ crossing the subject site as a single trace as shown by the dark, bold line with the bar and ball pattern on Figure 3. The fault is shown to strike in a northeasterly direction with the bar and ball pattern on the down-thrown (northwest) side of the fault. Where the fault crosses the gravel pit area and youngest alluvial fan deposits (Unit Qaf₁) at the site it is

mapped as a dashed line indicating the location is approximate where surface expression of the fault has been removed by human activity and/or alluvial fan processes. Surface fault rupture and related hazards at the site are discussed in greater detail in **Section 4.7**.

4.5 Aerial Photographs and LiDAR Imagery

Low light angle aerial photographs taken in 1970 of the Wasatch Fault Zone in the vicinity of the subject site were obtained from the Utah Geological Survey collection (<https://geodata.geology.utah.gov/imagery/>) and viewed as stereo pairs. The photos show that the sand and gravel mining quarry on the southwestern portion of the site was in operation and the surface on much of that portion of the site was disturbed. To the northeast of the quarry operation the ground was densely vegetated with brush but an intermittent, linear break in slope is visible striking northeasterly across the site. The break in slope is interpreted to be a scarp related to surface fault rupture in the WFZ. The scarp is not readily visible beyond the mouths of several larger drainages where it has been eroded and/or covered by alluvial sediment from the drainages. The trace of the fault crossing the site mapped by Solomon (2010, 2010) appears to correspond with this scarp.

A digital elevation model (DEM) produced from high resolution LiDAR (Light Detection and Ranging) topography data of the subject site and surrounding areas, obtained from the Earthscope Intermountain Seismic Belt LiDAR Project (Raster) database through www.opentopography.org, was also reviewed. The reviewed DEM imagery was produced from airborne LiDAR data collected between July and August 2008 by National Center for Airborne Laser Mapping and has a resolution of 0.5 meters. A copy of the reviewed DEM image is included as **Figure 4, DEM Image**. In the DEM image shown in Figure 4 the darkest shades represent generally northwest-facing slopes while the lightest shades represent generally southeast-facing slopes.

The DEM imagery shown on **Figure 4** shows details of the topography and surface features across the site. Some visible features are labeled on **Figure 4** and include the drainages in the steeper terrain to the east of the proposed development and related ravines and washes crossing the proposed development area, the disturbed portions of the site where past sand and gravel mining activity occurred, slopes on and adjacent to the site, and some of the roads and trails crossing the site. Several mapped mining prospects in the steeper terrain to the southeast are visible on the DEM. Some evidence of surface displacement (scarp) along the northern strand of the Nephi Segment of the WFZ at the site is visible on portions of the site and adjacent areas but is generally subdued or not visible. This is likely due to erosion of the scarp, removal of the scarp by mining activities, or burial of the scarp by alluvial fan deposits.

4.6 Previous Reports

In 2008 the Utah Geological Survey (UGS) completed a paleoseismic investigation (DuRoss and others, 2008) of the northern strand of the Nephi Segment of the WFZ. This investigation was the first of its kind on the northern strand of the Nephi Segment as previous investigations have focused on the southern strand. The referenced investigation included the excavation of two trenches across a prominent, 9- to 13-foot (3 to 4 m) high scarp of the northern strand of the Nephi Segment of the WFZ approximately 500 feet south-southwest of the subject site. The trenches exposed a single trace of the fault showing approximately 9 feet of displacement down to the northwest. The authors only observed evidence of the most recent earthquake event (MRE) on the northern

strand and, based on radiocarbon-dated charcoal fragments collected from the trenches, estimated a preferred time of the MRE to be $500 \pm 100/-150$ calendar years before present. The estimated moment magnitude for this event is 7.0 ± 0.3 .

A UGS technical paper documenting multiple, fire-related debris flow events in the vicinity of the subject site in September 2002 was also reviewed. Over 8,000 acres on the west side of Dry Mountain to the east of the subject site was burned by the Mollie Wildfire in late 2001. On September 12, 2002, intense, localized precipitation triggered debris flows in several drainages on the west side of Dry Mountain in the vicinity of the site. The removal of vegetation and formation of hydrophobic soils by the wildfire contributed to the initiation of the debris flows. Debris flows occurred in five separate drainages designated by the UGS as Tributaries 2 through 6. None of these drainages empty onto the subject site and none of the debris flows impacted the site. The debris flows from drainages 3 and 4 caused property damage in a residential subdivision to the south-southwest of the property. A small park on the northern edge of the subdivision and adjacent to the southwest corner of the subject site has been constructed after the 2002 debris flows in the pathway of the channel of Tributary 3 on the alluvial fan and a catchment basin has been incorporated into the landscaping of the park. All of the drainages where debris flows occurred in the vicinity of the subject site are significantly larger, in both drainage basin area and channel length, than the drainages that empty onto the subject site. None of the drainages that empty onto the site experienced debris flow activity during the 2002 event. However, this does not preclude the smaller drainages that empty onto the subject site from experiencing debris flow events that could impact the proposed development. Potential debris flow hazards at the site are discussed in greater detail in **Section 4.7** below.

4.7 Geologic Hazards

4.7.1 Surface Fault Rupture Hazards

As discussed in **Sections 4.3 and 4.4** and shown on **Figure 3**, the northern stand of the Nephi Segment of the WFZ crosses the portions of the subject site where development is planned in a southwest to northeast direction. The fault was encountered in the exploration trenches at the site at multiple locations. The fault strand was manifest within the subsurface generally as a zone of faulting several feet to several tens of feet wide with one or more primary faults and, in areas, several adjacent subsidiary faults within the zone. Some of the subsidiary faults were observed to be antithetic to the primary fault traces. The overall sense of displacement across the fault zone was observed to be in a normal fashion and down to the northwest, as mapped by Solomon (2010, 2010). On the northeast portion of the subject site, the fault strand appears to branch into two distinct traces which extend off-site to the northeast.

The locations of the zone of faulting observed in the exploration trenches at the site were marked during our field work and later surveyed by the client. Based on these locations, along with information provided in our review of the previous geologic mapping by Solomon (2010, 2010), DEM model (Figure 4) and reviewed aerial photographs, the zone of surface faulting associated with the northern stand of the Nephi Segment of the WFZ crossing the site was mapped. The mapped zone of faulting is shown on **Figure 14, Fault and Setback Map**. The recommended building setbacks in relation to the zone of faulting are also shown on **Figure 1** in relation to the proposed development at the site. The zone of faulting and/or individual traces of the fault are mapped as red lines on **Figure 14**.

The maximum net vertical displacement across the fault zone at the subject site was observed and measured to be in excess of 8 feet (**Figures 5 through 12**). As previously discussed in **Section 4.6**, the UGS (DuRoss and others, 2008) observed up to 9 feet of displacement in their trenches just west-southwest of the subject site. To avoid structural failure in habitable structures and critical infrastructure during a future ground-rupturing earthquake event, the only currently accepted form of mitigation is to avoid placing such structures and infrastructure across or adjacent to identified active fault traces, such as those observed and mapped at the subject site. Current guidelines and our recommendations for appropriate building setbacks from the mapped faulting at the subject site are discussed in Section 5.0.

4.7.2 Landslide and Slope Stability Hazards

No landslide features or deposits, including lateral spread (landslides on surfaces with low topographic relief) deposits, are mapped on the portions of the subject site planned for development by Solomon (2010, 2010) and Elliot and Harty (2010). Review of topographic maps, aerial photographs and LiDAR imagery, and surface observations did not identify features indicative of past landslides, such as hummocky and stair-step terrain, grabens, head-scarps, pressure ridges, displaced landforms, lobate deposits, convex surface morphology, etc. on or adjacent to the portions of the site planned for development. Several manmade slope cuts have been made on the slopes on the eastern margin of the site and beyond as part of apparent mining explorations. These slope cuts are visible on aerial photographs, LiDAR imagery, and in our site observations but do not represent natural slope failures.

Although no landslide or slope instability activity is mapped or observed at the site, existing or planned steeper slopes at the site are subject to potential instability. This poses a risk to development on the slopes or at the crests or toes of the slopes. We recommend that a geotechnical engineer perform slope stability analyses for any natural or planned slopes within or adjacent to proposed areas of development that meet the following criteria:

- Cut and/or fill slopes steeper than about 2 horizontal (h) to 1 vertical (v) (50%).
- Natural slopes steeper than or equal to 3 horizontal (h) to 1 vertical (v) (33%).
- Cut, fill, or natural slopes of any planned water-retention basins or flood-control Channels.

4.7.3 Rock Fall Hazards

Based on our observations, there are several bedrock outcrops and areas of loose boulders on the steeper slopes immediately southeast and up-slope from the proposed areas of development at the site. The locations of the outcrops and loose rock areas at the site are shown on **Figure 4**. Pieces of the outcrops and loose boulders on the surface can dislodge through natural weathering processes or from ground shaking during an earthquake event and roll or bounce down the slope and impact development at and beyond the base of the slope in the run-out zone.

The bedrock outcrops and loose rock areas on the slopes at the site are not extensive in area. The most cost effective method of rock fall mitigation at the site appears to be removal of loose rock from the outcrops and slopes in the source areas shown on Figure 3 prior to development of the site. We recommend that, at a minimum, any rocks equal to or greater than 2 feet in diameter or with at least one side equal to or greater than 2 feet be removed from the slopes above proposed areas of development. Outcrops could also be covered with

anchored wire mesh netting to prevent future rock fragments from dislodging. Other, costlier mitigation methods that could be implemented include rock fall berms, fences, or walls that could be installed on the slope below the rock fall source area or at the base of the slope in the runout zone. CMT can provide design parameters for these types of mitigation methods upon request.

4.7.4 Debris Flow and Alluvial Fan Flooding

As discussed in **Section 4.4**, the 2002 post wildfire debris flow events in the vicinity of the subject site did not impact any areas of proposed development at the site. However, several smaller drainages in the steeper terrain to the southeast of the proposed development empty onto the site and have the potential to direct debris and water onto the proposed development. Much of the surficial geology of the proposed development site and nearby areas to the north and south is comprised of alluvial fan deposits deposited by debris flows and fan flooding in events in the past. Solomon (2010, 2010) mapped the debris flow deposits from the 2002 post wildfire events near the site as Unit Qmd₁ - Modern debris-flow deposits, as shown on **Figure 2**. Alluvial fan deposits mapped at the site as Units Qaf₁ and Qaf₂ are dated by Solomon (2010, 2010) to be Holocene in age and, therefore represent active alluvial fans where debris flows and fan flooding have the potential to impact development.

Five unnamed drainages in the higher terrain to the southeast of the proposed development have the potential for debris flow initiation and flooding that could impact development on the fans and in the drainage channels at the mouths of the drainages. For the purposes of this investigation, the drainages have been designated as Drainages 1 through 5 and are shown on **Figure 15, Debris Flow Hazards Map**. The map also shows the active alluvial fan areas (Units Qaf₁ and Qaf₂, Solomon 2010, 2010) at the site.

The purpose of this analysis is to provide preliminary debris flow soil bulking estimates (probable debris-flow volumes), to assist the project civil engineer with regards to active debris flow and storm water systems mitigation as part of design for the site development. As with the 2002 debris flow events in the vicinity of the site, most of the damaging, historical debris flows along the Wasatch Front region of northern Utah have followed wildfires in the drainage basins where the debris flows initiated. Potential debris flow hazards in these burned basins can remain elevated for several years following the fire as vegetation is reestablished and hydrophobic soil conditions, caused by the heat of the fire baking the soil, diminish. For basins that have been burned, several methods for estimating debris flow volumes following wildfires in the western United States, that include the clear-water contribution to the flow, have been developed based on research. Such precipitation-event volume analysis was previously demonstrated by the Utah Geological Survey (UGS) (Giraud and Castleton, 2009) using regression modelling from Gartner and others (2008). Updated regression modelling by the U.S. Geological Survey (USGS) (Cannon and others, 2010) has since been adopted.

The updated regression modelling equation by Cannon and others (2010) is as follows:

$$\ln(V) = 7.2 + 0.6 \cdot \ln(A) + 0.7 \cdot (B)^{\frac{1}{2}} + 0.2 \cdot (T)^{\frac{1}{2}} + 0.3$$

Where:

V = volume (cubic meters)

A = Basin area with slopes greater than or equal to 30% (square kilometers)

B = Basin area burned at moderate and high severity (square kilometers), and

T= total storm rainfall (mm)

For this analysis we assumed a 100-percent burn area for the drainages at the site. We used the 60-minute/five-year storm event for the probabilistic design parameter, and the 60-minute/100-year storm event for deterministic comparison using the modeling equation developed by Cannon and others (2010). The 60-minute/five-year storm corresponds more closely to the probable storm occurring within a few years following a wildfire event (Giraud and Castleton, 2009; Cannon, 2010). The 60-minute/100-year storm corresponds to a more improbable deterministic event occurring within a few years following a wildfire event.

The results of this analysis for the five subject drainages are presented in the following table.

Estimated Precipitation-Event Debris Volume

Drainage	Precipitation Event	Point Precipitation* (inches)	Point Precipitation (mm)	Basin Area (Acres)	Basin Area (km ²)	Basin Slopes >30% (km ²)	Estimated Debris Volume (m ³)	Estimated Debris Volume (yd ³)
1	5 yr./60 min.	0.72	18.29	27	0.12	0.09	1,278	1,672
1	100 yr./60 min.	1.69	42.93	27	0.12	0.09	2,014	2,635
2	5 yr./60 min.	0.72	18.29	22	0.10	0.08	1,166	1,525
2	100 yr./60 min.	1.69	42.93	22	0.10	0.08	1,838	2,404
3	5 yr./60 min.	0.72	18.29	52	0.21	0.16	1,802	2,356
3	100 yr./60 min.	1.69	42.93	52	0.21	0.16	2,840	3,714
4	5 yr./60 min.	0.72	18.29	43	0.17	0.10	1,426	1,865
4	100 yr./60 min.	1.69	42.93	43	0.17	0.10	2,247	2,939
5	5 yr./60 min.	0.72	18.29	20	0.08	0.05	859[#]	1,124[#]
5	100 yr./60 min.	1.69	42.93	20	0.08	0.05	1,354[#]	1,771[#]

*From: https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ut

Does not pose a current risk to proposed development based on existing drainage configuration (Section 5.0)

Highlighted in yellow on the table are the recommended estimated debris volumes using the 5 year 60-minute interval estimate of 18.29mm (0.72 inches), and assuming a 100-percent basin area burn with the Cannon and others (2010) regression values.

As discussed in **Section 2.0**, seventeen (17) test pits were also excavated on portions of the subject site to aid in our analysis of potential debris flow and alluvial flood hazards at the site. The approximate locations of the test pits are shown on **Figure 2**. The test pits, as well as the exploration trenches, confirmed the presence of debris flow deposits on the alluvial fan areas mapped at the site (Solomon, 2010, 2010). In some instances where individual debris flow event deposits were discernable in the test pit walls, the thickness of the most recent event (MRE) deposit was measured and recorded. This was possible in only some of the test pits where debris flow deposits were exposed and individual events were discernable. In other test pits where debris flow

deposits were exposed, individual event deposits were either not discernable or possibly only one event deposit was represented within the depth of the test pit. The following table summarizes our observations of the debris flow deposits observed in the test pits excavated at the site. The lateral extents of individual debris flow deposits on the alluvial fans were not able to be determined with the limited number of test pits excavated. As such, we were not able to estimate actual debris flow event volumes on the alluvial fans and correlate those volumes with those calculated and shown in the above table. However, the test pit observations do give some idea of past flow thicknesses which can provide useful information for the design of some possible mitigation measures.

Summary of Most Recent Event Debris Flow Thicknesses Measured in Test Pits

Test Pit	Depth of Test Pit (feet)	Debris Flow Deposits Present?	Most Recent Event Discernable?	Consolidated Thickness of Most Recent Event Deposit (feet)
TP-1	7.5	No	N/A	N/A
TP-2	6.0	Yes	No	N/A
TP-3	6.0	Yes	No	N/A
TP-4	6.5	No	N/A	N/A
TP-5	7.5	Yes	No	N/A
TP-6	7.5	Yes	Yes	3.5
TP-7	7.0	No	N/A	N/A
TP-8	8.0	Yes	Yes	3.0
TP-9	8.5	Yes	Yes	3.0
TP-10	8.5	Yes	Yes	3.0
TP-11	9.0	No	N/A	N/A
TP-12	6.0	Yes	No	N/A
TP-13	4.0	Yes	No	N/A
TP-14	5.5	Yes	Yes	3.0
TP-15	7.5	Yes	Yes	4.0
TP-16	6.0	Yes	Yes	1.5
TP-17	6.5	Yes	Yes	2.0

As shown in the above table, where the MRE debris flow deposits were discernable in the test pits, the average consolidated MRE deposit thickness was about 2.9 feet. This gives some indication of expected minimum deposit thicknesses of future debris flow deposits on the alluvial fans at the site.

Possible mitigation of debris flow and fan flooding hazards at the subject site is discussed in **Section 5.0**.

4.7.5 Snow Avalanche

No evidence of past snow avalanche activity was observed at the subject site, particularly in the steeper terrain of the southeast portion of the site. Such evidence can include avalanche chutes and destroyed vegetation on the steeper mountain slopes. The Utah County Hazards Maps¹ do not show any portions of the subject site to

¹ <http://utahcounty.maps.arcgis.com/apps/MapSeries/index.html?appid=812923069cae45aab9f5741b3fb675f6>

be in avalanche study areas and no avalanche paths are mapped on or adjacent to the site. The potential for avalanche hazards to impact the site is rated as low.

4.7.6 Volcanic Eruption

There is no known active volcanic activity in the vicinity of the subject site or in the Wasatch Front region. The potential hazard is rated as low.

4.7.8 Seismic Seiche

A seismic seiche is defined as an earthquake-induced oscillation of a body of water in an enclosed or semi-enclosed basin that varies in period, depending on the physical dimensions of the basin, from a few minutes to several hours, and in height from several inches to several yards. The subject lot is located more than 7 miles from a large water body (Utah Lake) capable of experiencing seiche during an earthquake. The site is more than 300 feet higher than the average elevation of Utah Lake. As such, the potential hazard is rated as low.

4.7.9 Shallow Groundwater

Groundwater was not encountered in any of the exploration trenches or test pits on the subject site. Groundwater levels can fluctuate several feet seasonally. Numerous other factors such as heavy precipitation, irrigation of neighboring land, and other unforeseen factors, may also influence ground water elevations at the site. The detailed evaluation of these and other factors, which may be responsible for ground water fluctuations, is beyond the scope of this study.

4.7.10 Seismically Induced Soil Liquefaction

Liquefaction is defined as the condition when saturated, loose, sandy soils lose their support capabilities because of excessive pore water pressure which develops during a seismic event. Clayey soils, even if saturated, will generally not liquefy during a major seismic event. The Utah County Hazards Maps² show the entire subject site to be in a “very low” liquefaction potential area. The potential hazard is rated as low.

4.8 Summary of Geologic Findings

Surface fault rupture associated with the active Nephi Segment of the WFZ, debris flows and alluvial fan flooding associated with the several small drainages at the site, and rock fall related to several small outcrops and loose boulders on the steep slopes at the site, pose the greatest risk to the proposed development.

The logged and mapped faults crossing the site were observed to displace Holocene age sediments, and, therefore, are considered to be active. Although surface expression of the fault zone at the site is subdued, and even absent in places, the site likely experienced surface rupture along the fault zone during the most recent large earthquake on the Nephi Segment of the WFZ.

Alluvial fans at the site emanating from the five small drainages in the higher terrain to the southeast are largely comprised of Holocene debris flow deposits based on the geologic mapping by Solomon (2010, 2010) and our observations. As such, the fans, while not as large as others at the mouths of larger drainages in the vicinity,

² <http://utahcounty.maps.arcgis.com/apps/MapSeries/index.html?appid=812923069cae45aab9f5741b3fb675f6>

are considered to be active, and debris flow and fan flooding hazards pose a risk to development on the alluvial fans.

Potential rock fall hazards at the site are not widespread, but areas directly downslope of several small outcrops and areas where loose boulders are present on slopes (Figure 4) are in potential rock fall travel paths and runout zones. Future development in these areas is at risk from potential rock fall hazards.

Although no landslide or slope instability activity is mapped or observed at the site, existing or planned steeper slopes at the site are subject to potential instability. This poses a risk to development on the slope or at the crest or toe of the slope.

The risk to the proposed development at the site from other geologic hazards is rated as low and no additional investigation or mitigation pertaining to these other potential geologic hazards at the site is warranted.

4.9 Site Subsurface Variations

Based on the results of the subsurface explorations and our experience, variations in the continuity and nature of subsurface conditions should be anticipated. Due to the heterogeneous characteristics of natural soils/bedrock, care should be taken in interpolating or extrapolating subsurface conditions between or beyond the exploratory locations.

Also, when logging and sampling of the exploration trenches and test pits was completed, the trenches and pits were backfilled with the excavated soils but only moderate efforts were made to compact these soils. Thus, the trench backfill should also be considered non-engineered and settlement of the backfill in the trenches over time should be anticipated.

5.0 CONCLUSIONS and RECOMMENDATIONS

The locations of the zones of faulting and related ground deformation at the site associated with the Nephi Segment of the WFZ are shown on **Figure 14, Fault and Setback Map** as well as on **Figure 1, Site Plan**. The zone of faulting at the site was mapped based on the observations and data of the exploration trenching as well as our review of the referenced, published geologic maps, aerial photographs, and LiDAR derived DEM. As shown on Figure 14, the individual fault traces and the zone of faulting between primary fault traces at the site are mapped as red lines. Based on our observations, up to 9 feet of net vertical displacement has occurred across the zone of faulting at the site in the most recent ground-rupturing earthquake on the Nephi Segment of the WFZ. Based on these observations, future large magnitude earthquake events could produce similar, single-event displacement.

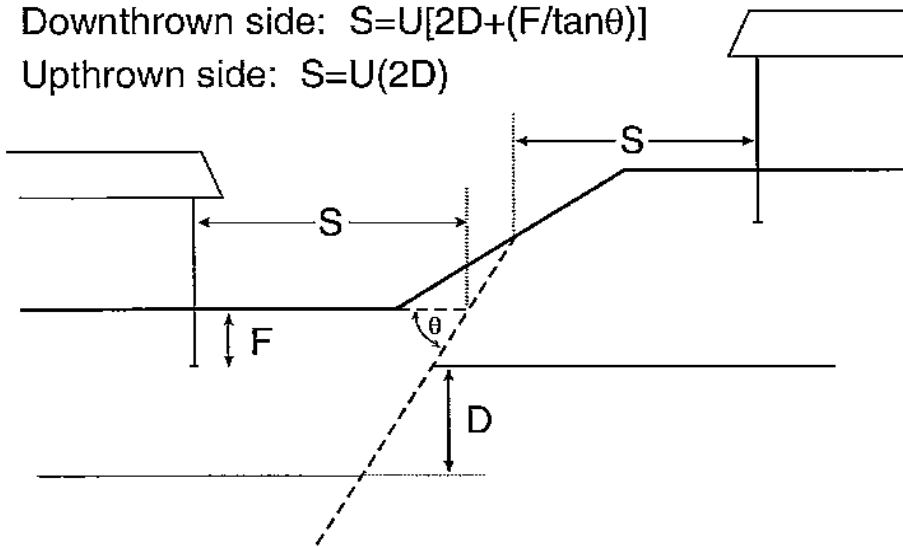
The mapped zone of faulting on the subject site is presumed to be active and appropriate building setbacks from the zone must be established and implemented in any new development at the site. For the purposes of this investigation, we are considering the zone of faulting at the site as a single, normal fault trace with an overall down-to-the-northwest sense of movement. Thus, the down-thrown or “hanging wall” side of the fault is to the northwest and the up-thrown or “foot wall” side is to the southeast. On the northeast portion of the subject

site the primary faults within the zone of faulting branch and the primary faults are mapped as single, branching traces.

To calculate the building setbacks from the identified fault zone and individual fault traces at the site, the measured and observed characteristics of the faulting were used in conjunction with the equations and diagram below which is provided by the Utah Geological Survey (Bowman and Lund, 2016).

Downthrown side: $S = U[2D + (F/\tan\theta)]$

Upthrown side: $S = U(2D)$



U = Criticality Factor (1.5 for proposed development at subject site)

D = Per-event fault displacement measured or estimated for the fault

F = Planned footing depth

θ = Average dip angle of fault

Minimum building setbacks from faults have been established in the International Building Code (IBC) based on building type (occupancy group) and criticality. As such, the minimum building setback from the faulting at the site is 15 feet on either side of the zone of faulting. Where the calculated setback using the equations above is greater than the minimum setback, the calculated setback takes precedence and should be applied. To account for some uncertainty with regards to planned footing depths, we have added five (5) feet to the calculated setbacks on each side of the faults to maintain an acceptable factor of safety.

Based on the setback equations above and where:

U = 1.5

D = 9 feet (maximum displacement observed from trench observations)

F = 10 feet (There is some uncertainty here as discussed above)

θ = 60 degrees (based on the average of the fault dips observed at the site)

Down-thrown side: S = 40 feet (setback)

Up-thrown side: S = 32 feet (setback)

The calculated setbacks above are both more than the minimum setback of 15 feet for the site. Thus, the calculated setbacks should be implemented in design and construction of the new development at the site. If the proposed development is different than what we have understood or changes following the submittal of this report, please inform CMT so that appropriate changes can be made to the required building setbacks, if warranted.

The required building setbacks of 40 feet on the down-thrown side of the faulting and 32 feet on the up-thrown side at the subject site are shown on **Figures 1 and 14** as blue lines. No footings for any building designed for human occupancy should be placed between or across the setback lines at the site. The areas beyond the setbacks on either side of the zone of faulting are suitable for the location of buildings in relation to surface fault rupture hazards.

Areas of proposed development at the site currently at risk from debris flow and fan flooding hazards are shown on **Figure 15, Debris Flow Hazard Map**. Typically, the most effective method for mitigating debris flow and alluvial fan flooding is to capture and detain debris and flood water on or up-stream of the fan and up-stream of areas of development that require protection. Other mitigation methods include avoidance of active fans and/or drainage channels subject to debris flows and flooding, diverting debris and flood water to areas of non-development through the use of engineered channels and other diversion structures, and slowing/stopping debris flows within the drainage above the fan through the use of engineered barrier nets or check dams.

We recommend that the estimated, more probable debris flow volumes for the drainages at the site based on the 60-minute/five-year storm be used in the design of any debris flow and flood mitigation systems. These volumes are shown in the table in **Section 4.7.4**. Based on the proposed development plan shown on **Figure 1**, the upper roadway within the development will cross four of the five of the site drainages that empty onto the proposed building areas of the site. The roadway at these locations is up-stream of any proposed building lots. It is our conclusion that the roadway fills crossing the drainages channels at these locations could also be designed as catchment basin dams to capture debris and water upstream of the roadway. Some expansion of the channels up-stream of the road way fill dams may also be required to allow for the design debris volumes provided in Section 4.7.4.

Based on the proposed development locations and existing topography, Drainage #5 (Figure 15) lies beyond the northeast corner of the development and the current channel of the drainage drains past any proposed building lots and onto the alluvial fan beyond to the north of the development. As such, Drainage #5 does not pose a current risk to the planned development at the site.

As discussed in **Section 4.7.3**, the bedrock outcrops and loose rock areas on the slopes at the site are not extensive in area (Figure 4). The most cost effective method of rock fall mitigation at the site appears to be removal of loose rock from the outcrops and slopes in the source areas shown on **Figure 3** prior to development of the site. We recommend that, at a minimum, any rocks equal to or greater than 2 feet in diameter or with at least one side equal to or greater than 2 feet be removed from the slopes above proposed areas of development. Outcrops could also be covered with anchored wire mesh netting to prevent future rock fragments from dislodging. Other, costlier mitigation methods that could be implemented include rock fall berms, fences, or

walls that could be installed on the slope below the rock fall source area or at the base of the slope in the runout zone. CMT can provide design parameters for these types of mitigation methods upon request.

As discussed in **Section 4.7.2**, existing or planned steeper slopes at the site are subject to potential instability. This poses a risk to development on the slope or at the crest or toe of the slope. We recommend that a geotechnical engineer perform slope stability analyses for any natural or planned slopes within or adjacent to proposed building lots or critical infrastructure that meet the following criteria:

- Cut and/or fill slopes steeper than about 2 horizontal (h) to 1 vertical (v) (50%).
- Natural slopes steeper than or equal to 3 horizontal (h) to 1 vertical (v) (33%).
- Cut, fill, or natural slopes of any planned water-retention basins or flood-control Channels.

It is our conclusion that the subject site is suitable for the planned development thereon with respect to geologic hazards provided the findings and recommendations of this investigation are understood and implemented in the proposed development.

6.0 LIMITATIONS

It must be understood that, along with the earthquake faults identified crossing the proposed building areas of the subject site, the site is located in a geologically/seismically sensitive area where there are inherent risks associated with development in relation to geologic hazards. The conclusions and recommendations presented in this report are intended to provide a factor of safety against surface fault rupture and related tectonic and seismic hazards, debris flow/fan flooding hazards, rock fall hazards, and slope stability hazards sufficient to reduce the risk to human life. However, potential structural and property damage due to these natural hazards at the site cannot be totally mitigated due to the inherent level of uncertainty associated with analyzing and predicting such hazards. Therefore, by choosing to develop, build, and/or reside at the subject site, the current or any future property owner(s), developers, builders, and/or residents should understand and accept the inherent risks associated with building and living in a geologically and seismically sensitive area.

The recommendations provided herein were developed by evaluating the information obtained from the subsurface explorations and soils encountered therein, as well as published/available geologic maps, aerial photographs, and LiDAR derived DEMs. The exploration trench logs reflect the subsurface conditions only at the specific locations at the particular time designated on the log. Soil and ground water conditions may differ from conditions encountered at the actual exploration locations. The nature and extent of any variation in the explorations may not become evident until during the course of construction. If variations do appear, it may become necessary to re-evaluate the recommendations of this report after we have observed the variation.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering geology and geotechnical engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

We appreciate the opportunity to be of service to you on this project. If we can be of further assistance or if you have any questions regarding this project, please do not hesitate to contact us at (801) 492-4132.

7.0 REFERENCES CITED

- Aerial Photographs from Utah Geological Survey: <https://geodata.geology.utah.gov/imagery/>
Photo Year 1970: WF_4-7-74, WF4-11-211, WF_4-11-211.
- Benson, L.V., Lund, S.P., Smoot, J.P., Rhode, D.E., Spencer, R.J., Verosub, K.L., Louderback, L.A., Johnson, C.A., Rye, R.O. and Negrini, R.M., (2011), *The rise and fall of Lake Bonneville between 45 and 10.5 ka*; USGS Staff -- Published Research. Paper 726, Published in Quaternary International Vol. 235, pp. 57-69.
- Black, B.D., Lund, W.R., and Mayes, B.H., 1995, *Summary of New Information From the South Fork Dry Creek Site, Salt Lake County, Utah*: Environmental and Engineering Geology of the Wasatch Front Region, edited by W.R. Lund, Utah Geological Association Pub. 24, p. 11-30.
- Cannon, S.H., Gartner, J.E., Rupert, M.G., Michael, J.A., Rea, A.H., and Parrett, C., 2010, *Predicting the Probability and Volume of Post Wildfire Debris Flows in the Intermountain Western United States*; Geological Society of America Bulletin, v. 122, p. 127-144.
- DuRoss, C.B., 2008, *Holocene Vertical Displacement on the Central Segments of the Wasatch Fault Zone, Utah*; Bulletin of the Seismological Society of America, Vol. 98, No. 6, pp. 2918-2933.
- DuRoss, C.B., McDonald, G.N., and Lund, W.R., 2008, *Paleoseismic Investigation of the Northern Strand of the Nephi Segment of the Wasatch Fault Zone at Santaquin, Utah*; Paleoseismology of Utah, Volume 17, Utah Geological Survey Special Study 124.
- Elliot, A.H., and Harty, K.M., 2010, *Landslide Maps of Utah, Nephi 30' x 60' Quadrangle*; Utah Geological Survey Map 246DM, Plate 19 of 46, Scale: 1:100,000.
- FEMA, 2019, Flood Zone Mapping:
<https://msc.fema.gov/portal/search?AddressQuery=4120%20s%20highland%20drive%2C%20millcreek%2C%20ut#searchresultsanchor>
- Gartner, J.E., Cannon, S.H., Santi, P.M., and DeWolfe, V.G., 2008, *Empirical Models to Predict the Volumes of Debris Flows Generated by Recently Burned Basins in the Western U.S.*; Geomorphology, v. 96, p. 339-354.
- Giraud, R.E., and Castleton, J.J., 2009, *Estimation of Potential Debris Flow Volumes for Centerville Canyon, Davis County, Utah*; Utah Geological Survey Report of Investigation 267, p. 14.
- Lund, W.R., Schwartz, D.P., Mulvey, W.E., Budding, K.E., and Black, B.D., 1991, *Fault Behavior and Earthquake Recurrence on the Provo Segment of the Wasatch Fault Zone at Mapleton, Utah County, Utah*: Paleoseismology of Utah, Vol. 1, Utah Geological Survey Special Study 75, 41 pp.

- Machette, M.N., Personius, S.F., Nelson, A.R., Schwartz, D.P., and Lund, W.R., 1991, *Segmentation and History of Holocene Earthquakes, Wasatch Fault Zone, Utah*: Journal of Structural Geology, Vol. 13, p. 137-149.
- McCalpin, J.P., Forman, S.L., and Lowe, M., 1994, *Reevaluation of Holocene Faulting at the Kaysville Site, Weber Segment of the Wasatch Fault Zone, Utah*: Tectonics, Vol. 13, p. 1-16.
- McCalpin, J.P., and Nishenko, S.P., 1996, *Holocene Paleoseismicity, Temporal Clustering, and Probabilities of Future Large ($M > 7$) Earthquakes on the Wasatch Fault Zone, Utah*: Journal of Geophysical Research, Vol. 101, No. B3, p. 6233-6253.
- Schwartz, D.P., and Coppersmith, K.J., 1984, *Fault Behavior and Characteristics of Earthquakes-Examples from the Wasatch and San Andreas Fault Zones*: Journal of Geophysical Research, Vol. 89, No. B7, p. 5681-5698.
- Solomon, B.J., 2010, Interim Geologic Map of the Unconsolidated Deposits in the Santaquin Quadrangle, Utah and Juab Counties, Utah; Utah Geological Survey Open File Report 570, Scale 1:24,000.
- Solomon, B.J., 2010, Interim Geologic Map of the Unconsolidated Deposits in the Payson Lakes Quadrangle, Utah County, Utah; Utah Geological Survey Open File Report 571, Scale 1:24,000.
- Swan, F.H., III, Schwartz, D.P., and Cluff, L.S., 1980, *Recurrence of Moderate to Large Magnitude Earthquakes Produced by Surface Faulting on the Wasatch Fault Zone, Utah*: Bulletin Seismological Society of America, Vol. 70, p. 1431-1462.
- Bowman, S.D., and Lund, W.R., 2016, *Guidelines for Investigating Geologic Hazards and Preparing Engineering-Geology Reports, With a Suggested Approach to Geologic-Hazard Ordinances in Utah*; Utah Geological Survey Circular 122.
- Van Horn, R., 1972, *Surficial Geologic Map of the Sugar House Quadrangle, Salt Lake County, Utah*; U.S. Geological Survey Map I-766-A, Scale 1:24,000.

Appendix

Building
Setbacks
related to
surface fault
rupture hazards



TABULATIONS	
YIELD LOT COUNT	= 529 DL
45% MAX DENSITY	= 417 DL
TOTAL DENSITY	= 475 DL
TOTAL AREA	= 16.16 DL
12-14 UNITS/BLDG	= 123 DL
MOWS/FAMILY	= 156 DL
TOTAL DENSITY	= 475 DL

VICINITY MAP

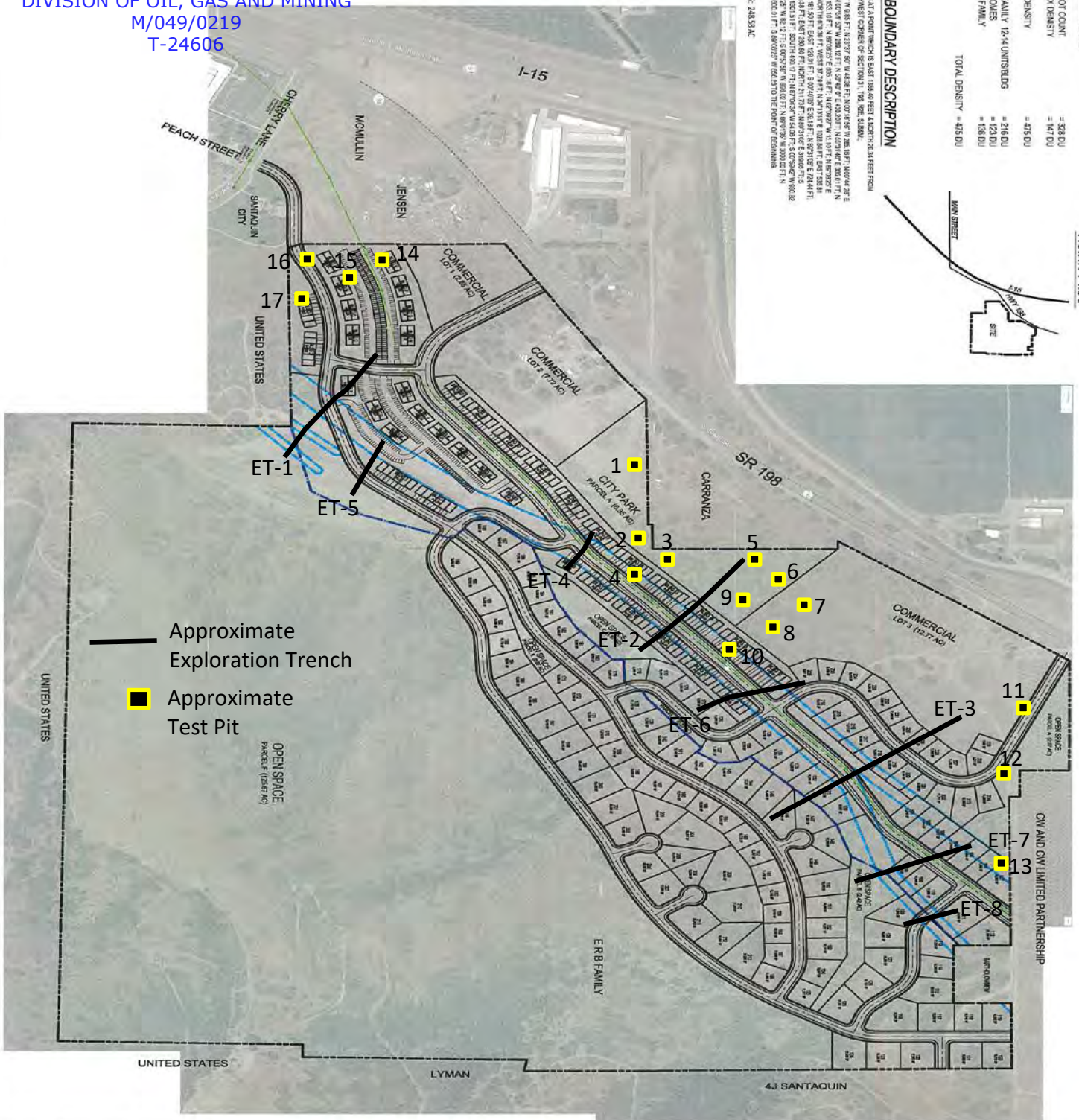
BOUNDARY DESCRIPTION

CONTAINS: 348.59 AC

CONTAINS: 248.58 AC

— Approximate
Exploration Trench

■ Approximate
Test Pit



Model number

SANTAQUIN
HEIGHTS

535 West Center Street
Lindon, UT 84042
(801) 785-8448



SCALE: 1" = 200'

On	Mid	End
1		
2		
3		
4		
5		
6		
7		



CIVIL ENGINEERING
 11030 N. Highland Blvd. Ste. 400
 Highlands, CA 94003
 office (415) 474-1277
 cell (907) 516-1577

SANTAQUIN HEIGHTS

PUD
PLAN

Site Map Provided by: Berg Civil Engineering

Figure:

2

CMTENGINEERING
LABORATORIES

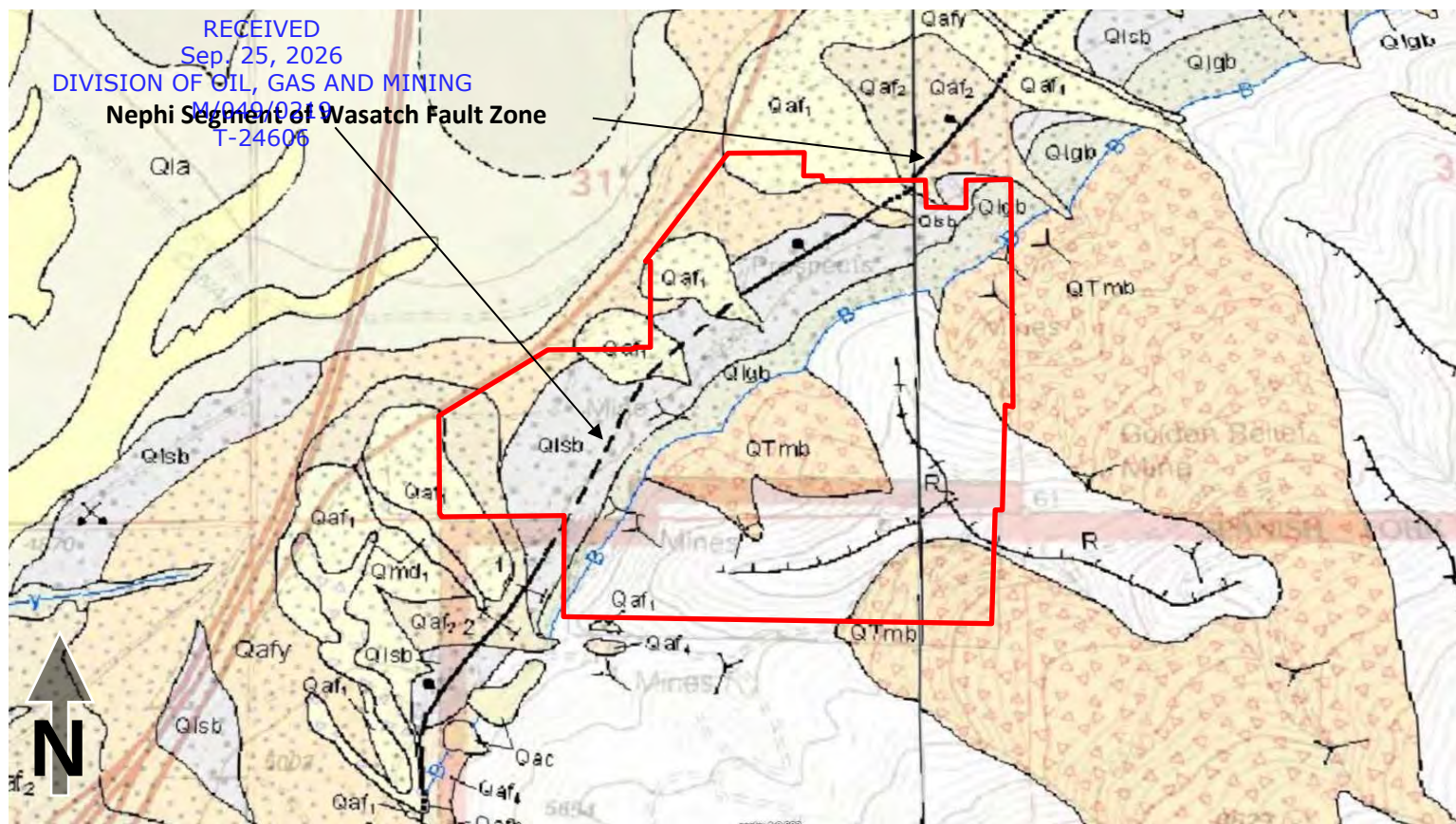
Locations of Explorations

Date:	26-Aug-19
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Job #	12330
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Santaquin Heights

Approx. 650 N. Hwy. 198, Santaquin, UT



Map from: Solomon, 2010, 2010

Geologic Units Mapped at Site (Section 4.4)

Qaf₁ - Level-1 alluvial-fan deposits (upper Holocene)

Qaf₂ - Level-2 alluvial-fan deposits (middle Holocene to upper Pleistocene)

Qafy - Young alluvial-fan deposits, undivided (Holocene to upper Pleistocene)

Qlsb - Lacustrine sand and silt (upper Pleistocene)

Qlgb - Lacustrine gravel and sand (upper Pleistocene)

QTmb - Megabreccia deposits (Pleistocene to Pliocene?)



Approximate Site Boundaries

Santaquin Heights

Approx. 650 N. Hwy. 198, Santaquin, UT

CMT ENGINEERING
LABORATORIES

Geologic Map

Date: 26-Aug-19

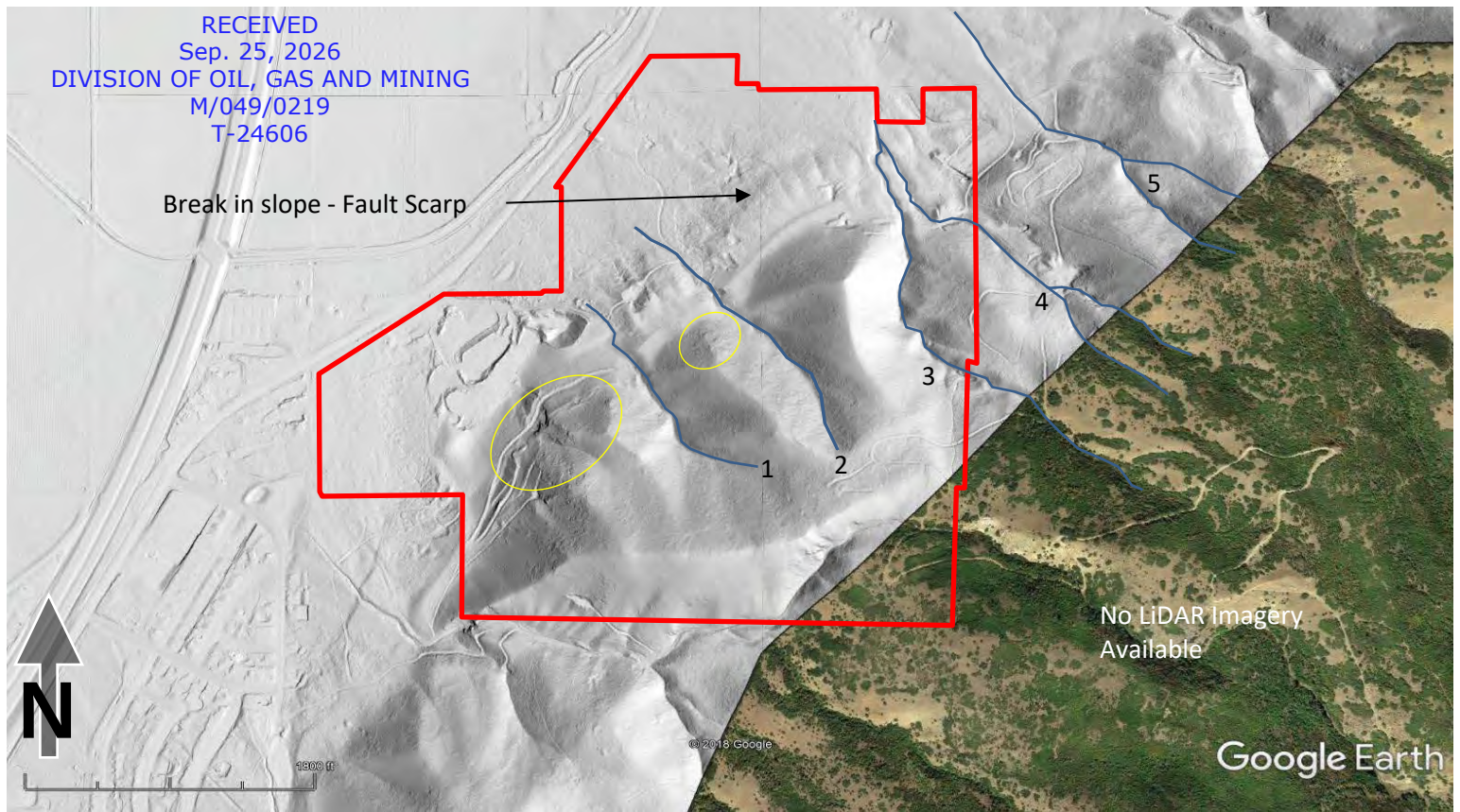
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Figure:

3

RECEIVED
 Sep. 25, 2026
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 M/049/0219
 T-24606

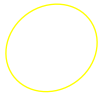
Break in slope - Fault Scarp



Approximate site boundaries



Drainages capable of debris flow initiation (Section 4.7.4)



Bedrock Outcrops - Rock Fall Source Areas

Santaquin Heights

Approx. 650 N. Hwy. 198, Santaquin, UT

CMTENGINEERING
 LABORATORIES

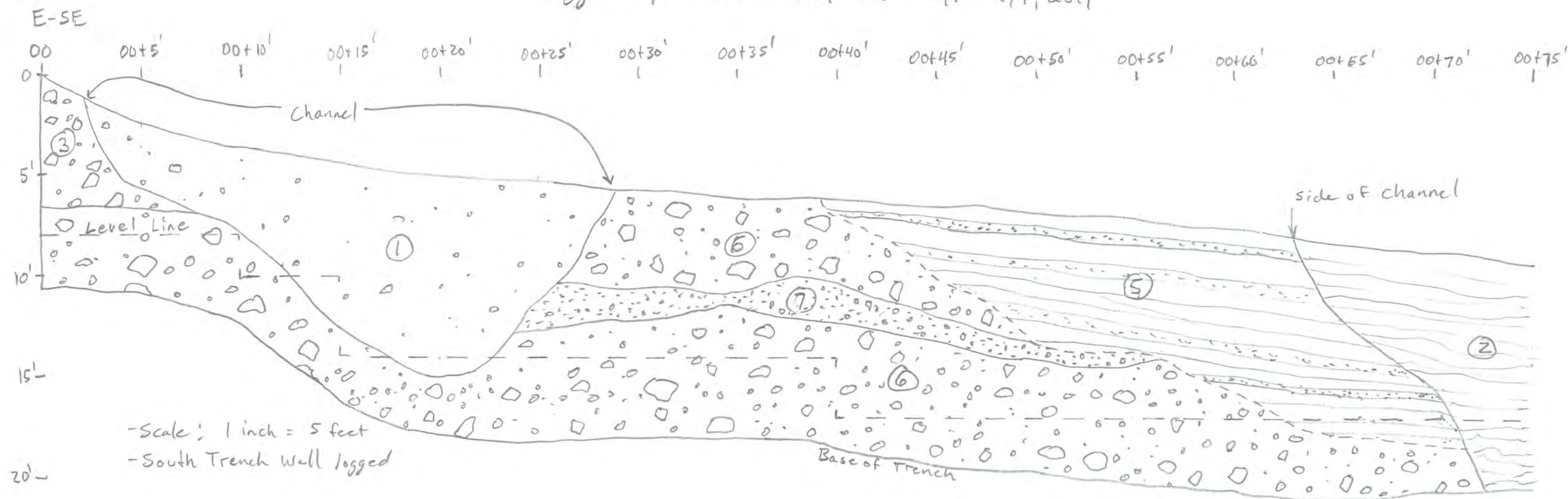
DEM Image

Date:	26-Aug-19
Job #	12330

Figure:

4

Trench Log - Trench ET-1, Santaquin Development, Santaquin, UT
Logged By: Mark Larsen, P.G. 2/1 - 2/4, 2019



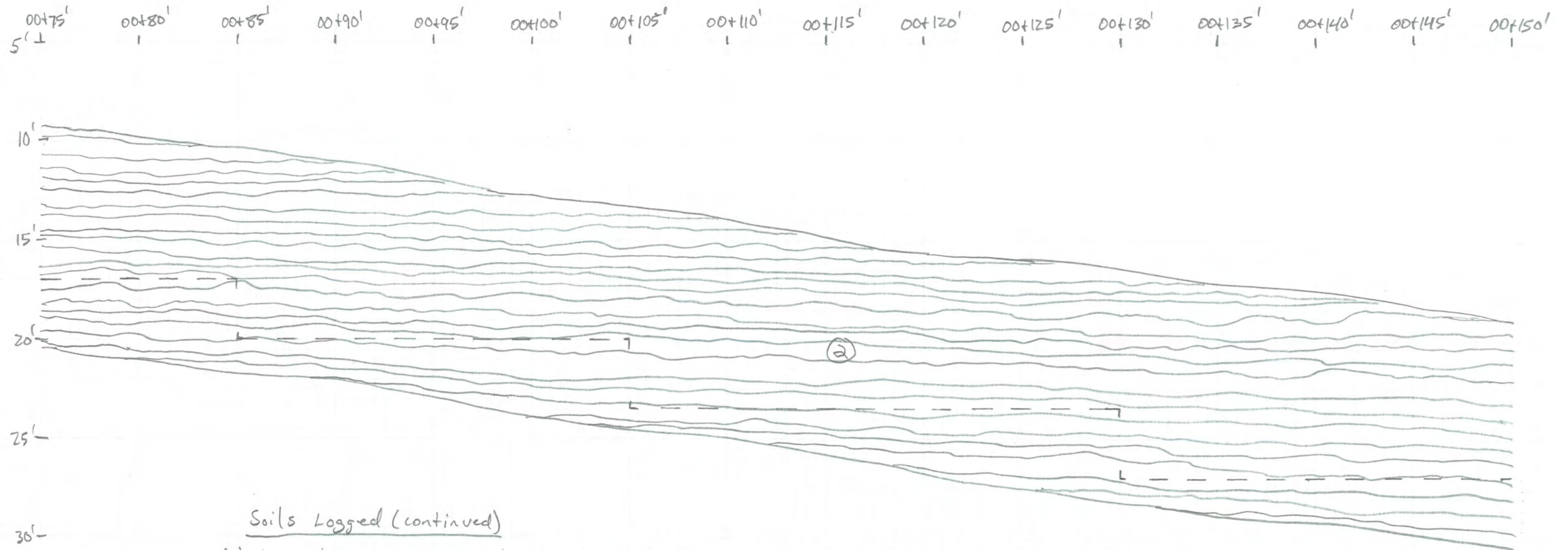
Soils Logged

- 1) Channel Fill - Massive silty sand w/ gravel, pebble to cobble-sized clasts, light-brown to brown.
- 2) Channel Fill - Infilled w/ younger lacustrine sediments. Poorly graded sand and silty sand w/ some gravel. Thin, convoluted bedding, light-brown to brown.
- 3) Colluvium - Some intermixed or entrained lacustrine gravels, pebble to boulder-size gravels, angular to subrounded, massive, gray.
- 4) Fan Alluvium - Clayey to silty gravel w/ sand, mostly pebble-sized angular clasts, brown. Likely deposited in 3-4 events.
- 5) Lacustrine Deposits - Bedded gravels and sands of Bonneville Lake cycle, pebble to cobble-sized, rounded clasts, grayish-brown.
 - 5a.) Lenses of poorly-graded sand w/ pebble gravel.
 - 5b.) Lacustrine silt.
 - 5c.) Lacustrine sand.



Figure 5

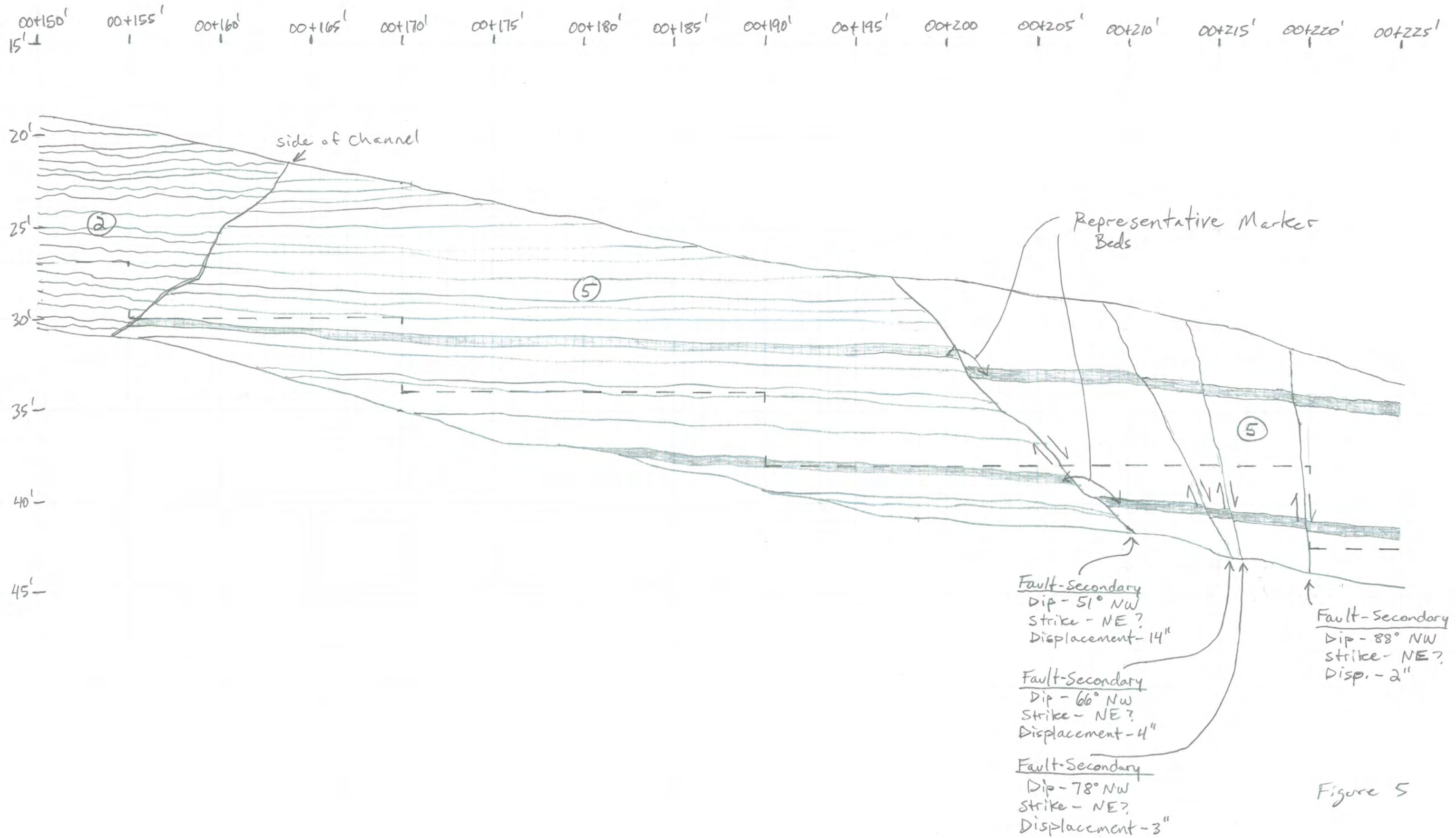
Trench ET-1 (continued)



- 6.) Lacustrine gravel & colluvium, Undivided - Poorly graded gravel w/ sand and silt, pebble to boulder-sized, subangular to rounded clasts, grayish-brown.
- 7.) Lacustrine gravels - Poorly graded gravels w/ sand, pebble-sized clasts, grayish-brown.

Figure 5

Trench ET-1 (continued)



Trench ET-1 (Continued)

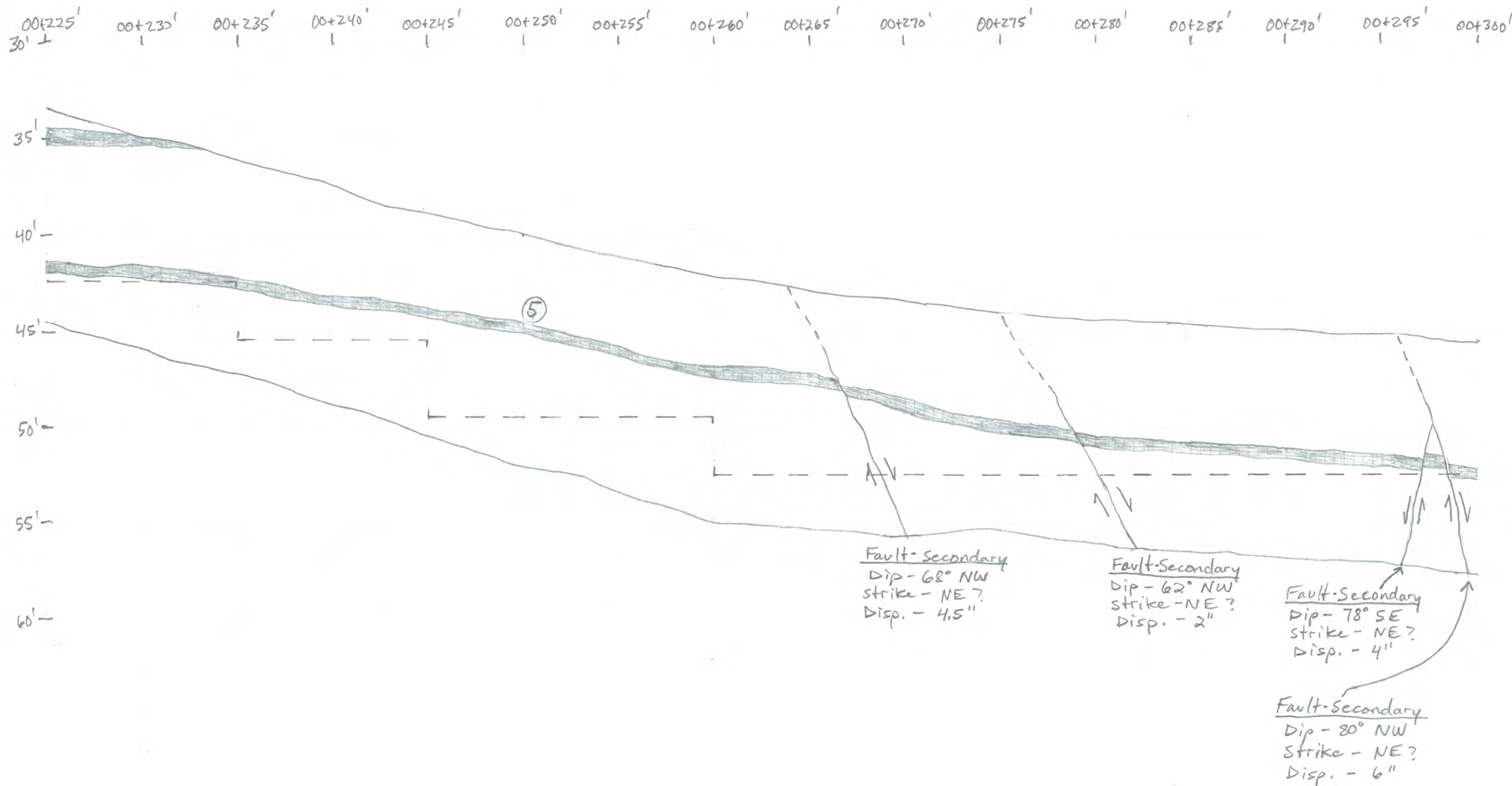


Figure 5

Trench ET-1 (Continued)

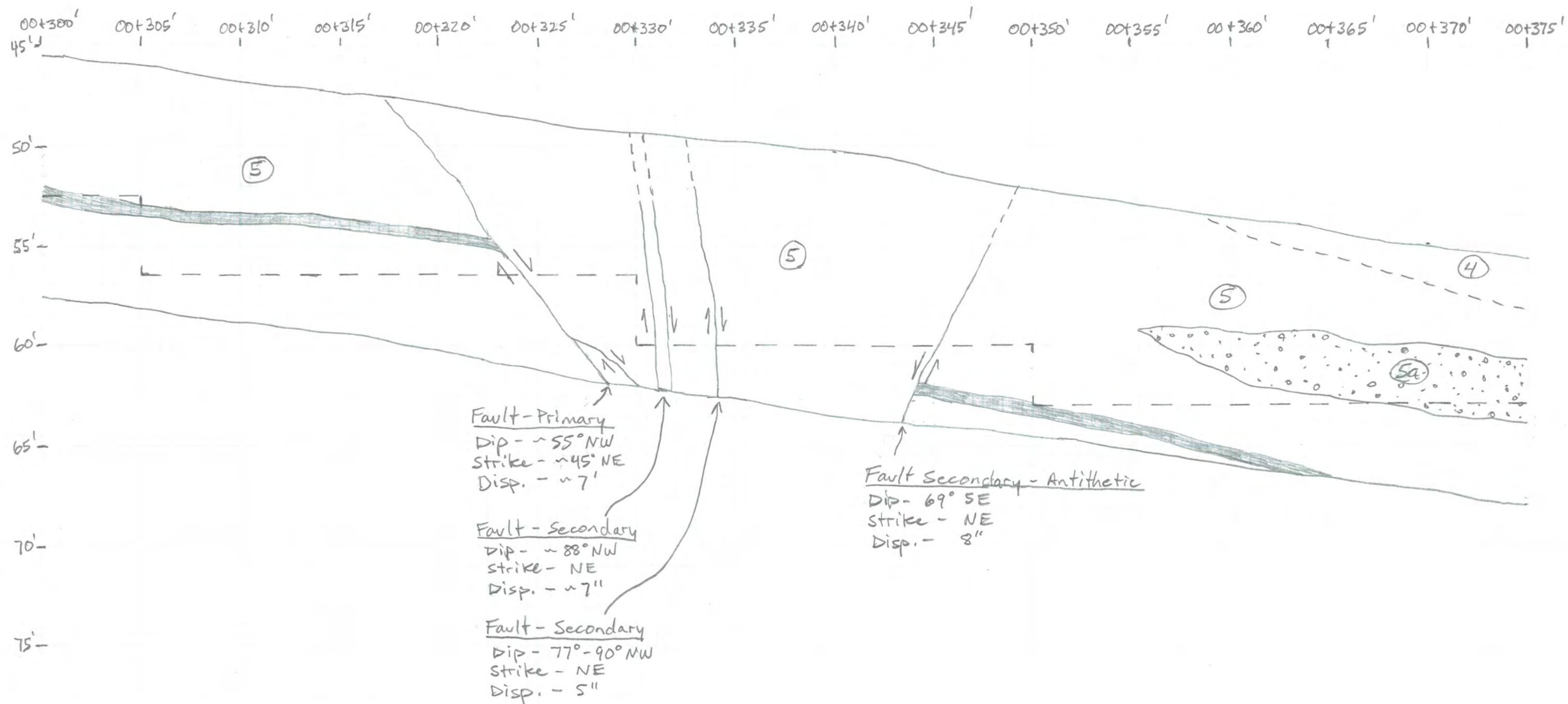


Figure 5

Trench ET-1 (Continued)

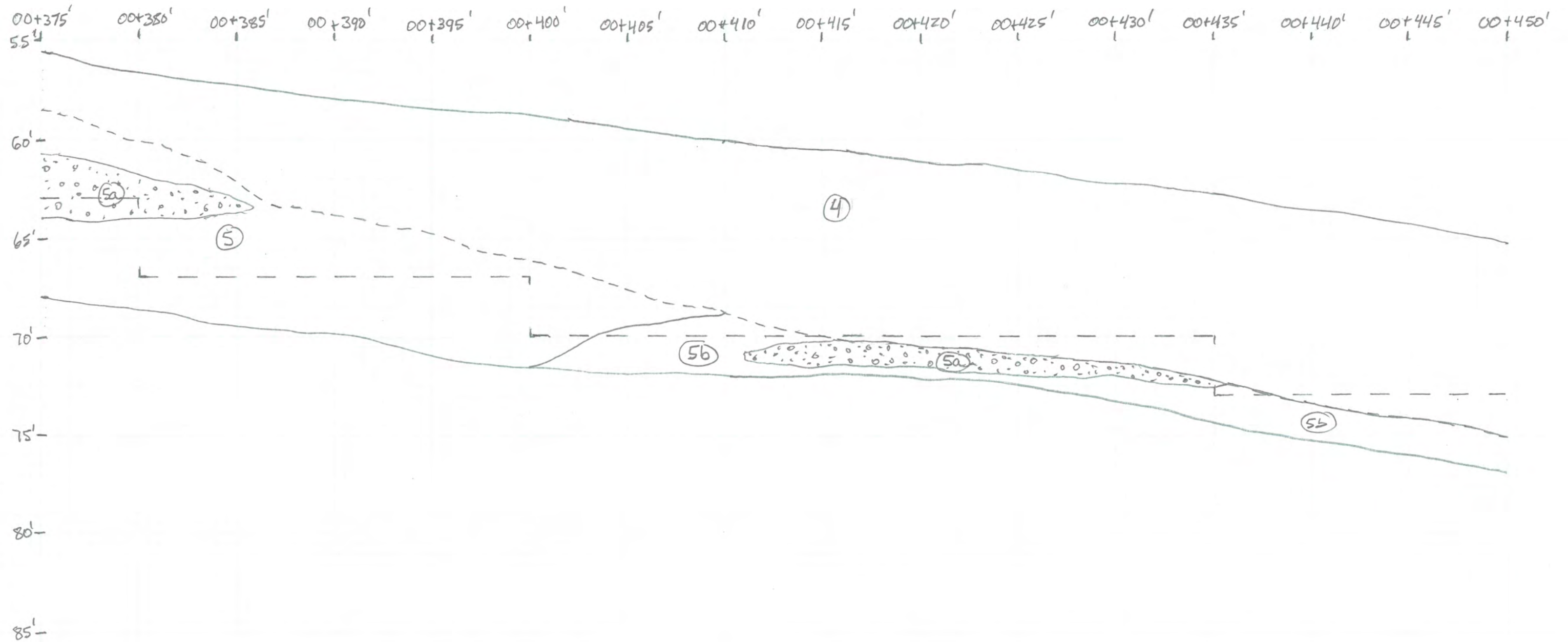


Figure 5

Trench ET-1 (Continued)

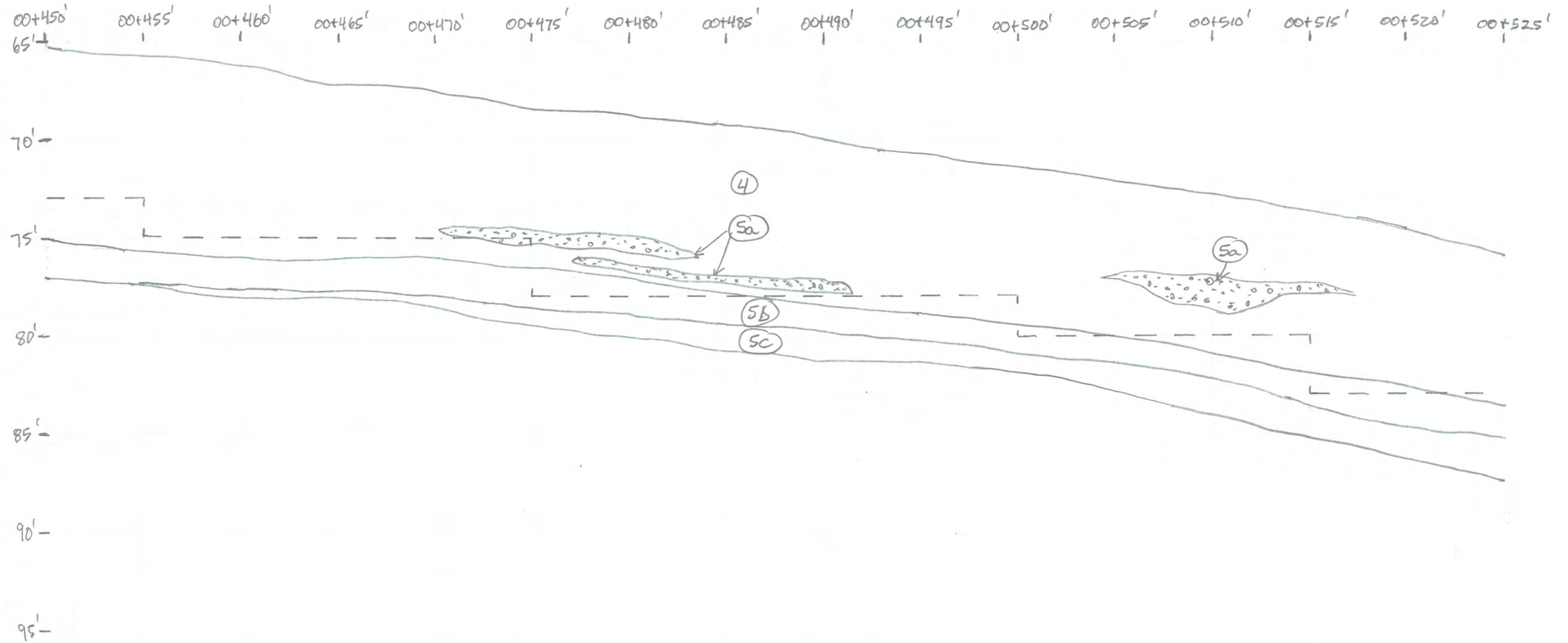


Figure 5

Trench ET-1 (continued)

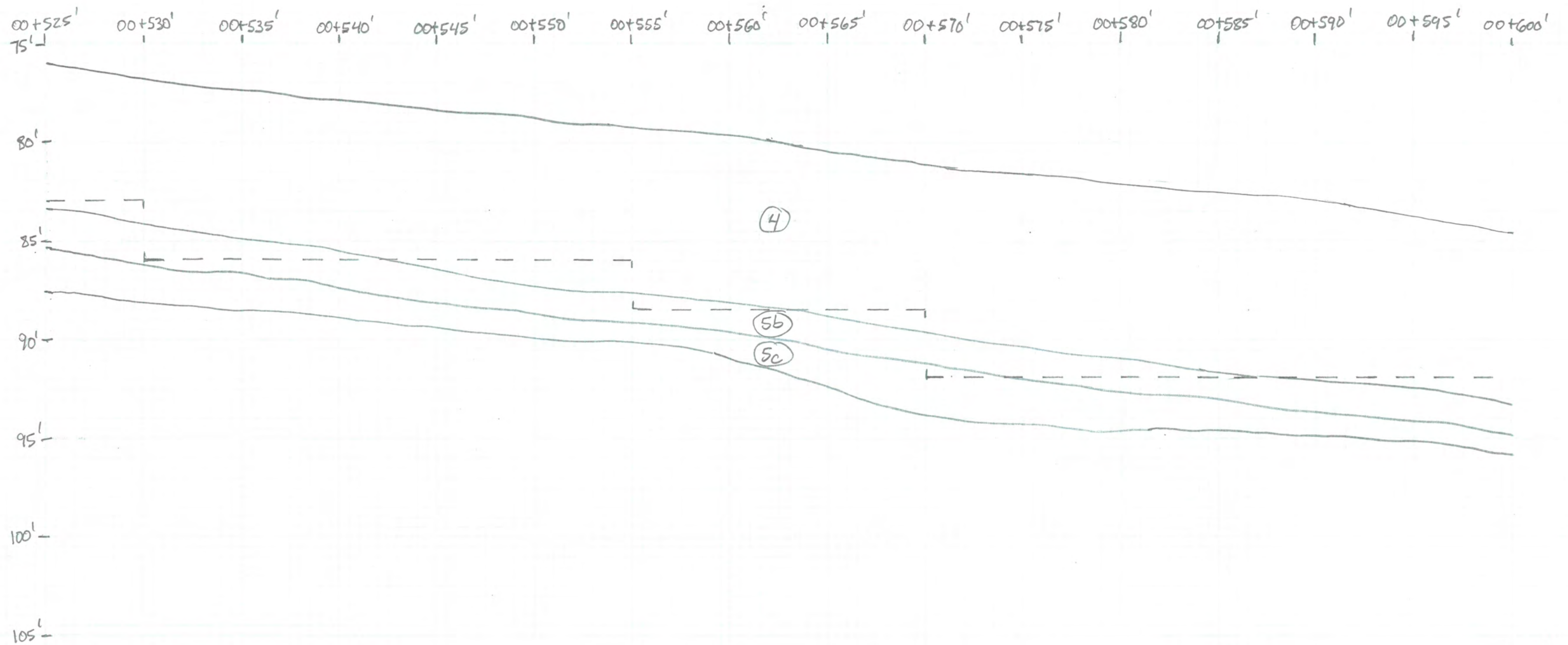


Figure 5

Trench ET-1 (continued)

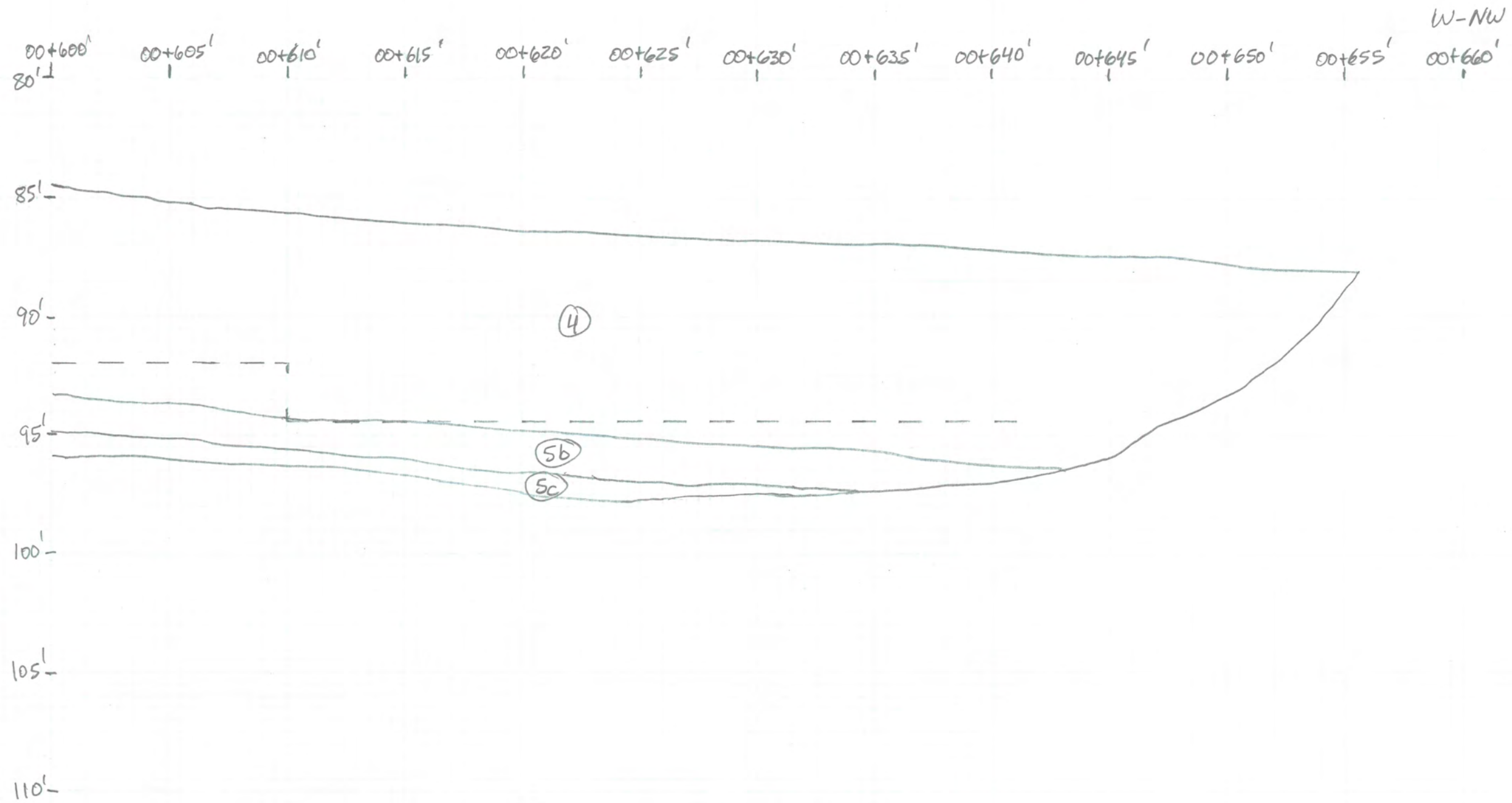


Figure 5

Trench Log - Trench ET-2 Santaquin Development, Santaquin, UT
Logged By: Mark Larsen, P.G., 2/9/19

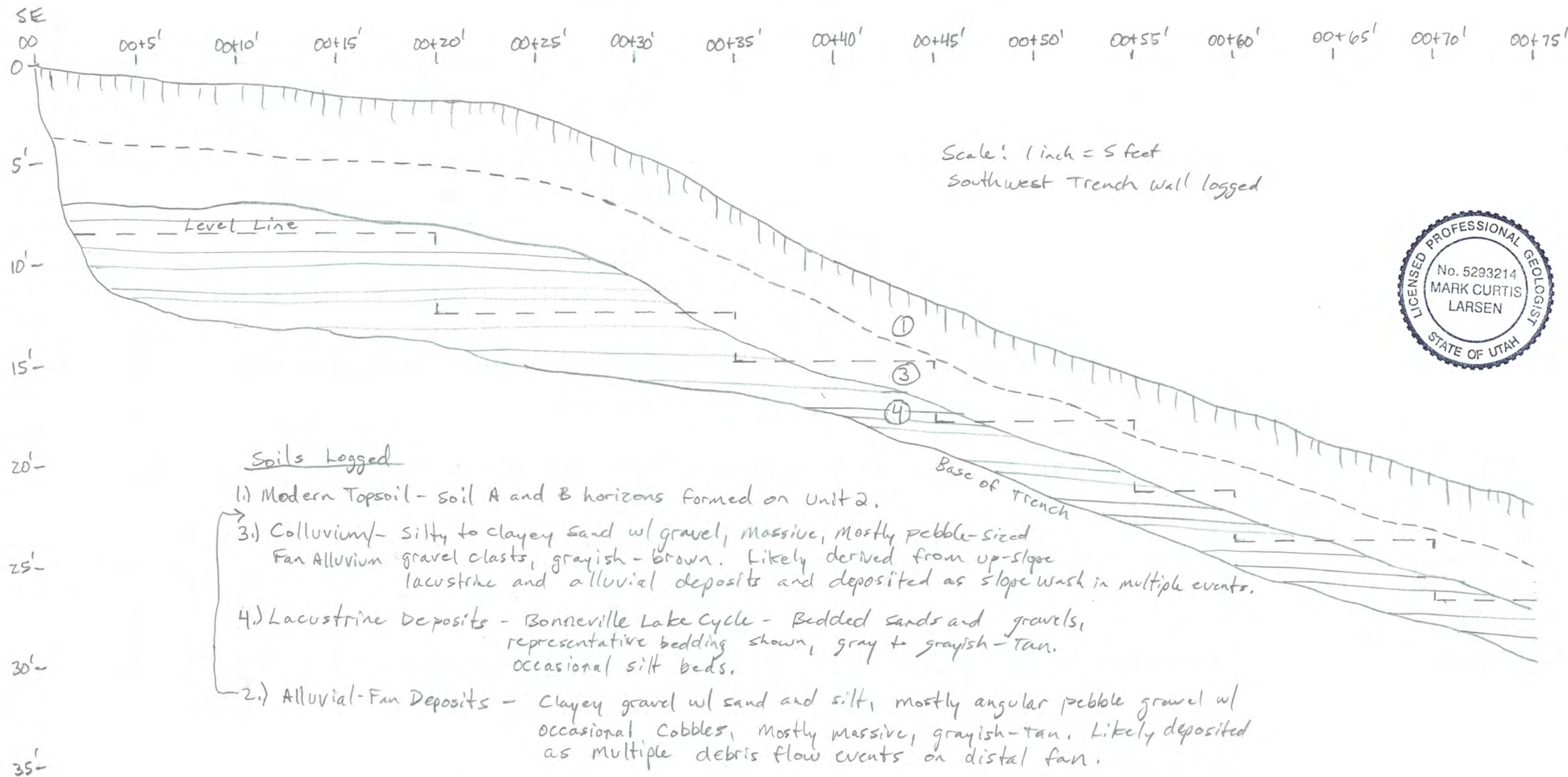


Figure 6

Trench ET-2 (continued)

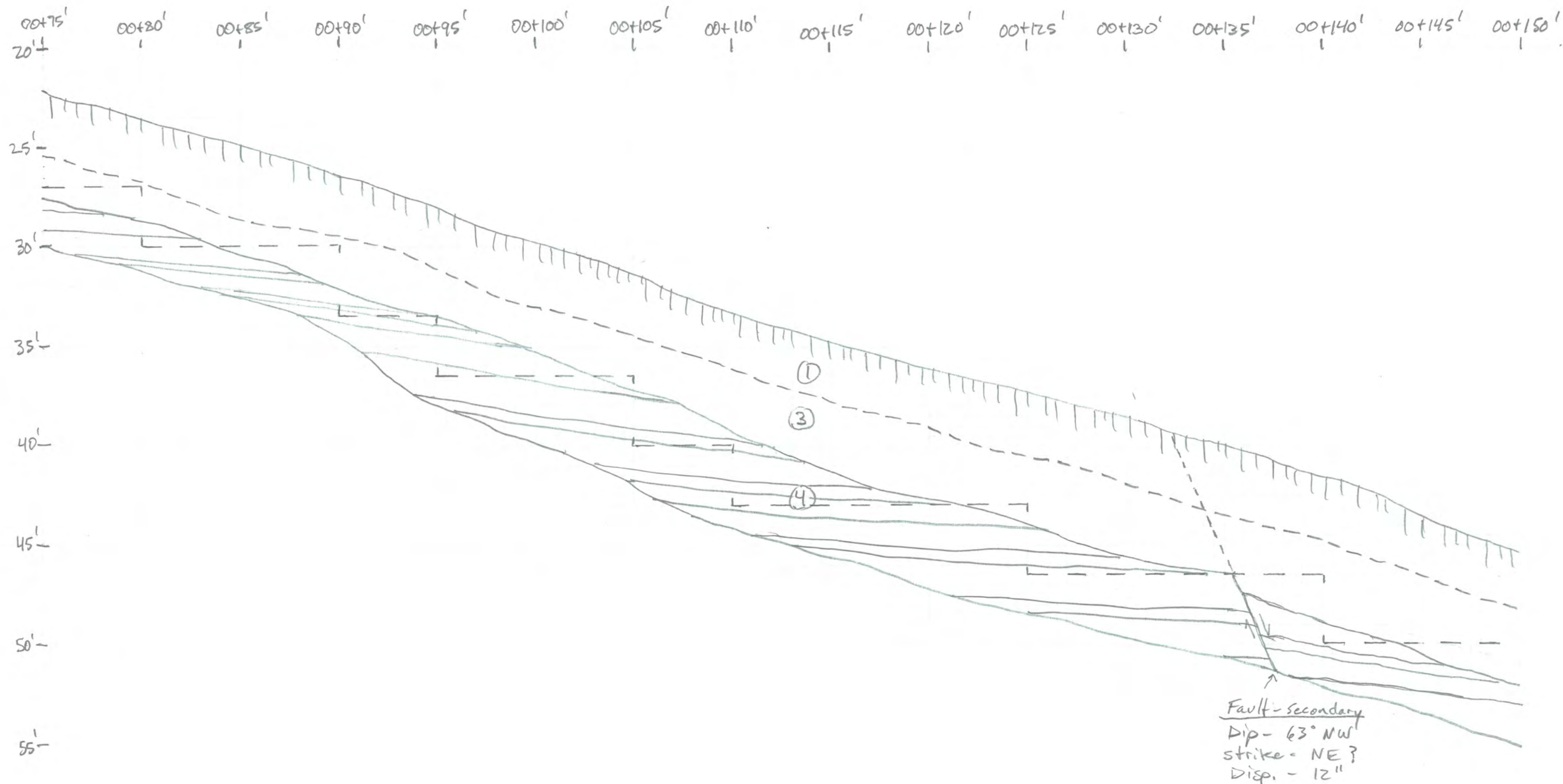


Figure 6

Trench ET-2 (continued)

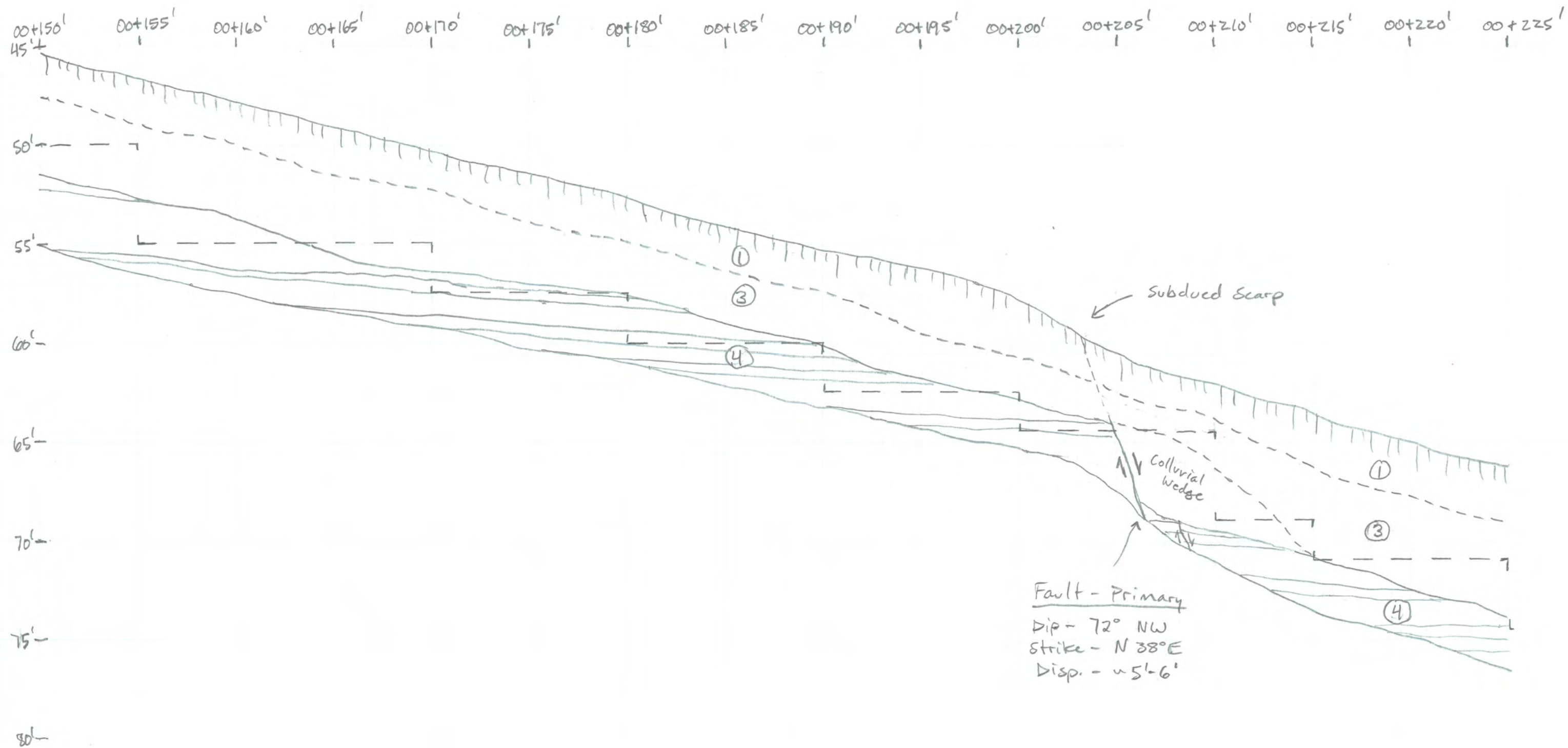


Figure 6

Trench ET-2 (continued)

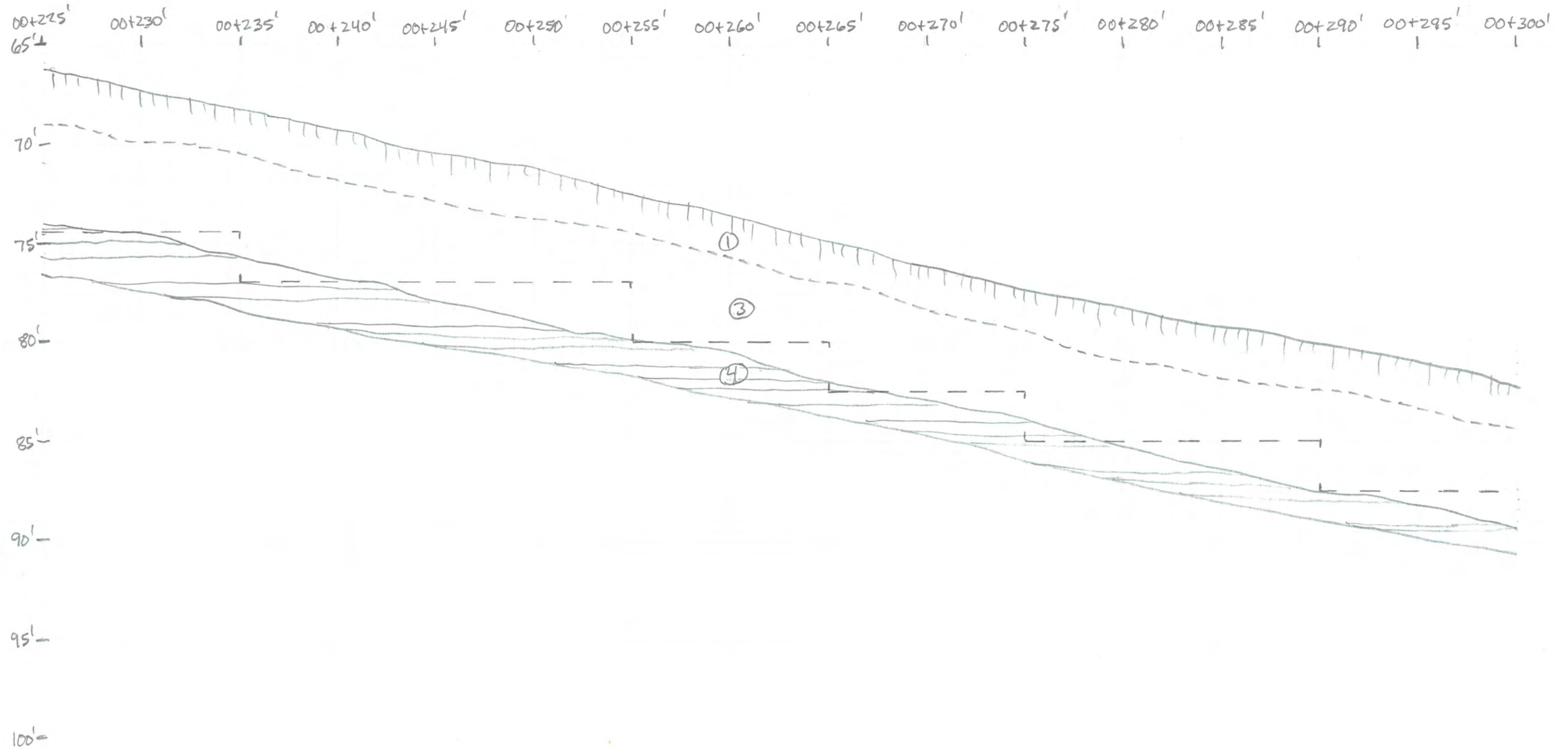


Figure 6

Trench ET-2 (Continued)

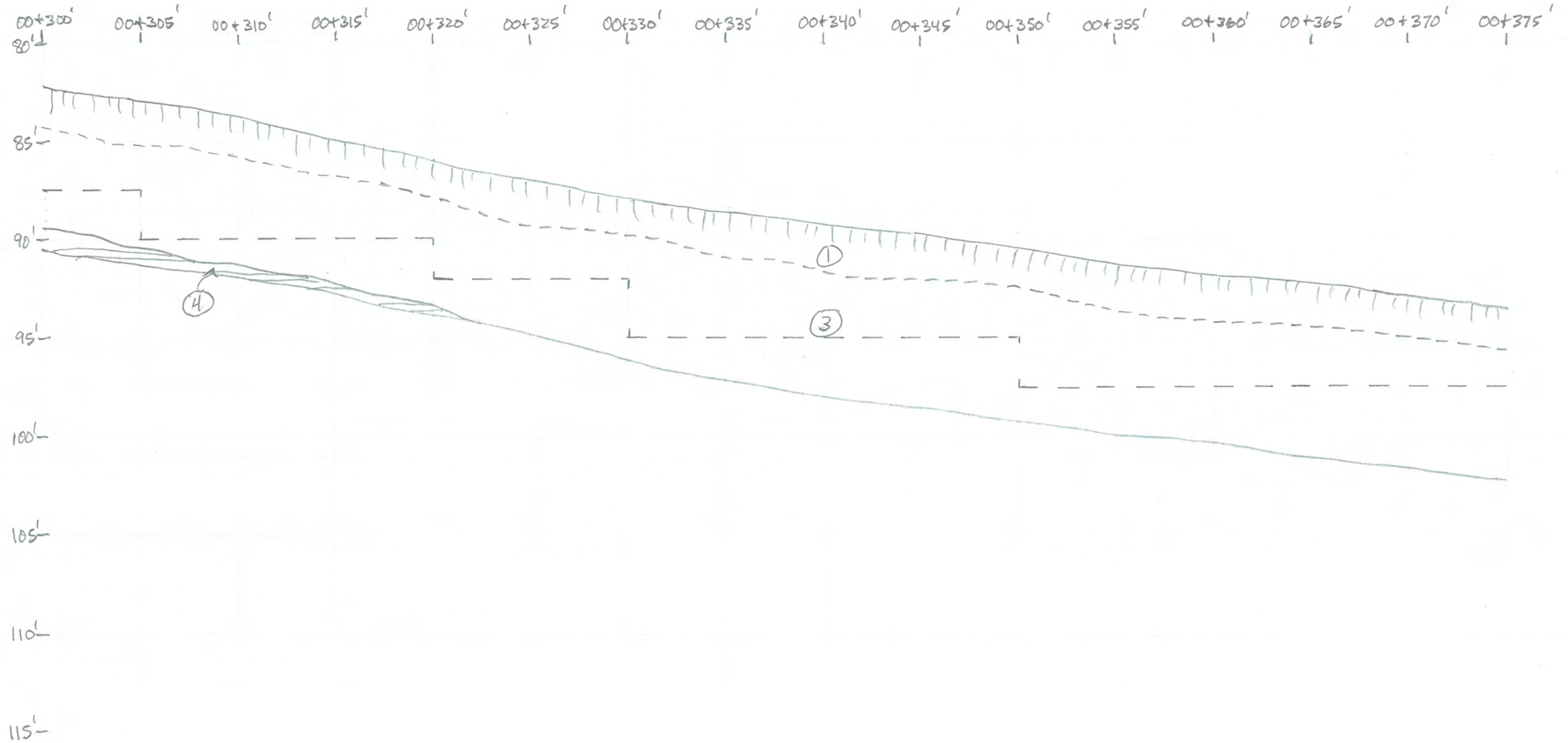


Figure 6

Trench ET-2 (continued)

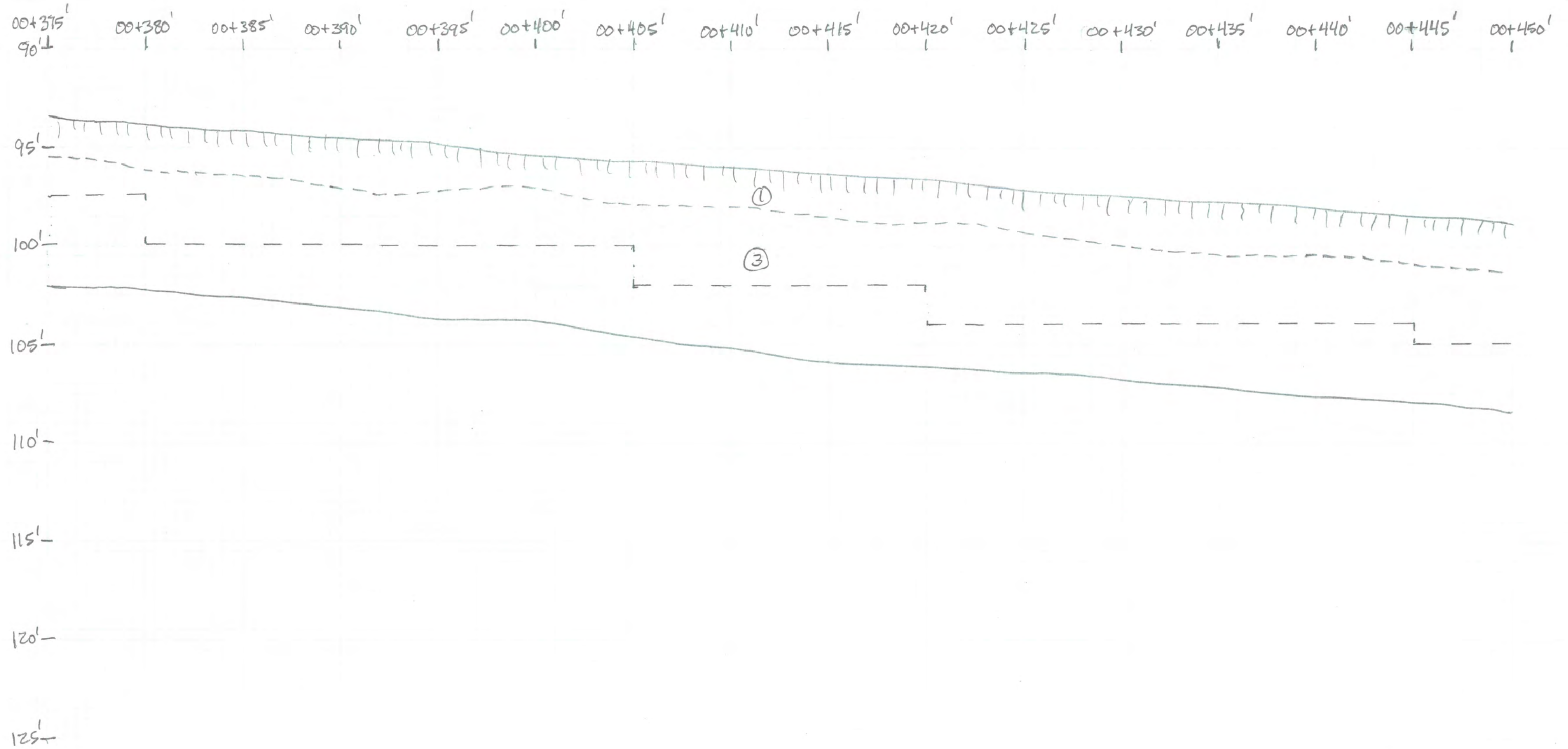


Figure 6

Trench ET-2 (continued)

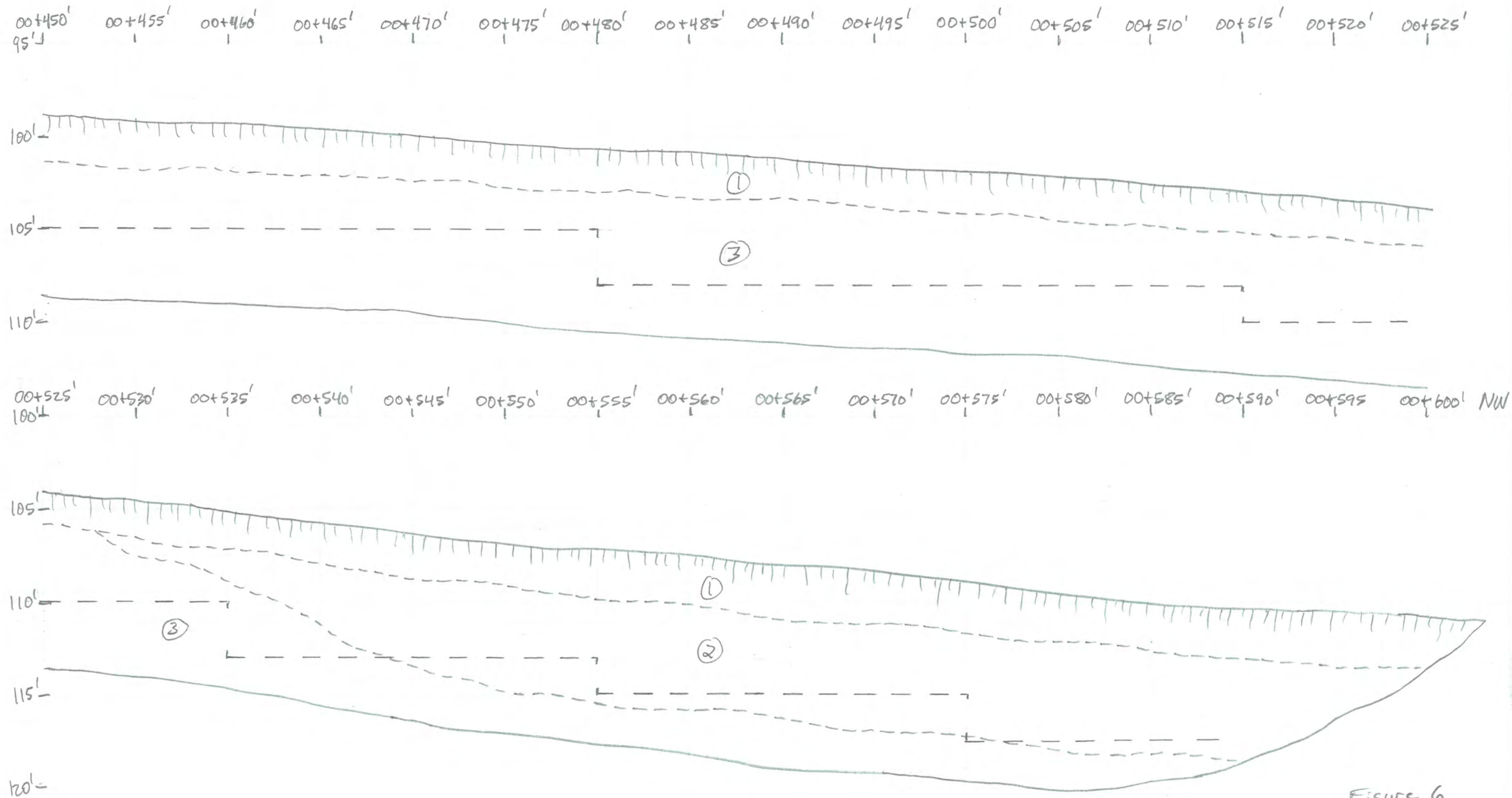
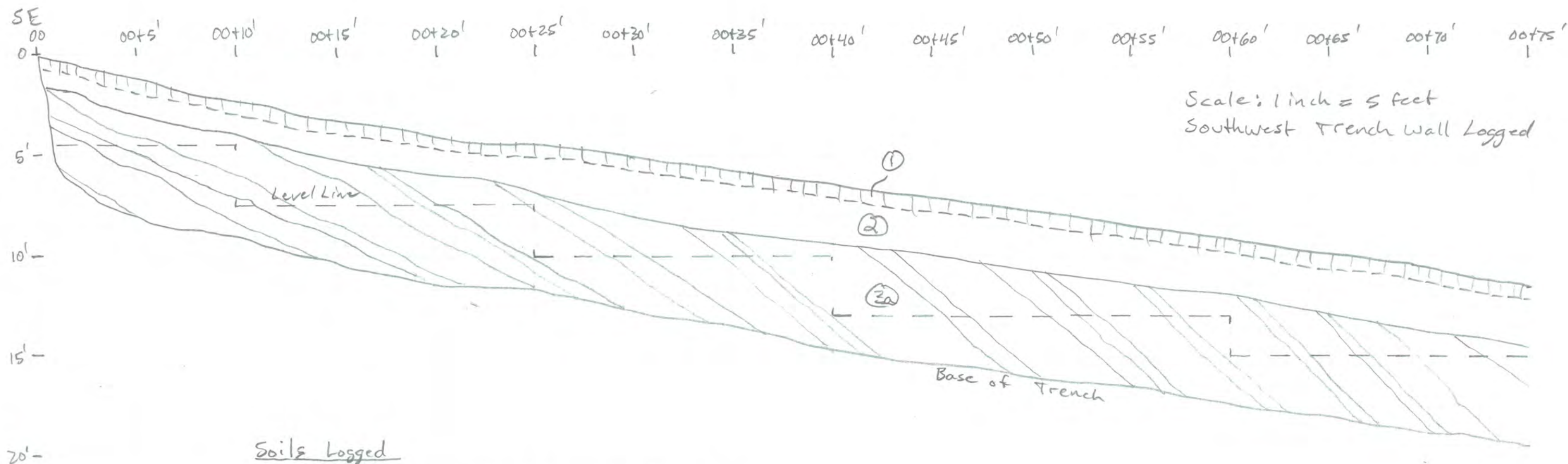


Figure 6

Trench Log - Trench ET-3, Santaquin Development, Santaquin, UT
Logged By: Mark Larsen, P.G. 2/19 - 2/20, 2019



Soils Logged

- 1.) Modern Topsoil - Soil A horizon formed Unit 2.
- 2.) Younger Fan - Alluvium & Colluvium, Undivided - Gravelly sand w/ silt, mostly massive, pebble to a few cobble-sized clasts, brown.
- 3a.) Lacustrine Sands and Gravels - Bonneville Lake Cycle - Bedded sands and gravels, mostly pebble-sized gravels, beds dip steeply in SE portion of trench and flatten to NW. - may show both transgressive and regressive deposits. gray to grayish-tan. Includes some gravel lenses w/ cobbles.
- 3b.) Lacustrine silts and sands - Bonneville Lake Cycle - Thinly-bedded, interbedded fine sands and silts, grayish-tan.
- 4.) Lacustrine silts and clays - Bonneville Lake Cycle - Thinly bedded, interbedded silts and clays w/ some fine sand beds, grayish-tan.
- 5.) Lacustrine Gravels - Bonneville Lake Cycle - Bedded, subrounded to rounded gravels, pebble to small boulder-sized clasts, w/ sand, gray.



Figure 7

Trench ET-3 (continued)

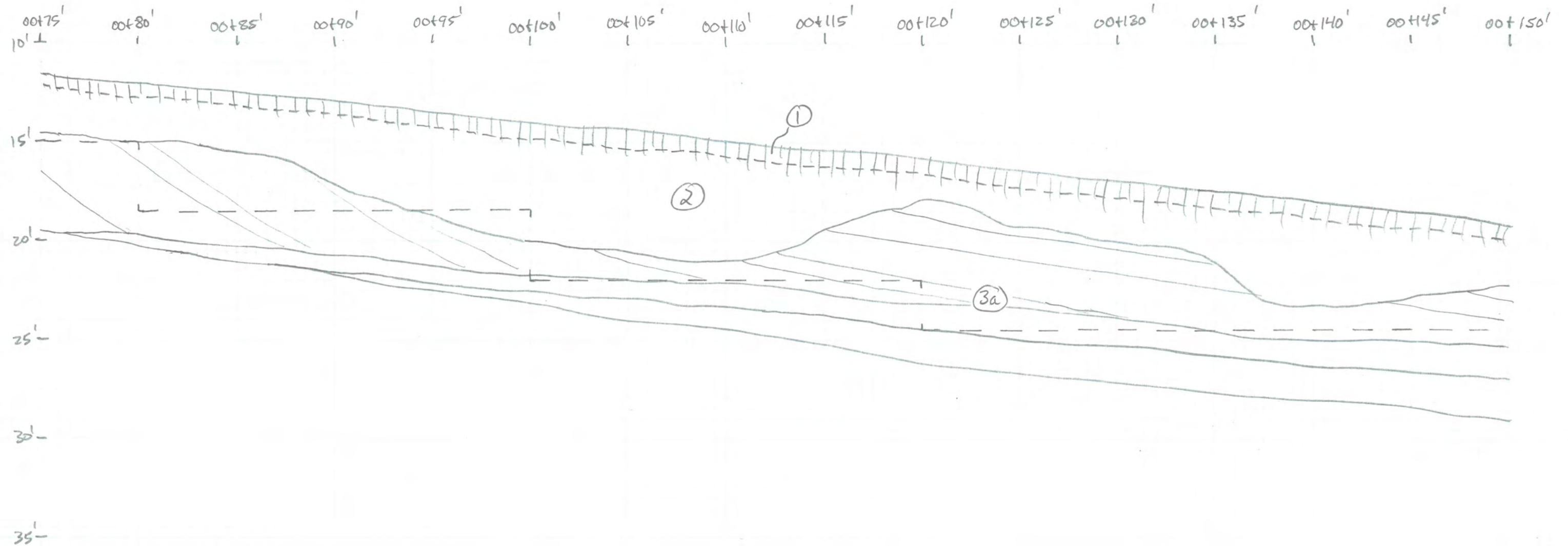


Figure 7

Trench ET-3 (Continued)

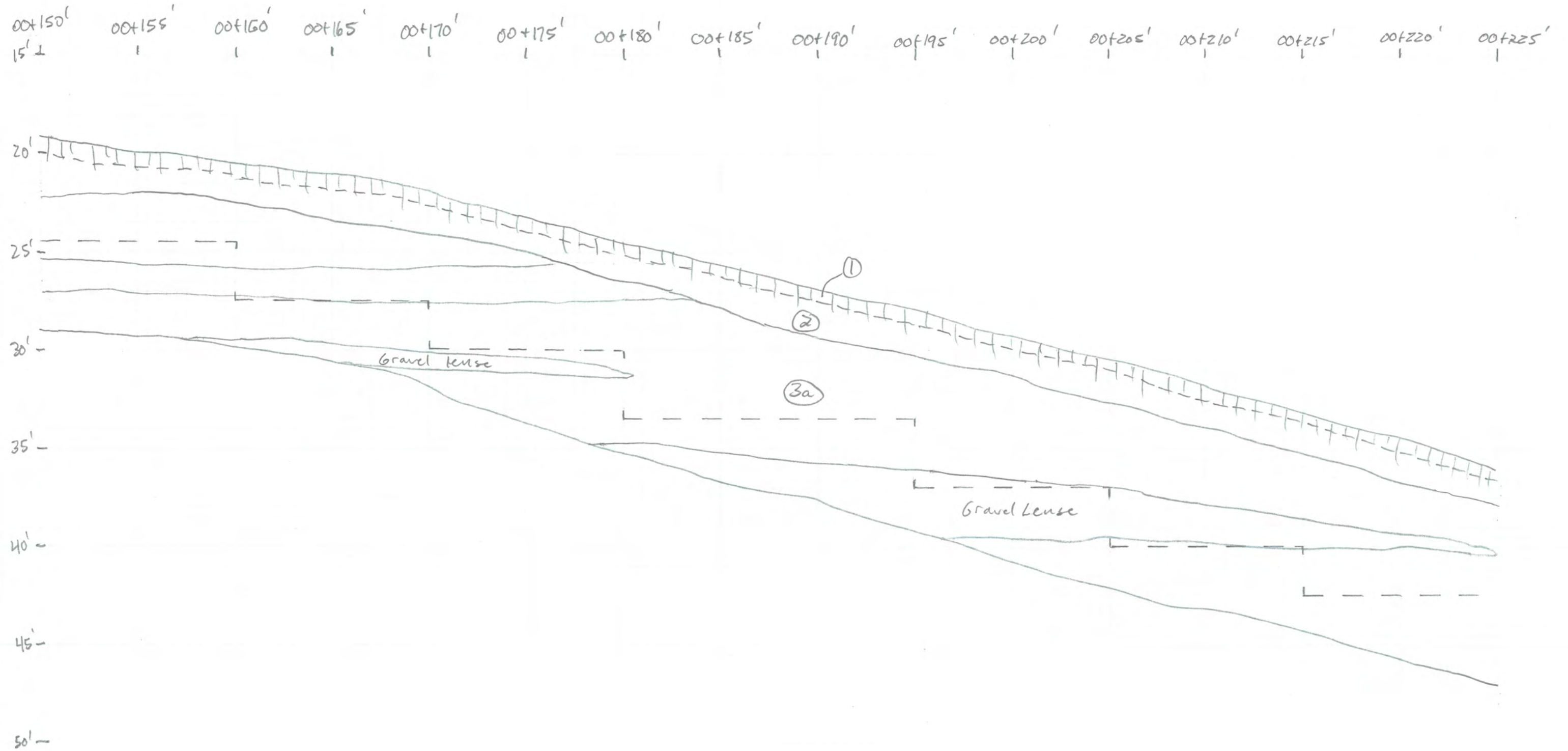


Figure 7

Trench ET-3 (Continued)

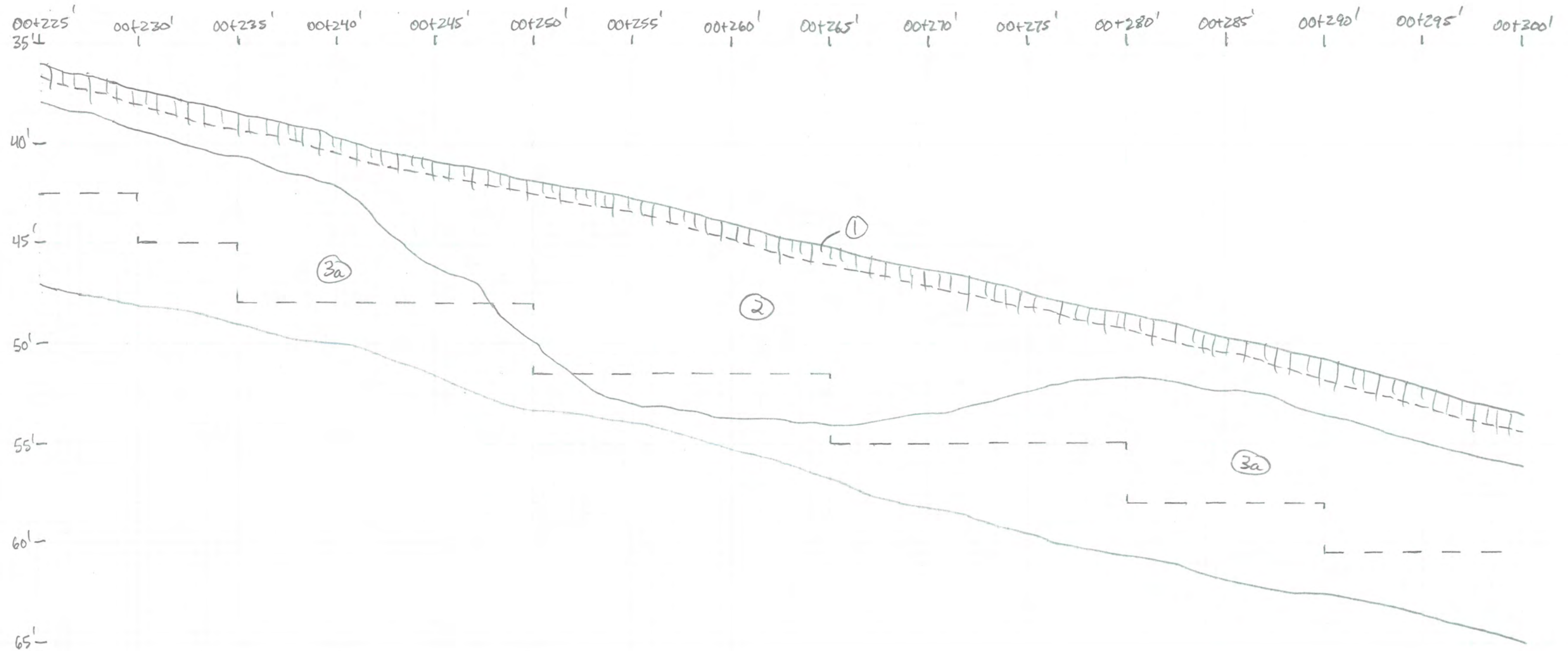


Figure 7

Trench ET-3 (continued)

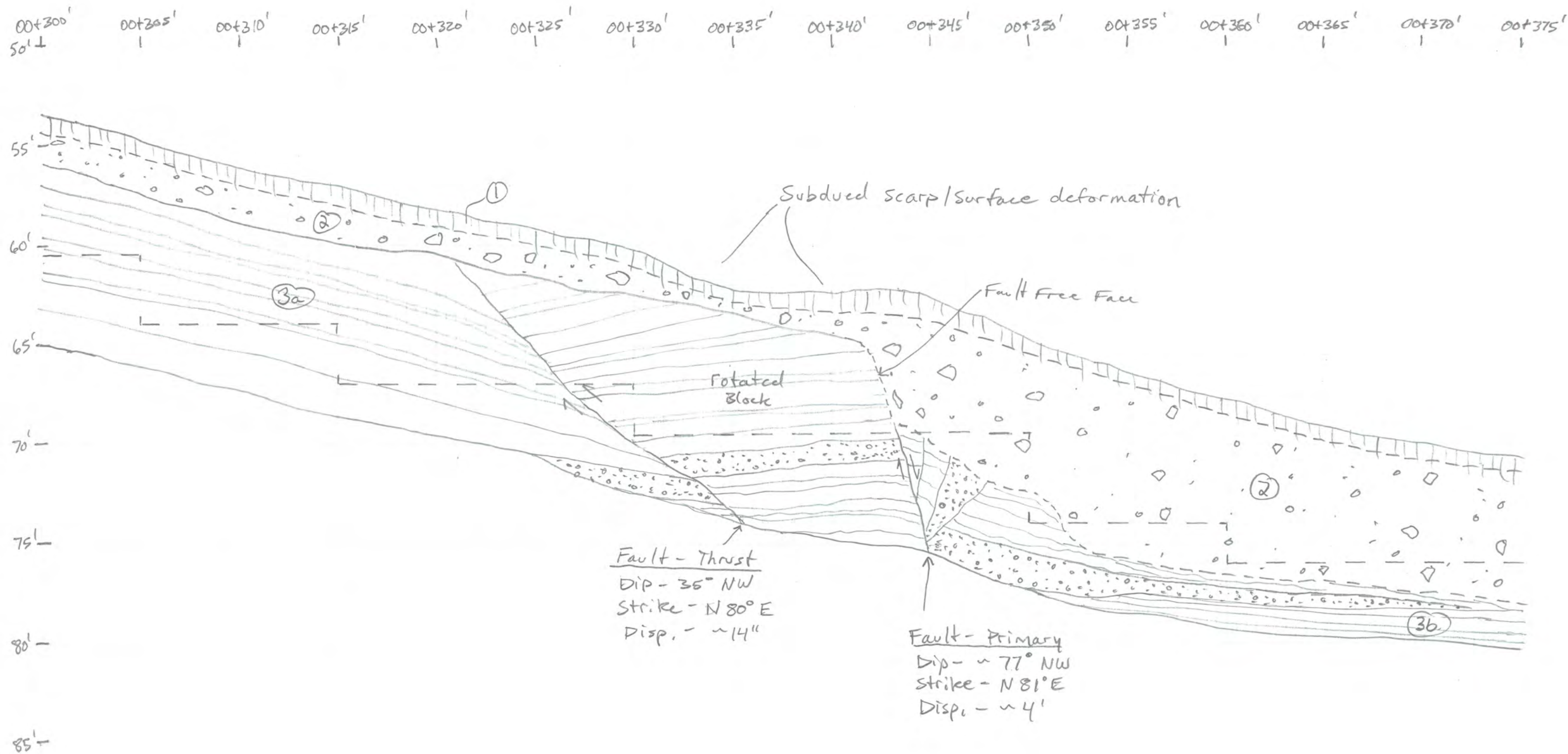


Figure 7

Trench ET-3 (continued)

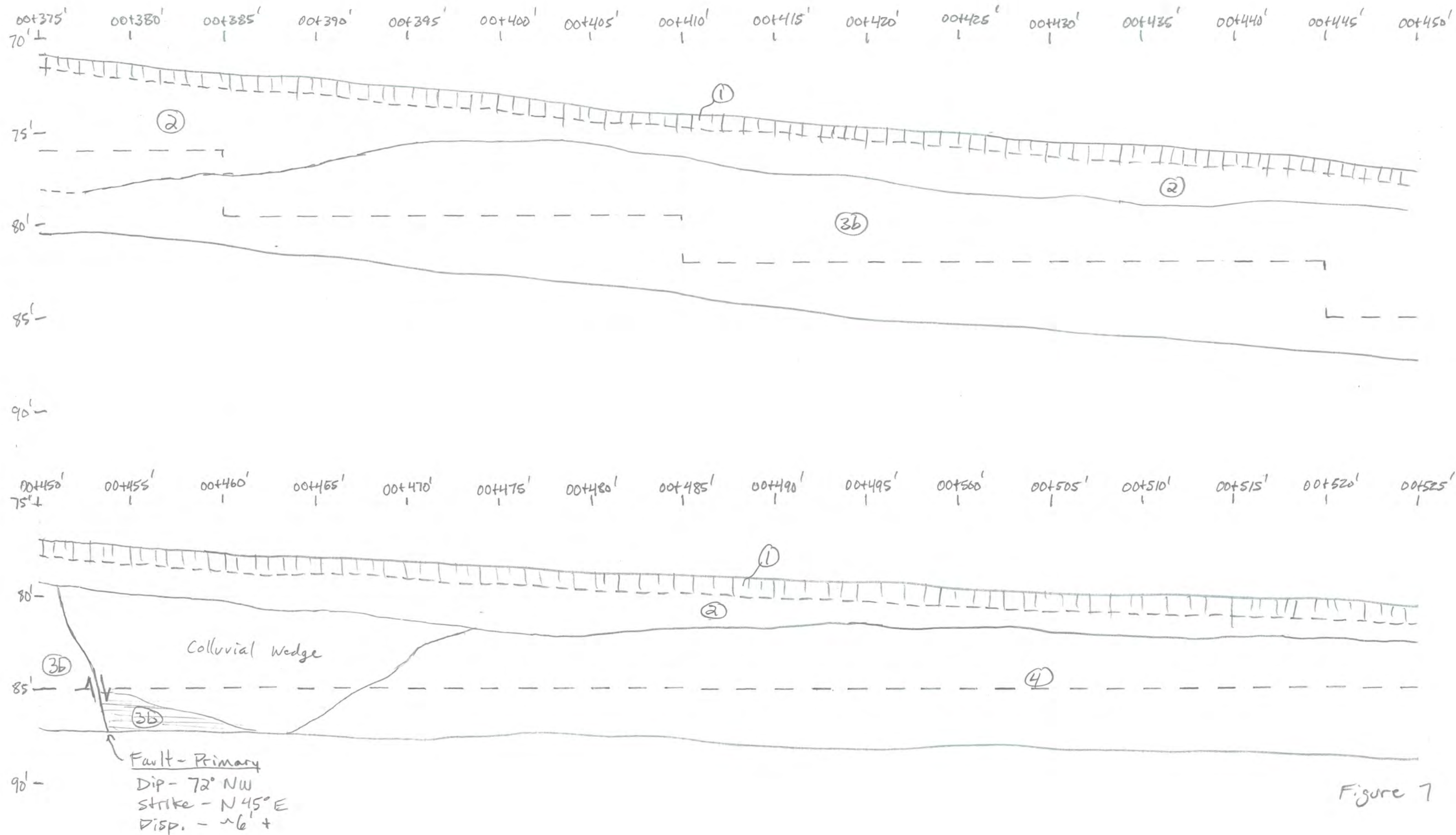
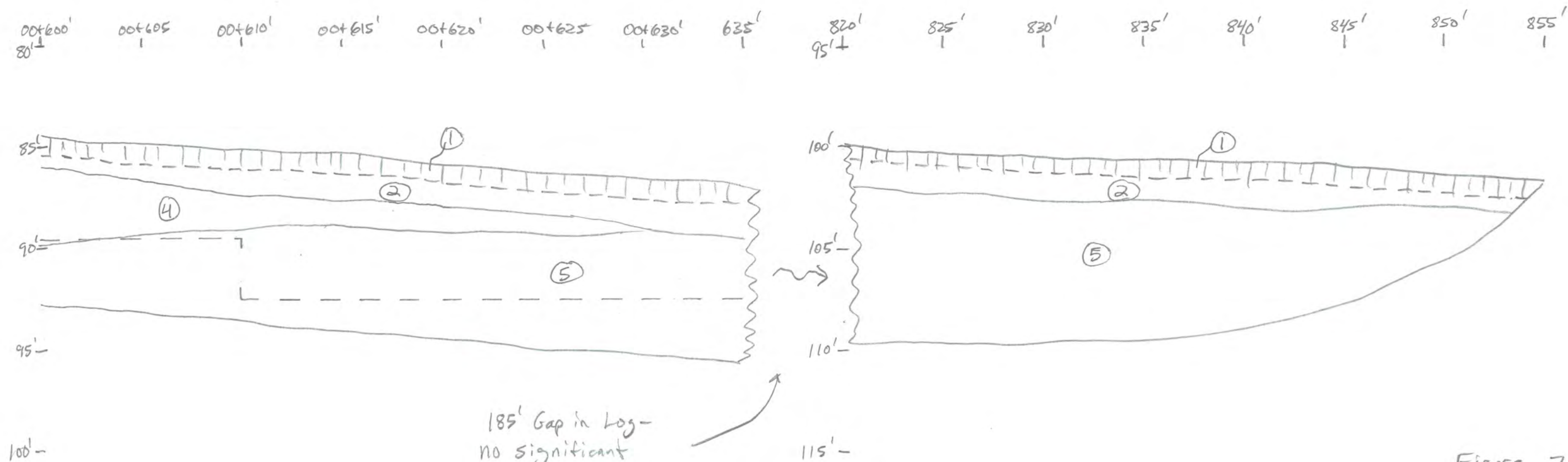
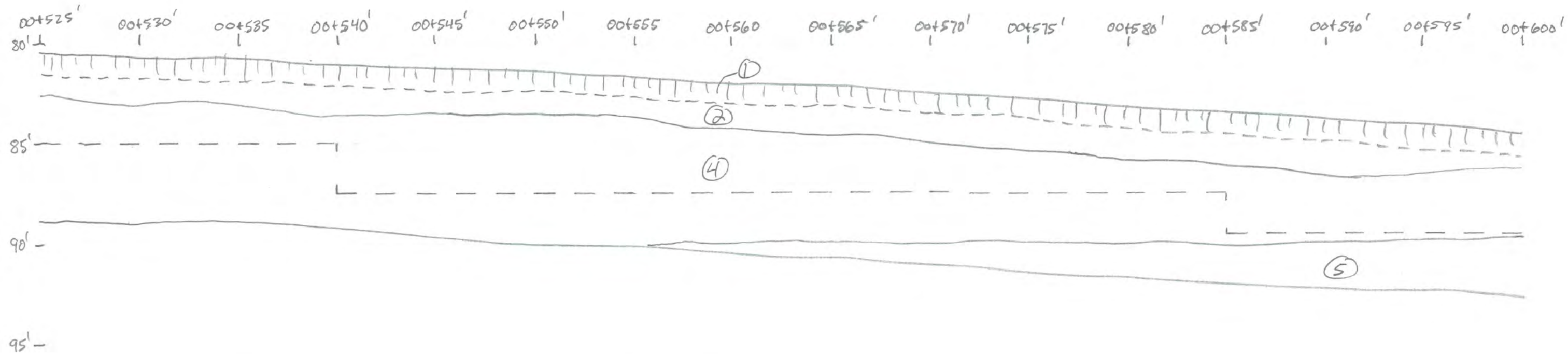


Figure 7

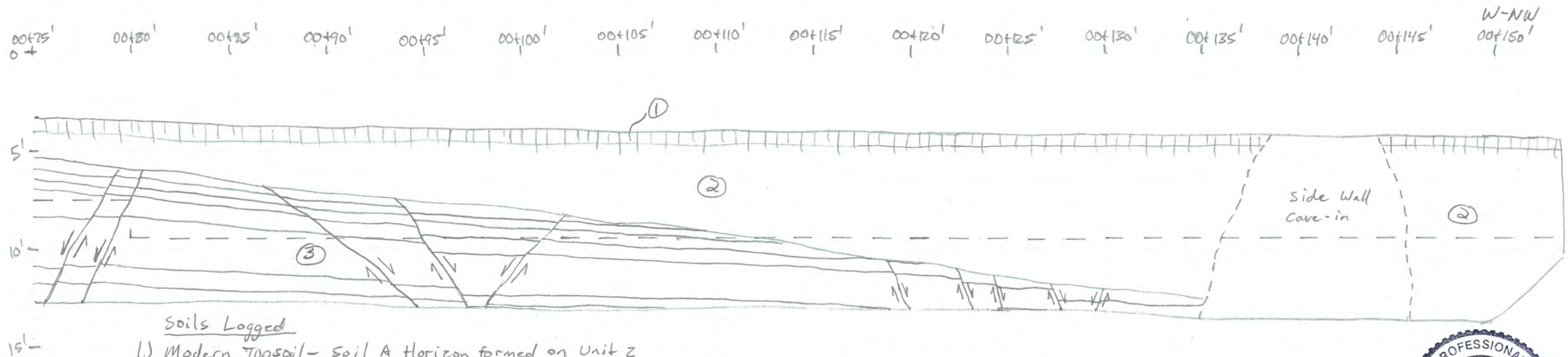
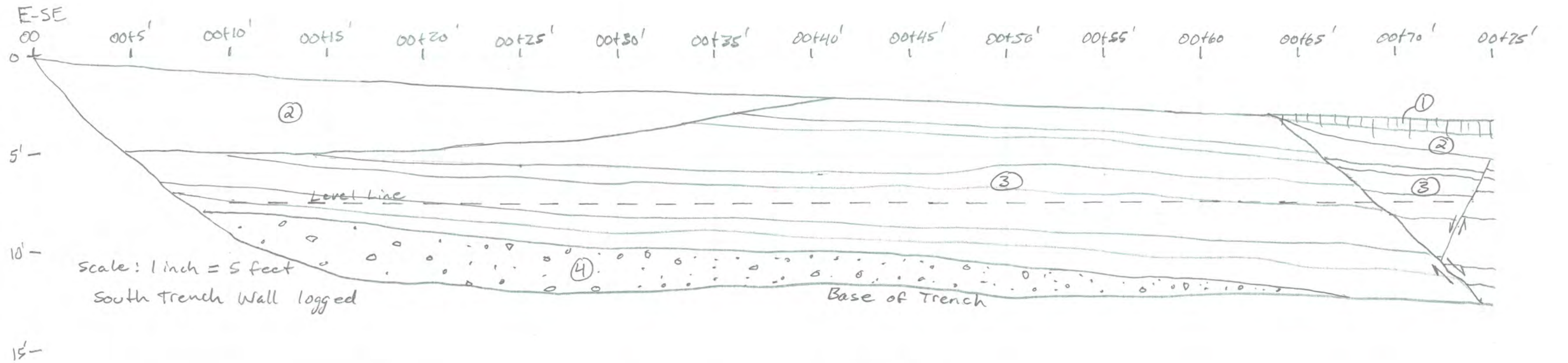
Trench ET-3 (Continued)



185' Gap in Log -
 no significant
 features or changes
 in strata.

Figure 7

Trench Log - Trench ET-4 Santaquin Development, Santaquin, UT
logged By: Mark Larsen, P.G. 3/25/19



Soils Logged

- 1.) Modern Topsoil - Soil A Horizon formed on Unit 2
- 2.) Channel fills - Sands and silts w/ some gravel - similar to Units 1 & 2 in ET-1, light brown.
- 3.) Lacustrine Deposits - Bonneville Lake Cycle - Bedded gravels and sands, pebble to cobble-sized gravel clasts, rounded to subrounded clasts, gray to grayish-tan.
- 4.) Older Fan-Alluvium - Pre Bonneville Lake Cycle - clayey gravel, angular, pebble-sized clasts, massive, grayish-brown.



Figure 8

Trench Log - Trench ET-S Santaquin Development, Santaquin, UT
Logged By: Mark Larsen, P.G. 4/18/19

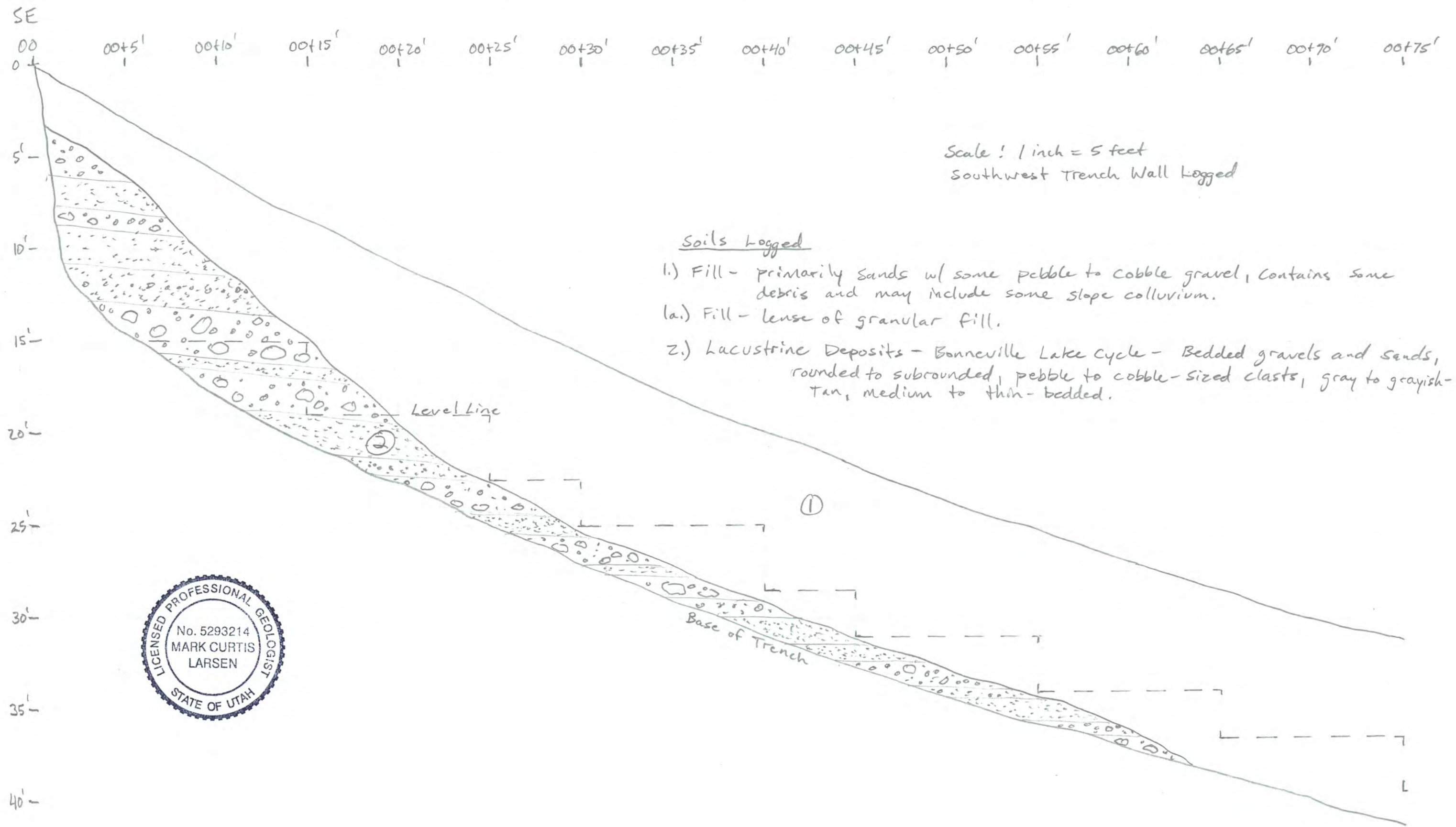


Figure 9

Trench ET-5 (Continued)

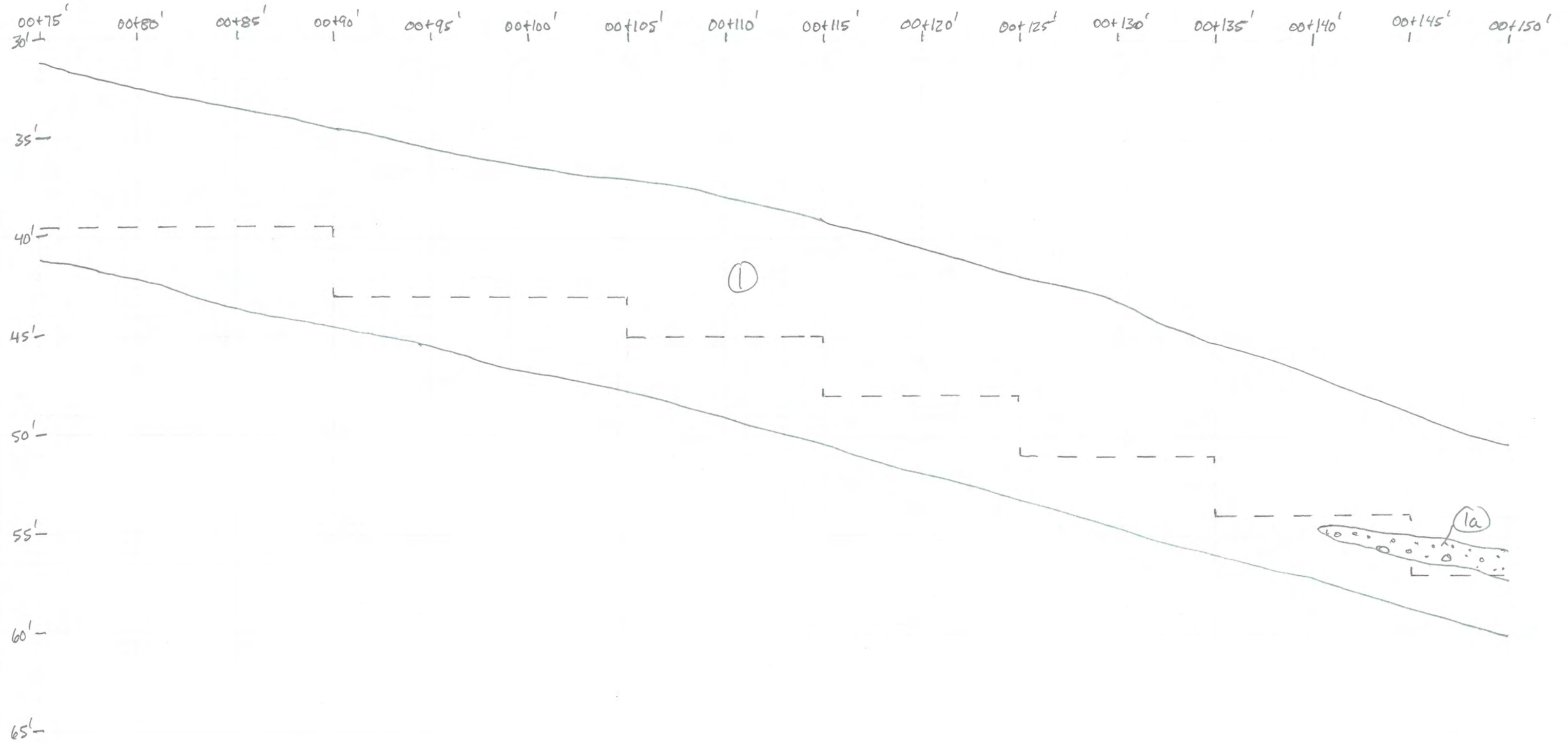


Figure 9

Trench ET-5 (continued)

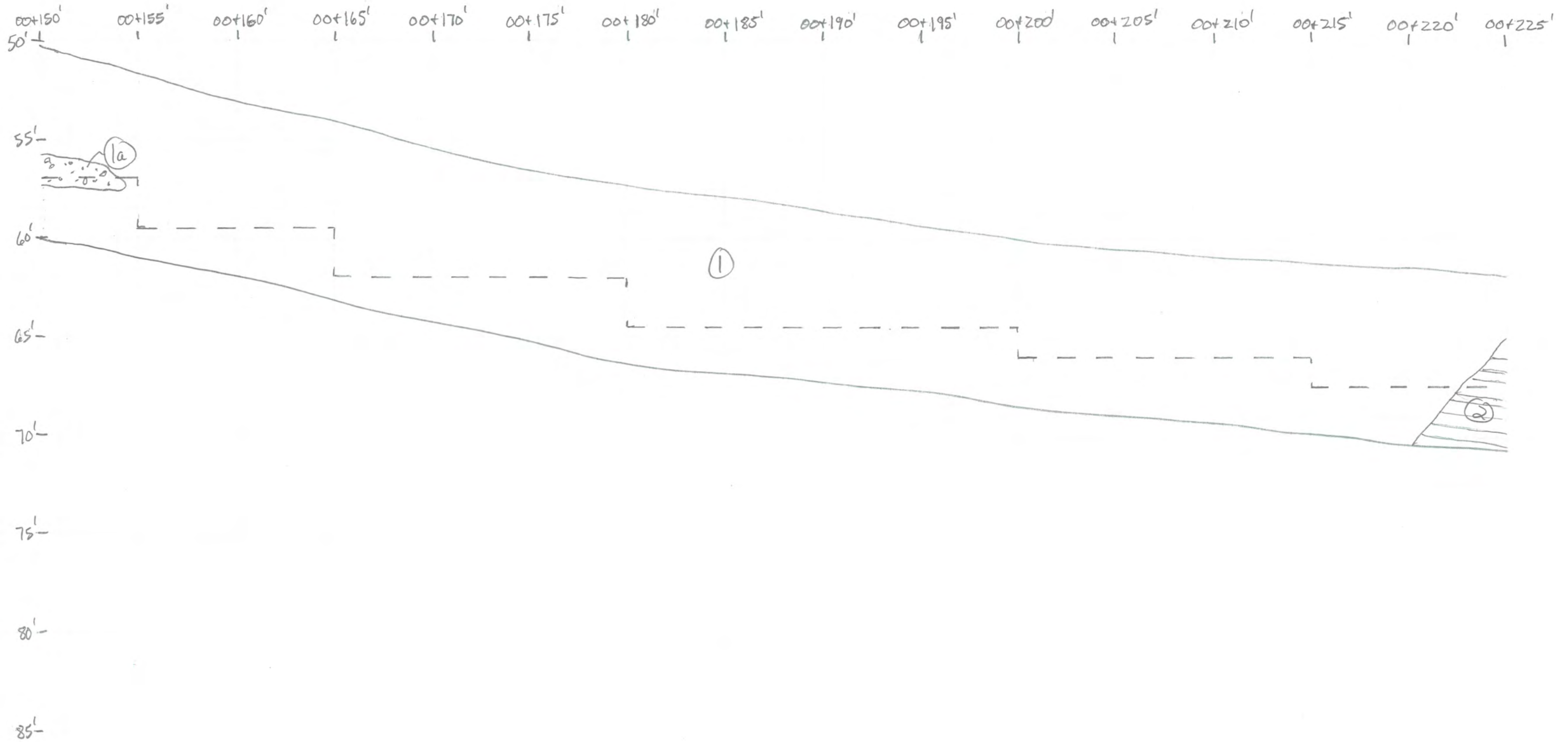


Figure 9

Trench ET-5 (Continued)

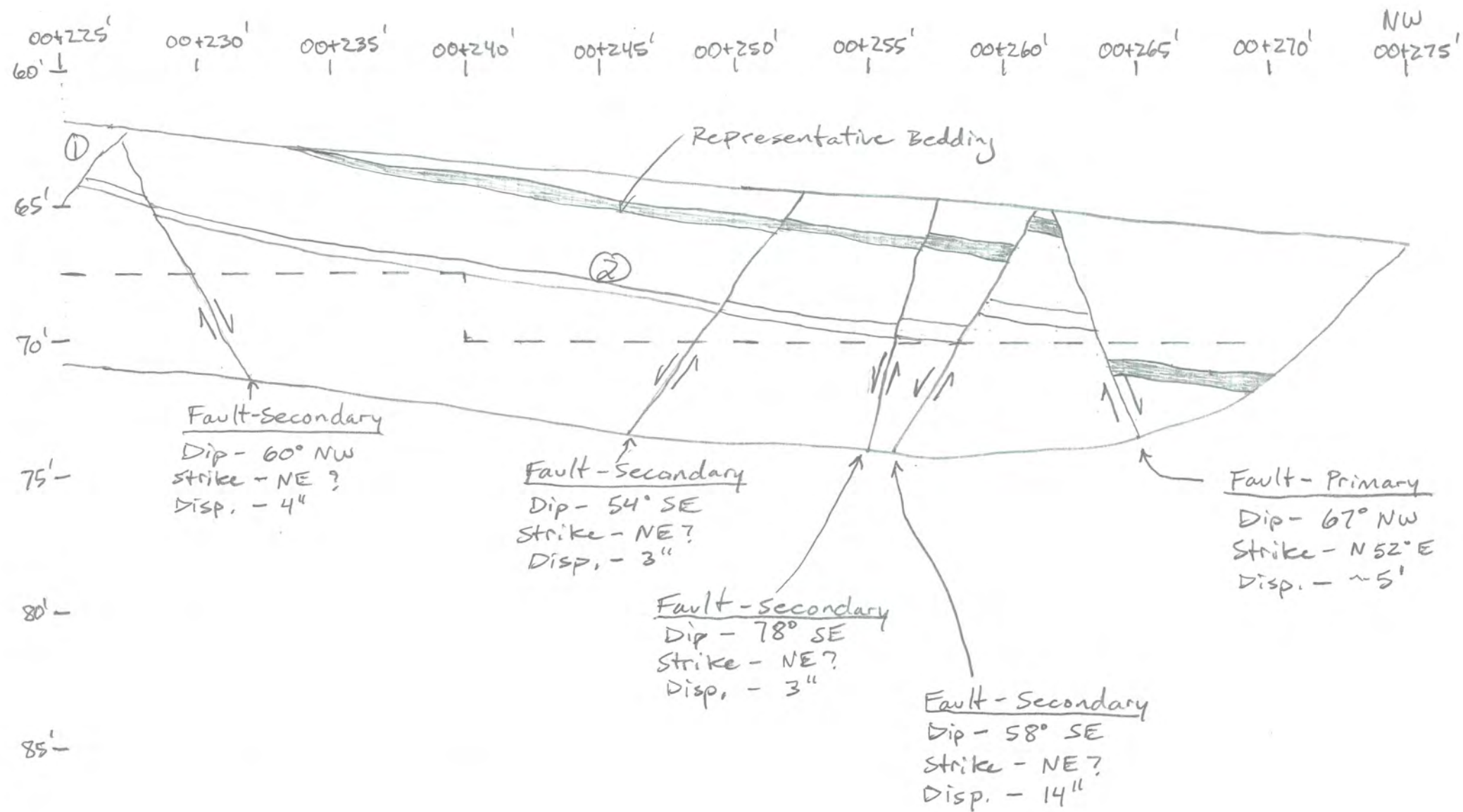
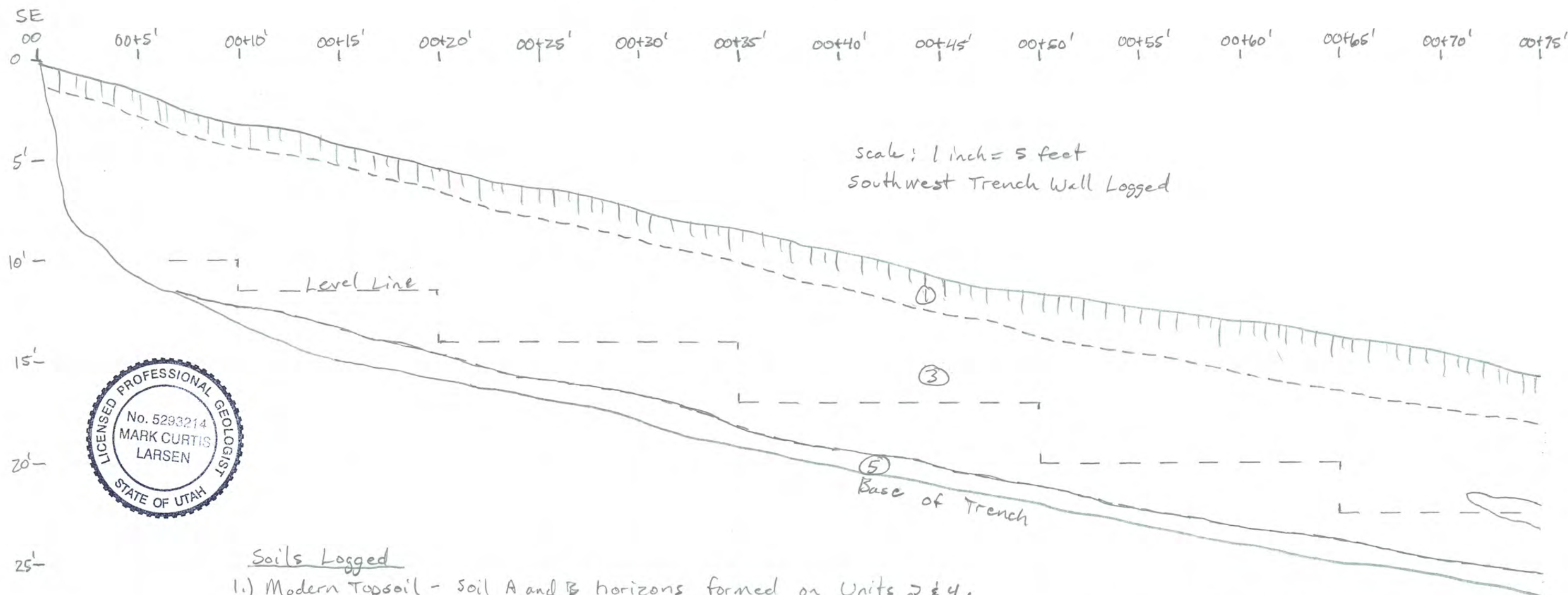


Figure 9

Trench Log - Trench ET-6 Santaquin Development, Santaquin, UT
Logged By: Mark Larsen, P.G. 4/19/19



Soils Logged

- 1.) Modern Topsoil - Soil A and B horizons formed on Units 2 & 4.
- 2.) Channel Fill - Alluvium - Silty gravel w/ sand and some clay, weakly bedded, pebble-sized cobbles, brown.
- 3.) Alluvial-Fan Deposits - Mostly sand w/ gravel and minor silt and clay, pebble to a few cobble-sized gravel clasts, likely deposited in multiple events, brown to light-brown. Includes a few clean gravel lenses.
- 4.) Lacustrine Gravels - Bonneville Lake Cycle - Gravels w/ sand and some silt, rounded to subrounded clasts, pebble to a few cobble-sized clasts, bedded, gray.
- 5.) Lacustrine Sands - Bonneville Lake Cycle - Sands, bedded, light-brown to gray. Did not observe any displacement or deformation that could be directly related to faulting.

Figure 10

Trench ET-6 (continued)

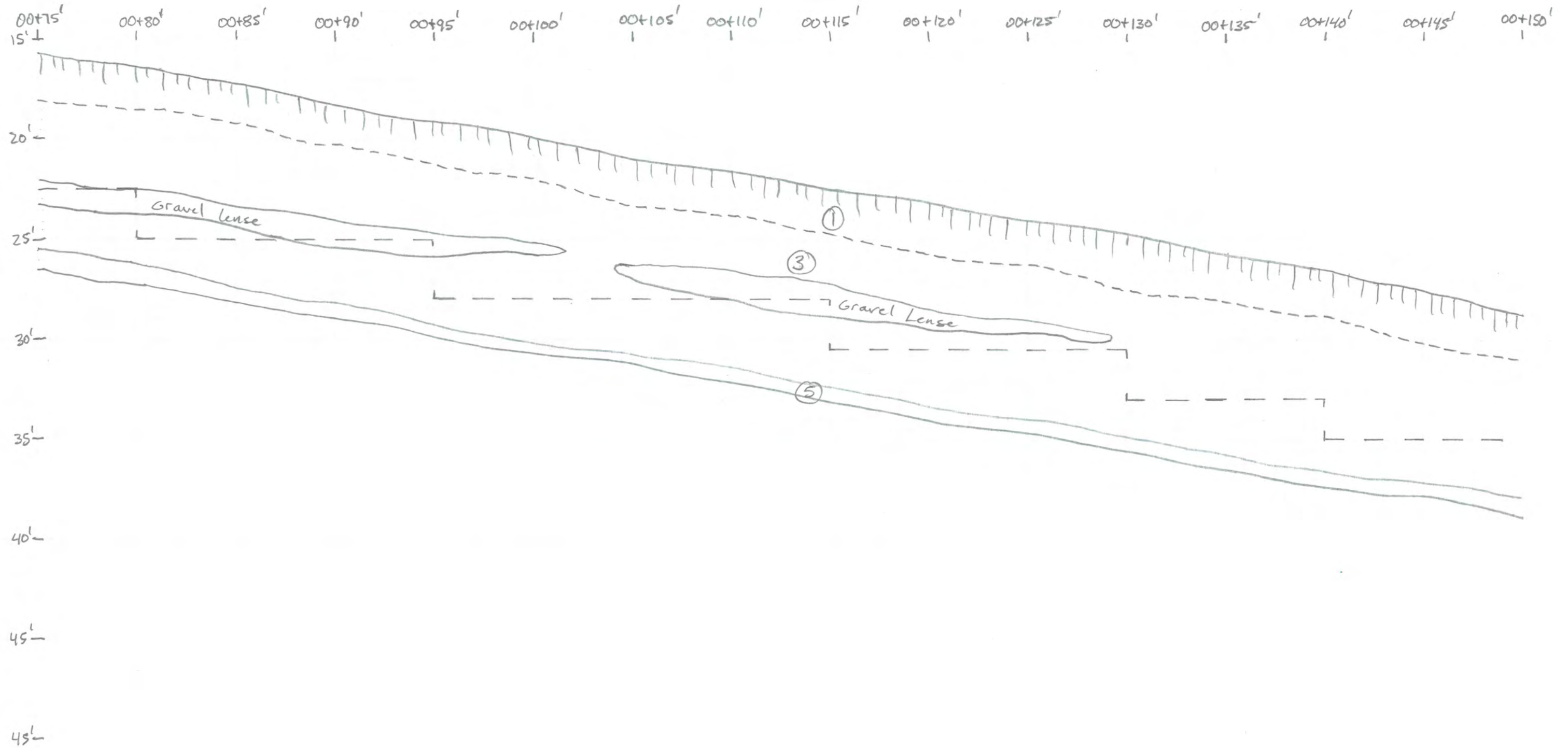


Figure 10

Trench ET-6 (Continued)

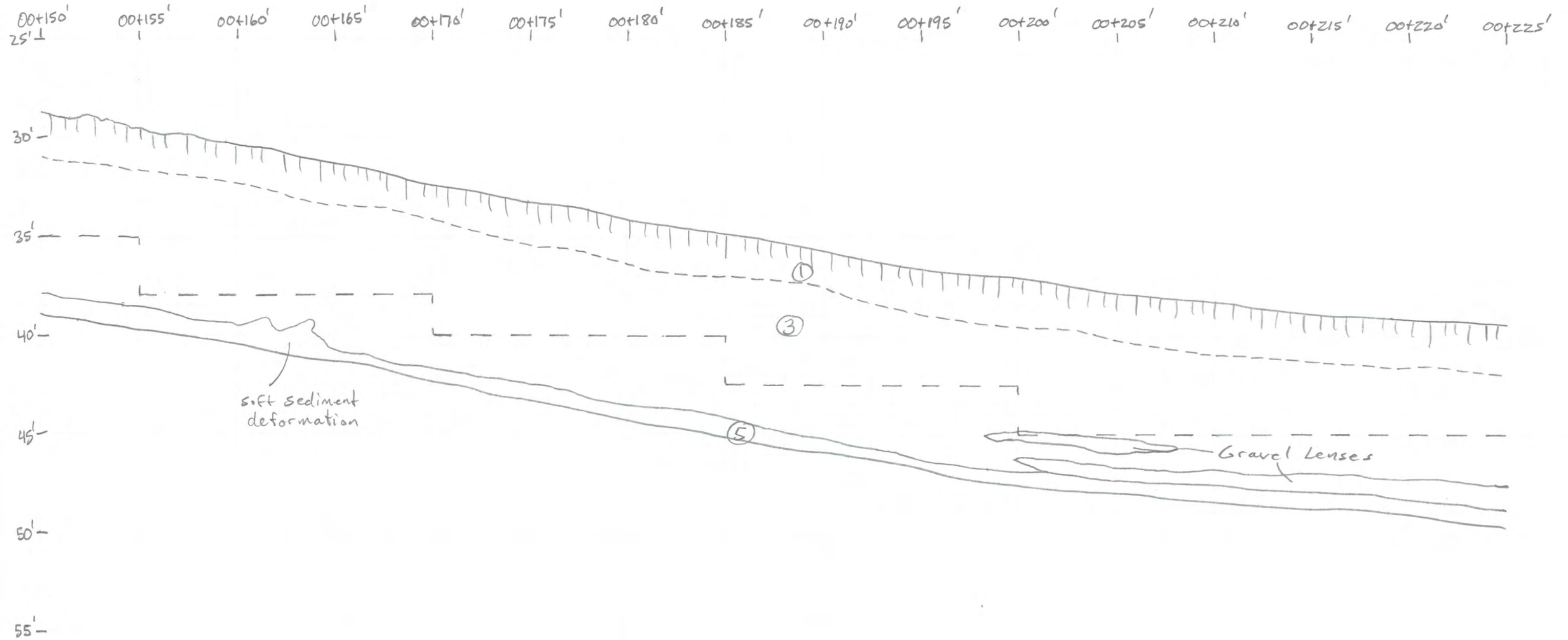


Figure 10

Trench ET-6 (Continued)

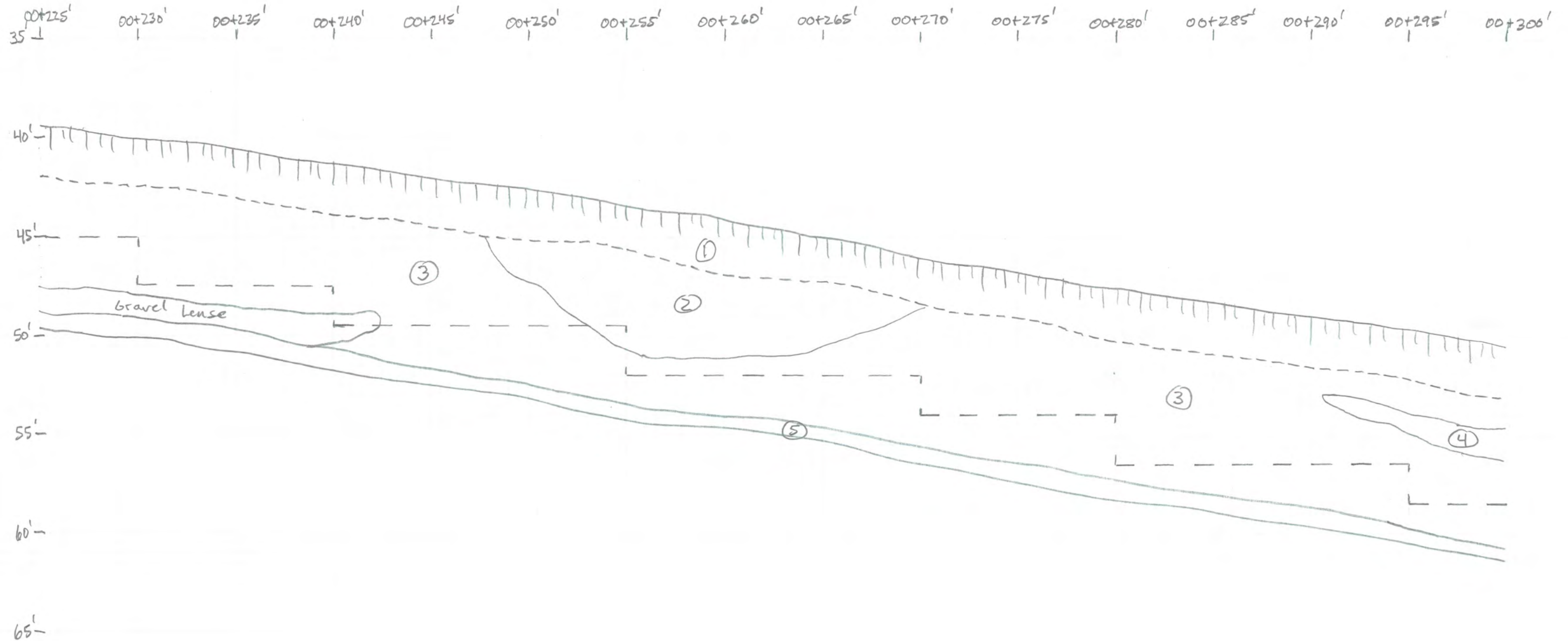


Figure 10

Trench ET-6 (Continued)

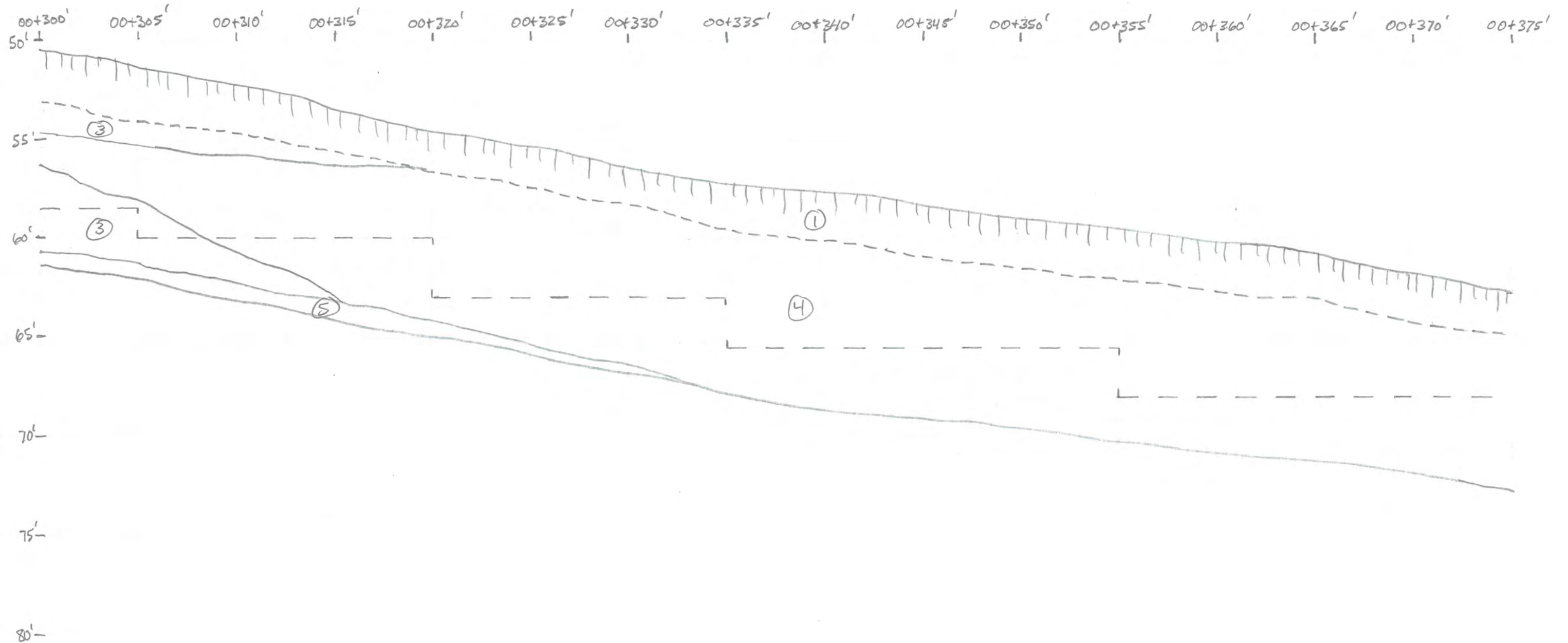


Figure 10

Trench ET-6 (Continued)

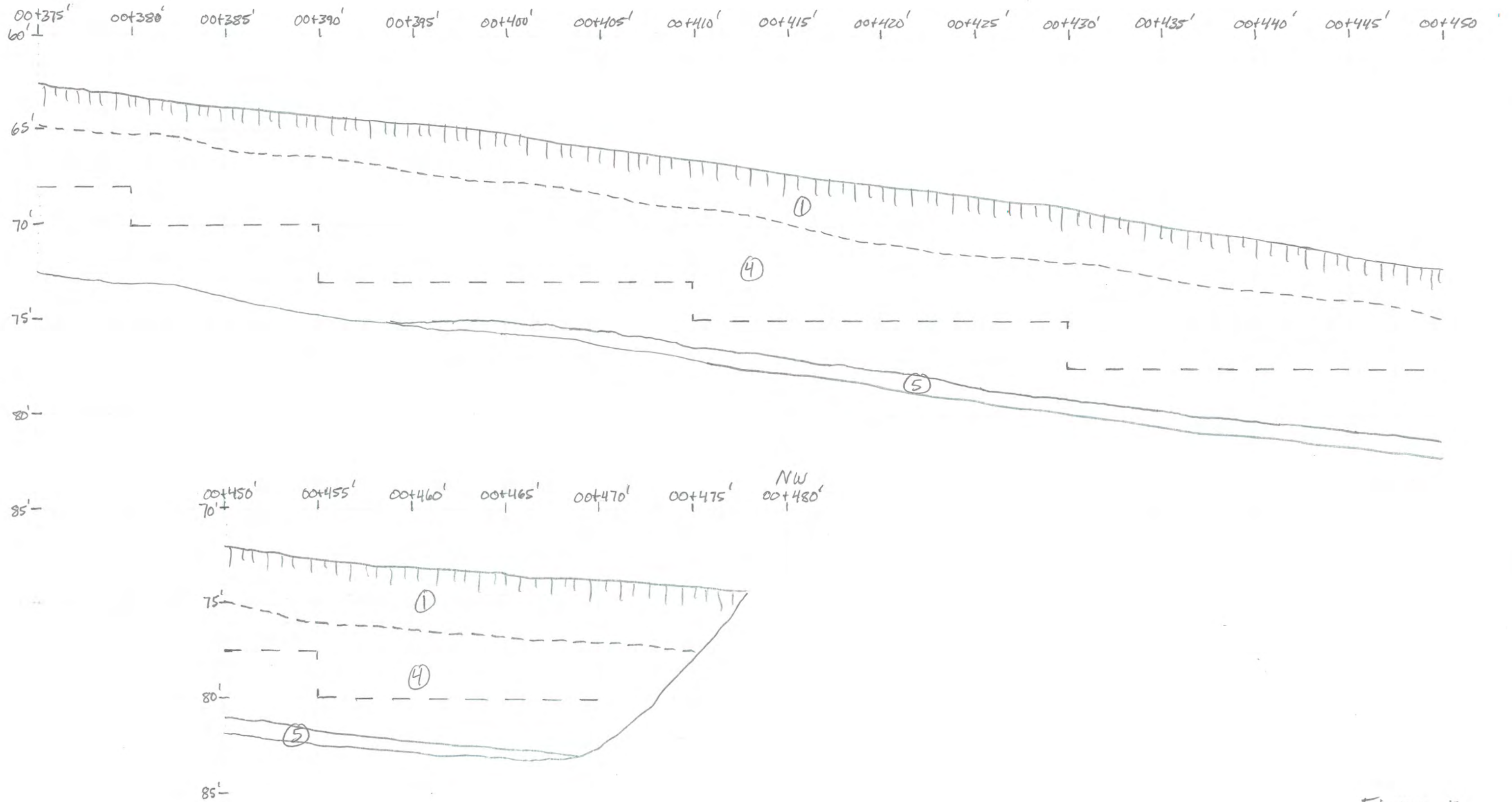


Figure 10

Trench Log - Trench ET-7 Santaquin Development, Santaquin, UT
Logged By: Mark Larsen, P.G. 4/19 - 4/20, 2019

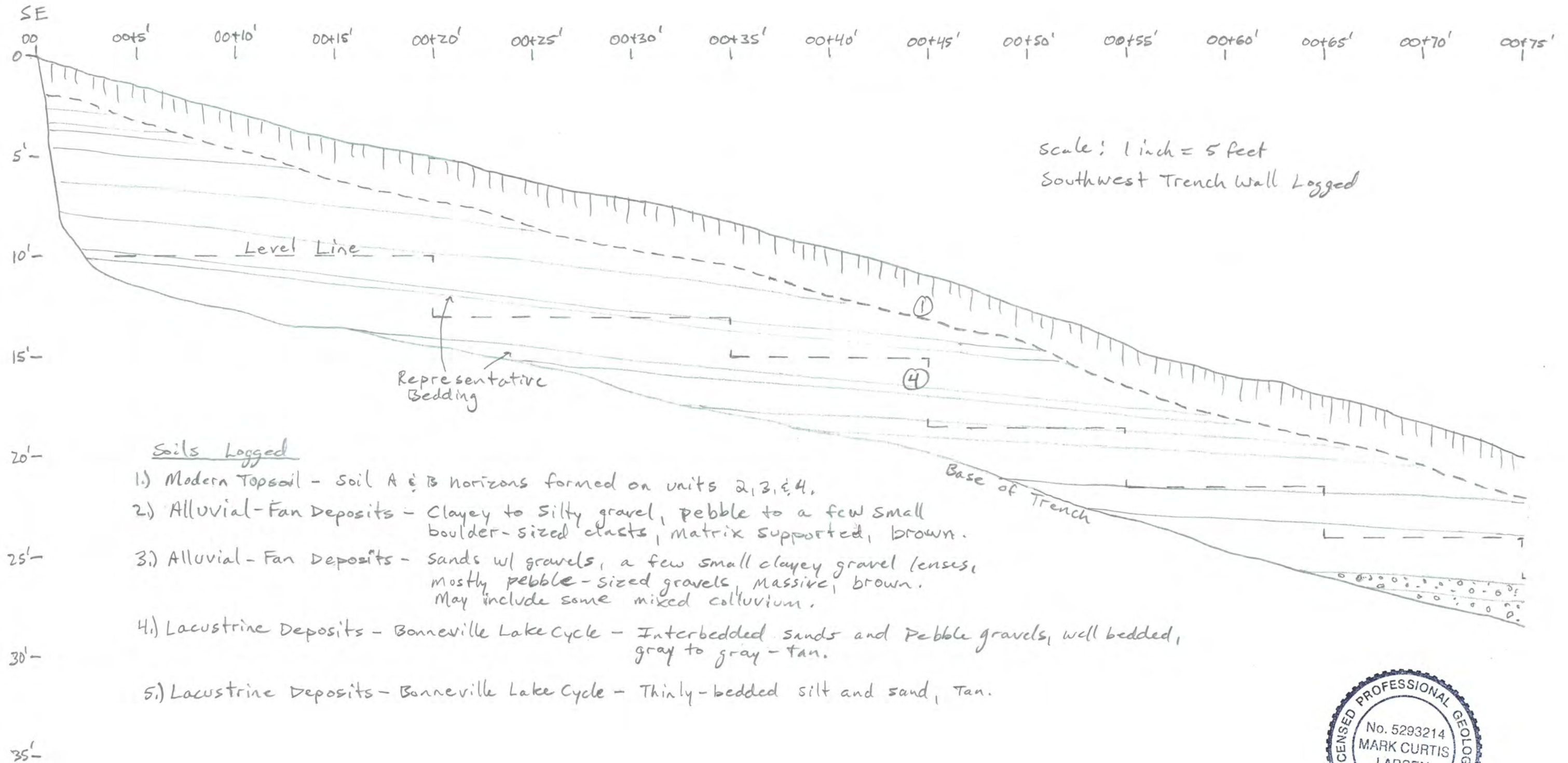


Figure 11

Trench ET-7 (continued)

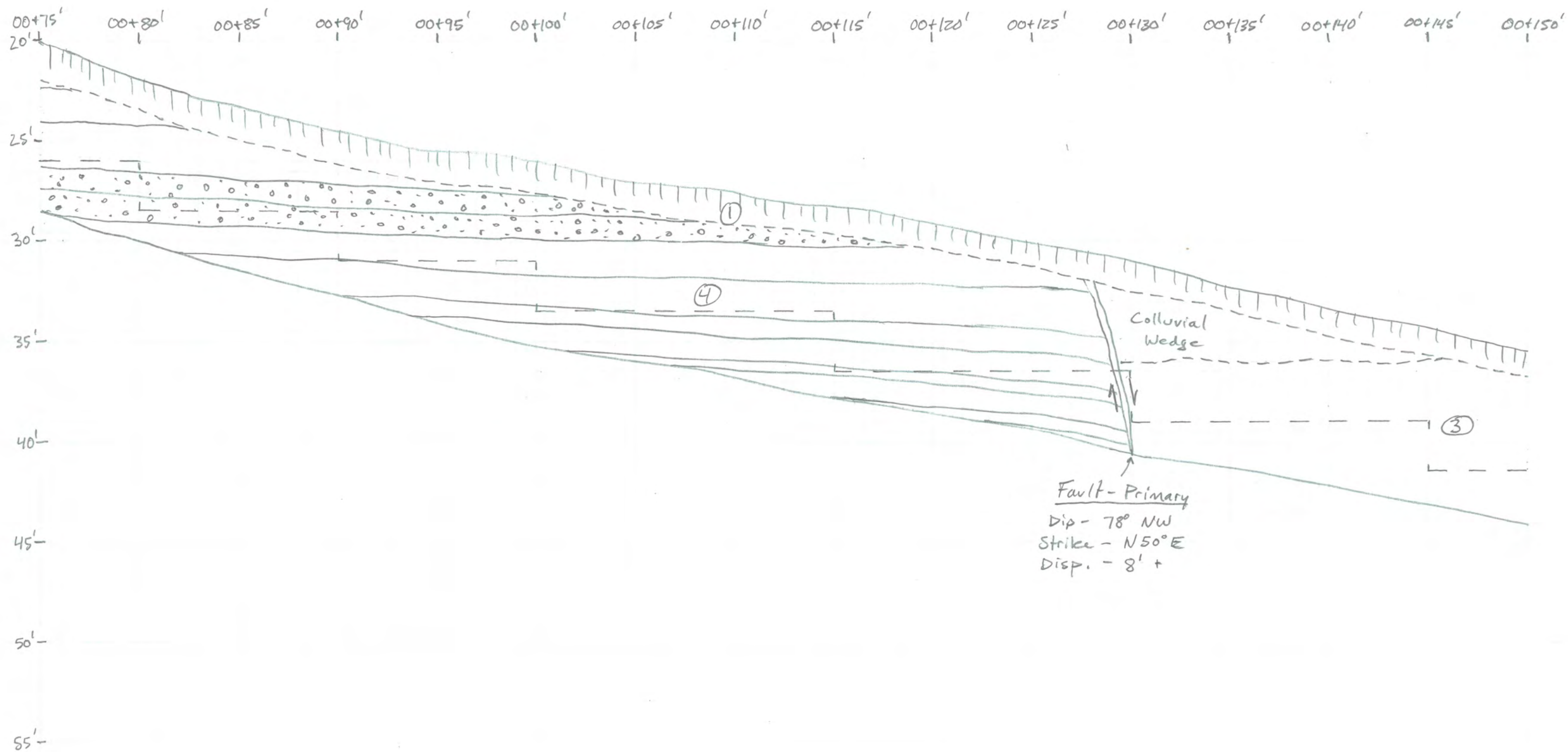


Figure 11

Trench ET-7 (continued)

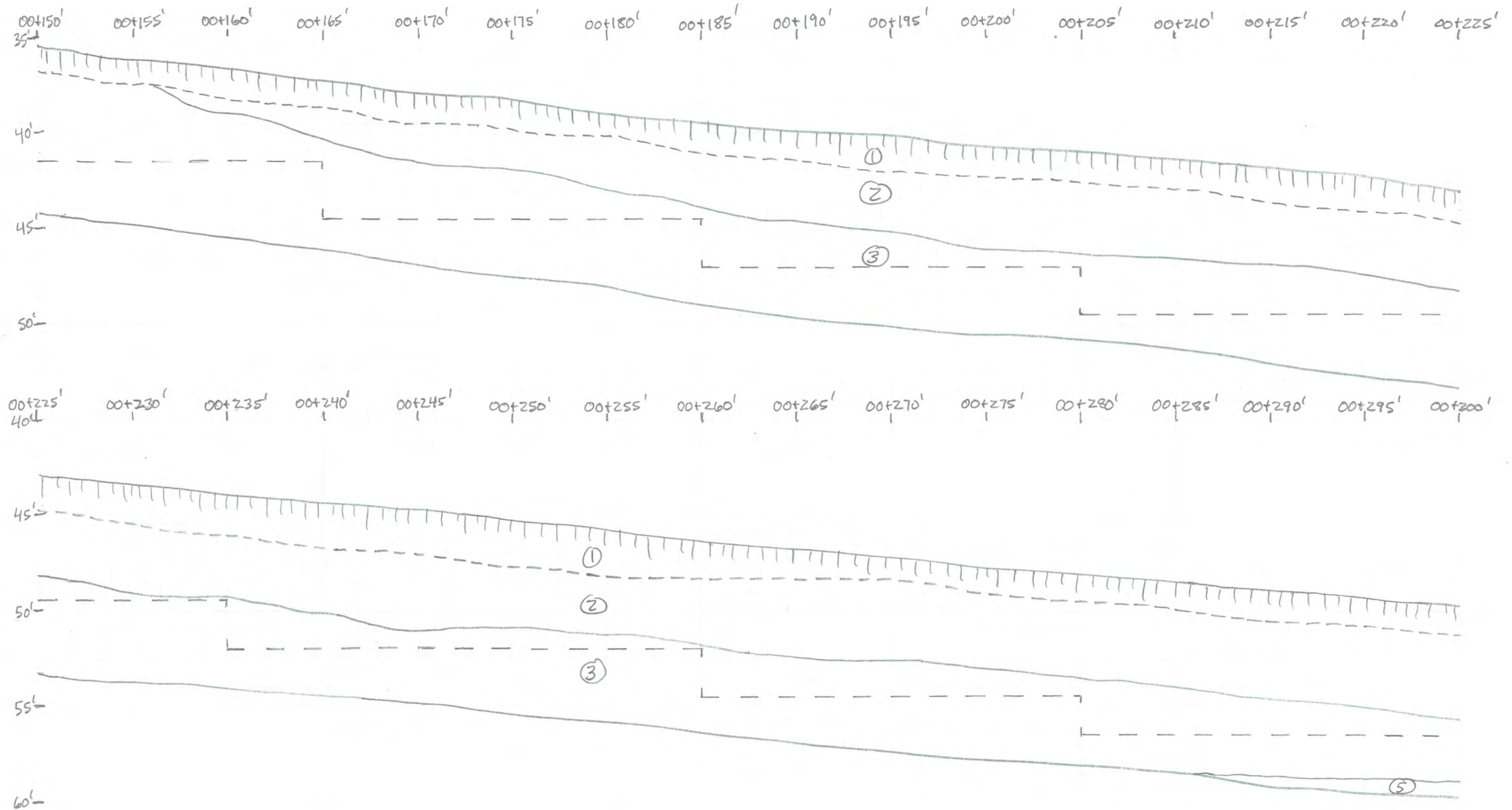


Figure 11

Trench ET-7 (continued)

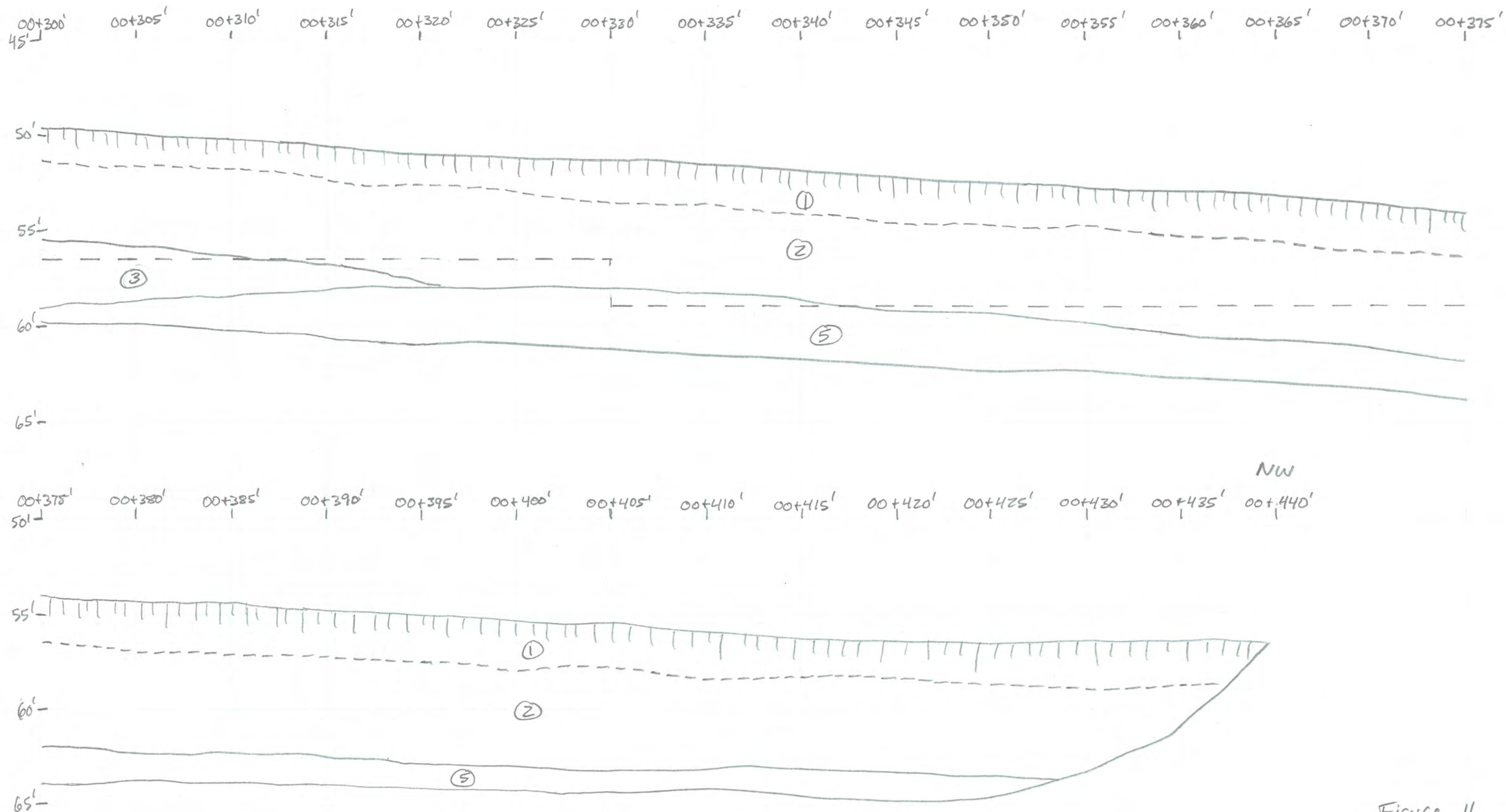
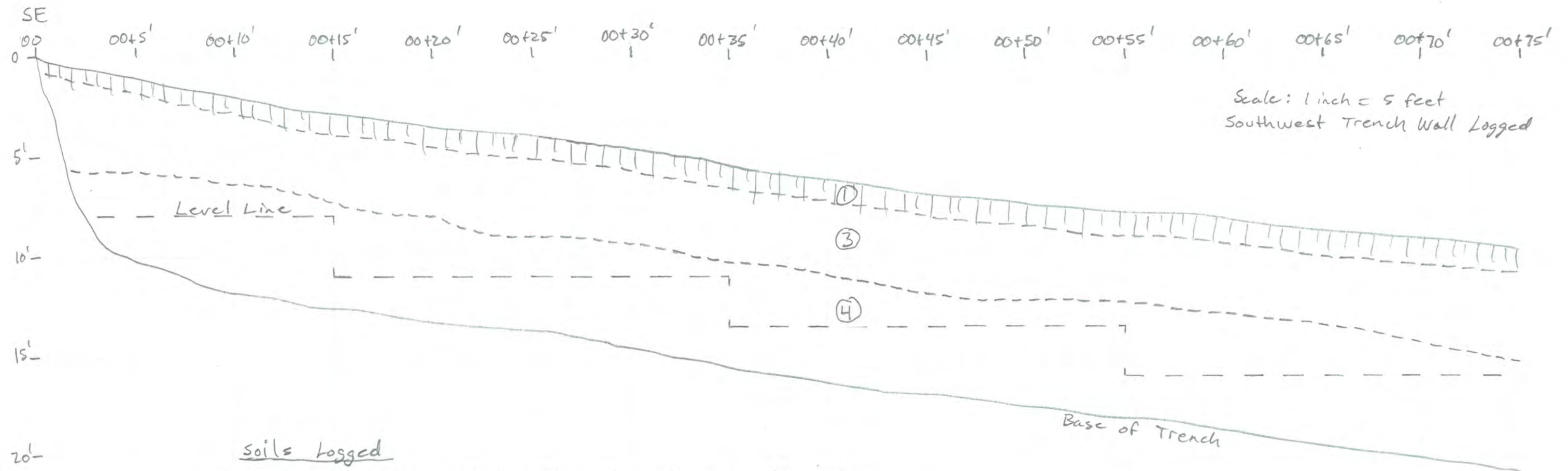


Figure 11

Trench Log, Trench ET-8 Santaquin Development, Santaquin, UT
Logged By: Mark Larsen, P.G. 4/23/19



Soils Logged

- 1.) Modern Topsoil - Soil A horizon formed on units 2 & 3.
- 2.) Younger Alluvial-Fan Deposits - Clayey gravel w/ sand and silt, pebble to a few small boulder-sized clasts, clasts are angular to subrounded, mostly matrix supported, brown.
- 3.) Alluvial-Fan Deposits - Clayey gravel w/ sand and silt, pebble to a few small boulder-sized clasts, clasts are angular to subrounded, matrix supported, brown to light-brown.
 - 3a.) Sand lense w/ pebble gravel.
 - 3b.) Gravel lense w/ silty sand.
- 4.) Alluvial-Fan Deposits - Clayey gravel w/ sand and silt, pebble to cobble-sized clasts, clasts are angular to subrounded, matrix supported, brown.



Figure 12

Trench ET-8 (continued)

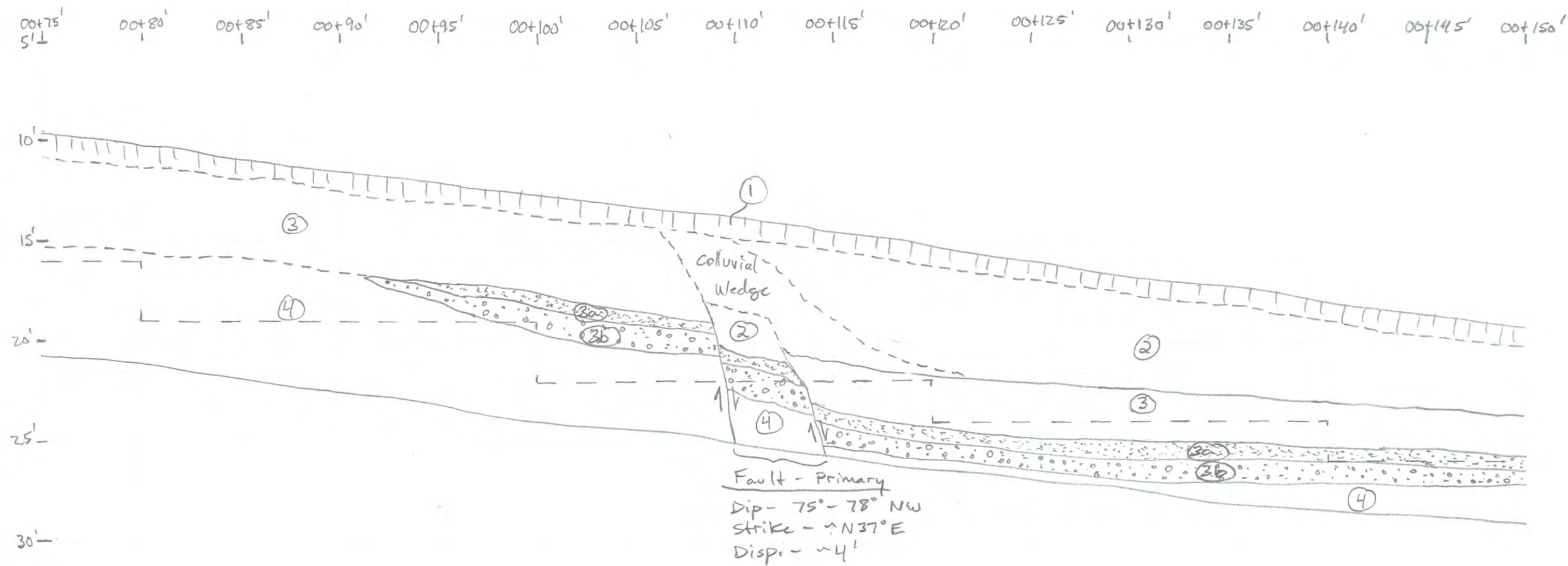


Figure 12

Trench ET-8 (continued)

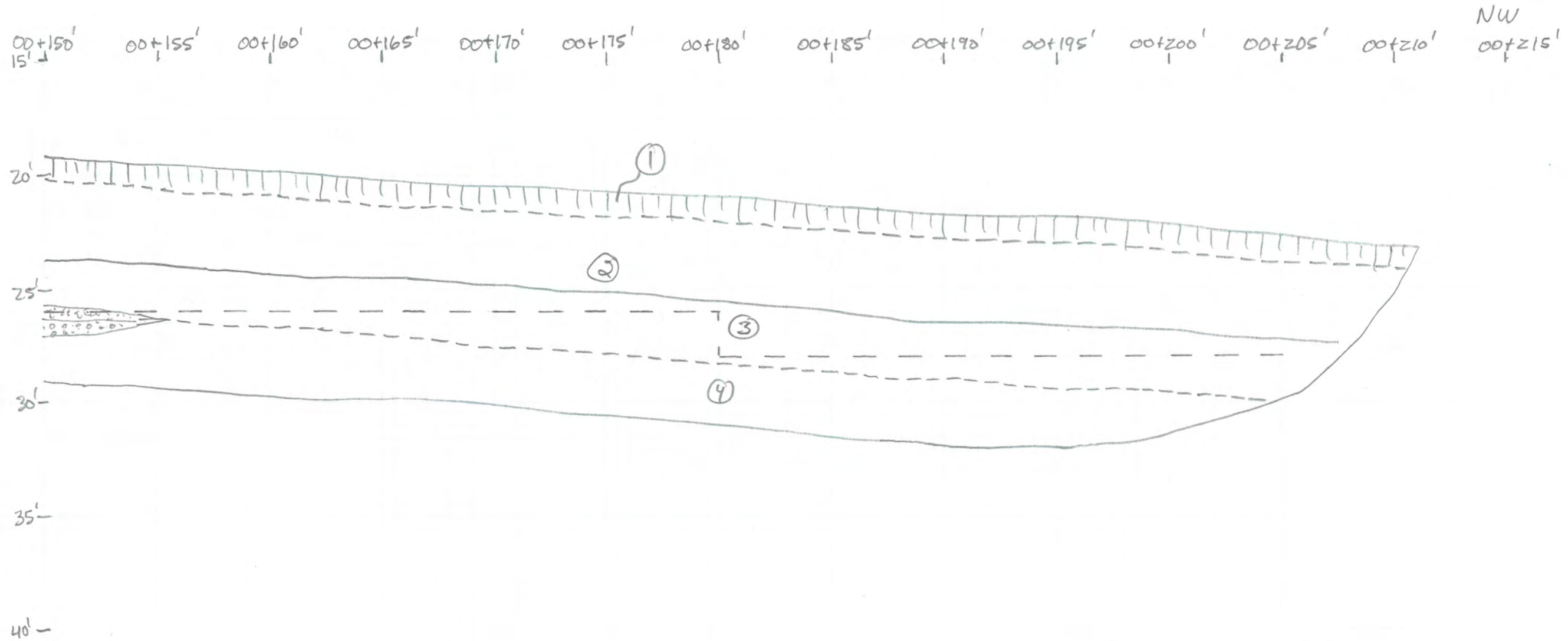


Figure 12

Key to Trench Log Symbols

Sharp Unit Contact – 

Gradational Unit Contact – 

Soil “A” Horizon – 

Level Line – 

Representative Bedding – 

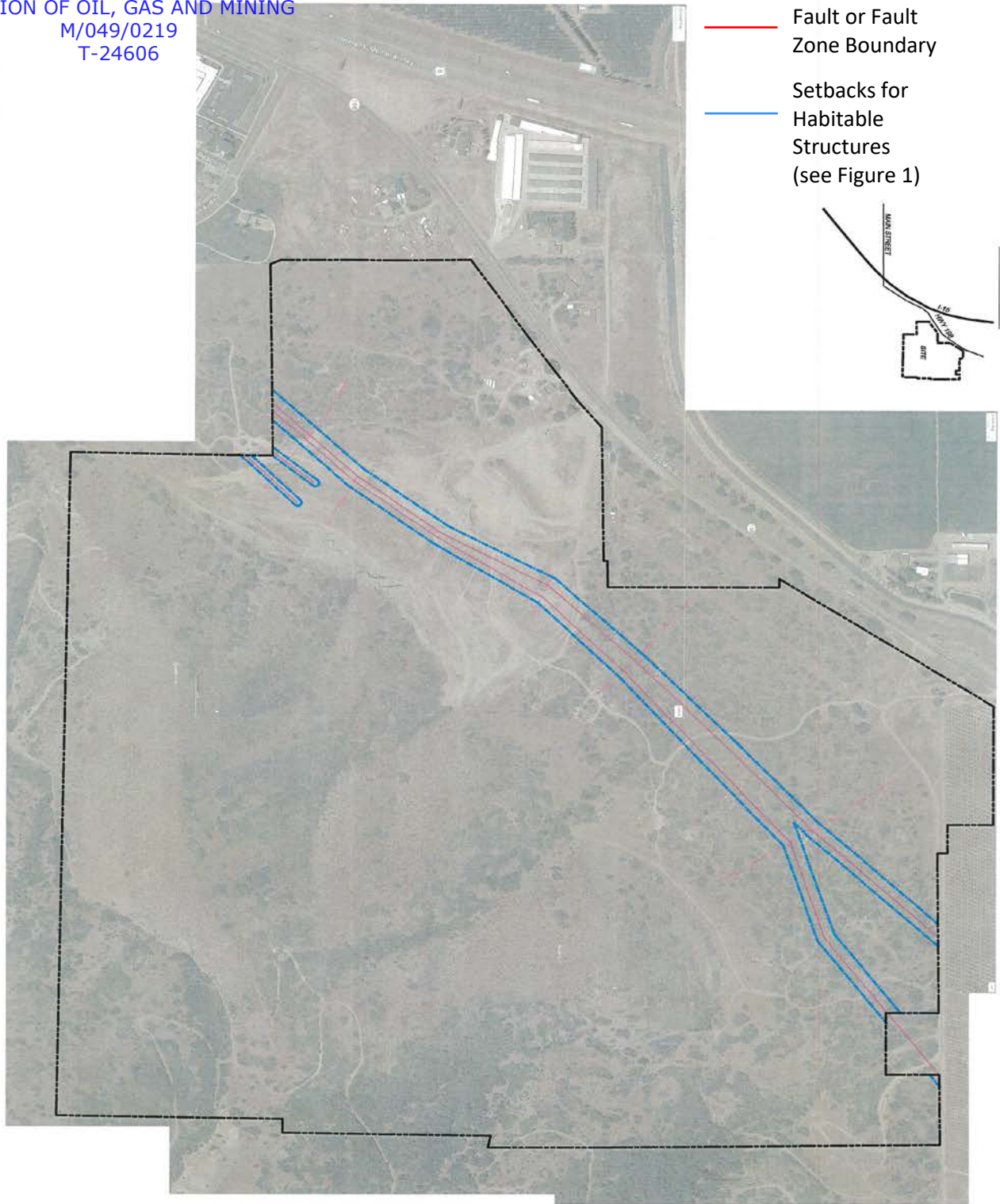
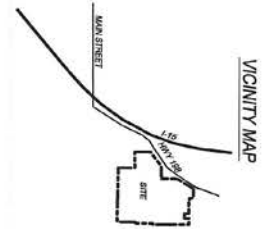
Representative Gravel Clasts – 

Normal Fault –
 (Arrows show relative Displacement) 

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Fault or Fault
 Zone Boundary

Setbacks for
 Habitable
 Structures
 (see Figure 1)



SANTAQUIN HEIGHTS FAULT MAP SHEET NAME: FAULT MAP SHEET NUMBER: 1		SANTAQUIN HEIGHTS PROJECT: SANTAQUIN HEIGHTS ACTION: SETBACK DATE: 08/26/19 BY: J. L. HARRIS CHECKED: J. L. HARRIS SCALE: 1" = 200' NORTH ARROW		555 West Center Street Lehi, UT 84043 (801) 735-8441	
Berg CIVIL ENGINEERING 1188 Highway 12, Suite 400 Lehi, UT 84043 (801) 735-8441		REVISIONS NO. DATE DESCRIPTION 1 08/26/19 Initial Design		DRAWN BY: J. L. HARRIS	

Provided by: Berg Civil Engineering

Santaquin Heights

Approx. 650 N. Hwy. 198, Santaquin, UT

CMT ENGINEERING
 LABORATORIES

Fault and Setback Map

Date: 26-Aug-19
 Job #: 12330

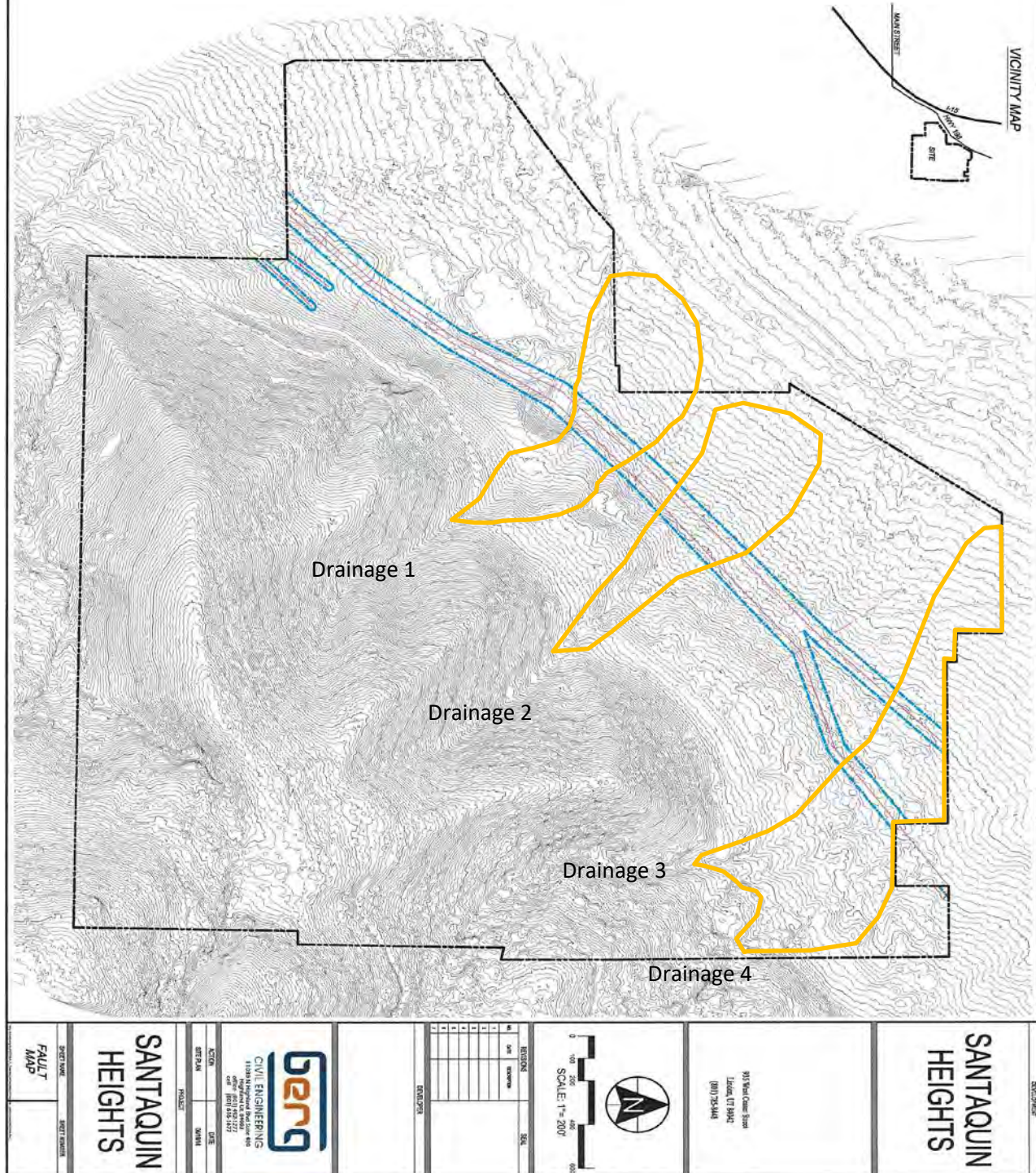
Figure:

14

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Potential Debris Flow
 and Fan Flooding Area



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Debris Flow Hazards

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 Job #: 12330

Figure:

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Appendix G

Wildlife Habitat IPaC

Report

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Project information

NAME

Grey Cliffs

LOCATION

Utah County, Utah



DESCRIPTION

Some(Rock aggregate mining and residential developement)

Local office

Utah Ecological Services Field Office

☎ (801) 975-3330

📠 (801) 975-3331

440 West 200 South

#500

Salt Lake City, UT 84101

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Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Log in to IPaC.

2. Go to your My Projects list.

3. Click PROJECT HOME for this project.

4. Click REQUEST SPECIES LIST.

Listed species¹ and their critical habitats are managed by the [Ecological Services Program](#) of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries²).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact [NOAA Fisheries](#) for [species under their jurisdiction](#).

1. Species listed under the [Endangered Species Act](#) are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the [listing status page](#) for more information. IPaC only shows species that are regulated by USFWS (see FAQ).

2. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
Mexican spotted owl <i>Strix occidentalis lucida</i> Wherever found There is final critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/8196	Threatened

Insects

NAME	STATUS
Monarch butterfly <i>Danaus plexippus</i> Wherever found There is proposed critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/9743	Proposed Threatened
Suckley's cuckoo bumble bee <i>Bombus suckleyi</i> No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/10885	Proposed Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

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You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and Golden Eagles are protected under the Bald and Golden Eagle Protection Act ² and the Migratory Bird Treaty Act (MBTA) ¹. Any person or organization who plans or conducts activities that may result in impacts to Bald or Golden Eagles, or their habitats, should follow appropriate regulations and consider implementing appropriate avoidance and minimization measures, as described in the various links on this page.

Additional information can be found using the following links:

- Eagle Management <https://www.fws.gov/program/eagle-management>
- Measures for avoiding and minimizing impacts to birds <https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds>
- Nationwide avoidance and minimization measures for birds <https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf>
- Supplemental Information for Migratory Birds and Eagles in IPaC <https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action>

There are Bald Eagles and/or Golden Eagles in your [project](#) area.

Measures for Proactively Minimizing Eagle Impacts

For information on how to best avoid and minimize disturbance to nesting bald eagles, please review the [National Bald Eagle Management Guidelines](#). You may employ the timing and activity-specific distance recommendations in this document when designing your project/activity to avoid and minimize eagle impacts. For bald eagle information specific to Alaska, please refer to [Bald Eagle Nesting and Sensitivity to Human Activity](#).

The FWS does not currently have guidelines for avoiding and minimizing disturbance to nesting Golden Eagles. For site-specific recommendations regarding nesting Golden Eagles, please consult with the appropriate Regional [Migratory Bird Office](#) or [Ecological Services Field Office](#).

If disturbance or take of eagles cannot be avoided, an [incidental take permit](#) may be available to authorize any take that results from, but is not the purpose of, an otherwise lawful activity. For assistance making this determination for Bald Eagles, visit the [Do I Need A Permit Tool](#). For assistance making this determination for golden eagles, please consult with the appropriate Regional [Migratory Bird Office](#) or [Ecological Services Field Office](#).

Ensure Your Eagle List is Accurate and Complete

If your project area is in a poorly surveyed area in IPaC, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the [Supplemental Information on Migratory Birds and Eagles](#), to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to bald or golden eagles on your list, see the "Probability of Presence Summary" below to see when these bald or golden eagles are most likely to be present and breeding in your project area.

Review the FAQs

The FAQs below provide important additional information and resources.

NAME	BREEDING SEASON
Bald Eagle <i>Haliaeetus leucocephalus</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31
Golden Eagle <i>Aquila chrysaetos</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read ["Supplemental Information on Migratory Birds and Eagles"](#), specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

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Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

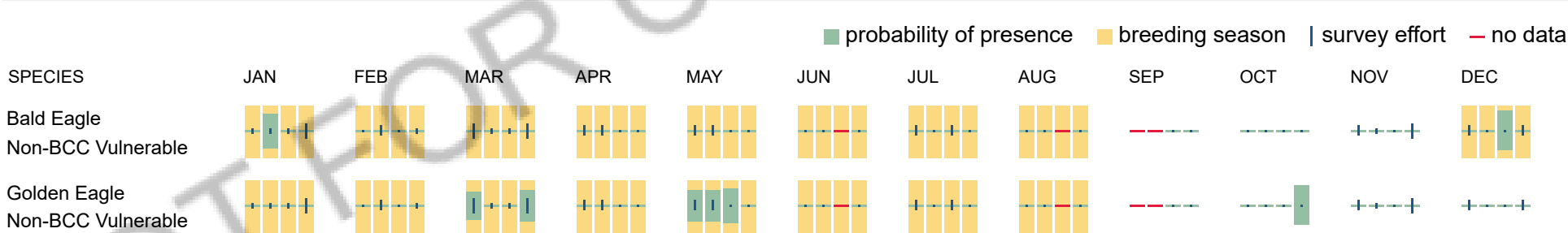
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (—)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Bald & Golden Eagles FAQs

What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are an eagle ([Bald and Golden Eagle Protection Act](#) requirements may apply).

Proper interpretation and use of your eagle report

On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort line or no data line (red horizontal) means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide you in knowing when to implement avoidance and minimization measures to eliminate or reduce potential impacts from your project activities or get the appropriate permits should presence be confirmed.

How do I know if eagles are breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the [RAIL Tool](#) and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If an eagle on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your "IPaC PROBABILITY OF PRESENCE SUMMARY" at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

Interpreting the Probability of Presence Graphs

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Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:

The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is $0.25/0.25 = 1$; at week 20 it is $0.05/0.25 = 0.2$.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

Migratory birds

The Migratory Bird Treaty Act (MBTA) ¹ prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the Department of Interior U.S. Fish and Wildlife Service (Service).

1. The [Migratory Birds Treaty Act](#) of 1918.
2. The [Bald and Golden Eagle Protection Act](#) of 1940.

Additional information can be found using the following links:

- Eagle Management <https://www.fws.gov/program/eagle-management>
- Measures for avoiding and minimizing impacts to birds <https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds>
- Nationwide avoidance and minimization measures for birds
- Supplemental Information for Migratory Birds and Eagles in IPaC <https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action>

Measures for Proactively Minimizing Migratory Bird Impacts

Your IPaC Migratory Bird list showcases [birds of concern](#), including [Birds of Conservation Concern \(BCC\)](#), in your project location. This is not a comprehensive list of all birds found in your project area. However, you can help proactively minimize significant impacts to all birds at your project location by implementing the measures in the [Nationwide avoidance and minimization measures for birds](#) document, and any other project-specific avoidance and minimization measures suggested at the link [Measures for avoiding and minimizing impacts to birds](#) for the birds of concern on your list below.

Ensure Your Migratory Bird List is Accurate and Complete

If your project area is in a poorly surveyed area, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the [Supplemental Information on Migratory Birds and Eagles document](#), to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the "Probability of Presence Summary" below to see when these birds are most likely to be present and breeding in your project area.

Review the FAQs

The FAQs below provide important additional information and resources.

RECEIVED Sep. 25, 2026 DIVISION OF OIL, GAS AND MINING T-24696		BREEDING SEASON
American White Pelican <i>pelecanus erythrorhynchos</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/6886		Breeds Apr 1 to Aug 31
Bald Eagle <i>Haliaeetus leucocephalus</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626		Breeds Dec 1 to Aug 31
Broad-tailed Hummingbird <i>Selasphorus platycercus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.		Breeds May 25 to Aug 21
California Gull <i>Larus californicus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.		Breeds Mar 1 to Jul 31
Cassin's Finch <i>Haemorhous cassinii</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9462		Breeds May 15 to Jul 15
Clark's Grebe <i>Aechmophorus clarkii</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.		Breeds Jun 1 to Aug 31
Evening Grosbeak <i>Coccothraustes vespertinus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.		Breeds May 15 to Aug 10
Franklin's Gull <i>Leucophaeus pipixcan</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.		Breeds May 1 to Jul 31
Golden Eagle <i>Aquila chrysaetos</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680		Breeds Jan 1 to Aug 31
Lesser Yellowlegs <i>Tringa flavipes</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679		Breeds elsewhere
Lewis's Woodpecker <i>Melanerpes lewis</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9408		Breeds Apr 20 to Sep 30
Northern Harrier <i>Circus hudsonius</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8350		Breeds Apr 1 to Sep 15
Olive-sided Flycatcher <i>Contopus cooperi</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3914		Breeds May 20 to Aug 31

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Rufous Hummingbird *Selasphorus rufus*
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
<https://ecos.fws.gov/ecp/species/8002>

Breeds Apr 15 to Jul 15

Virginia's Warbler *Leiothlypis virginiae*
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
<https://ecos.fws.gov/ecp/species/9441>

Breeds May 1 to Jul 31

Western Grebe *Aechmophorus occidentalis*
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
<https://ecos.fws.gov/ecp/species/6743>

Breeds Jun 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read ["Supplemental Information on Migratory Birds and Eagles"](#), specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is $0.25/0.25 = 1$; at week 20 it is $0.05/0.25 = 0.2$.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

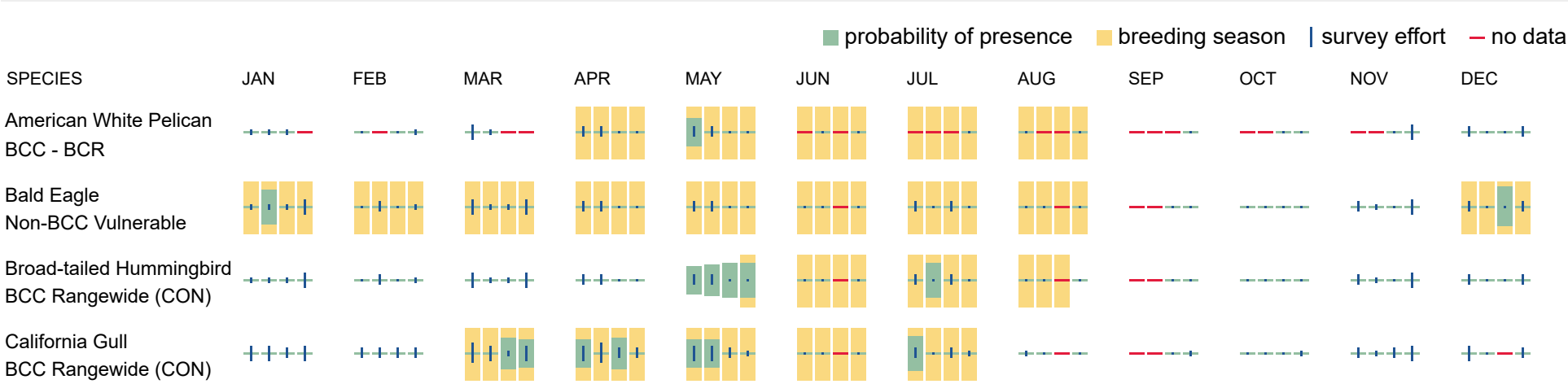
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

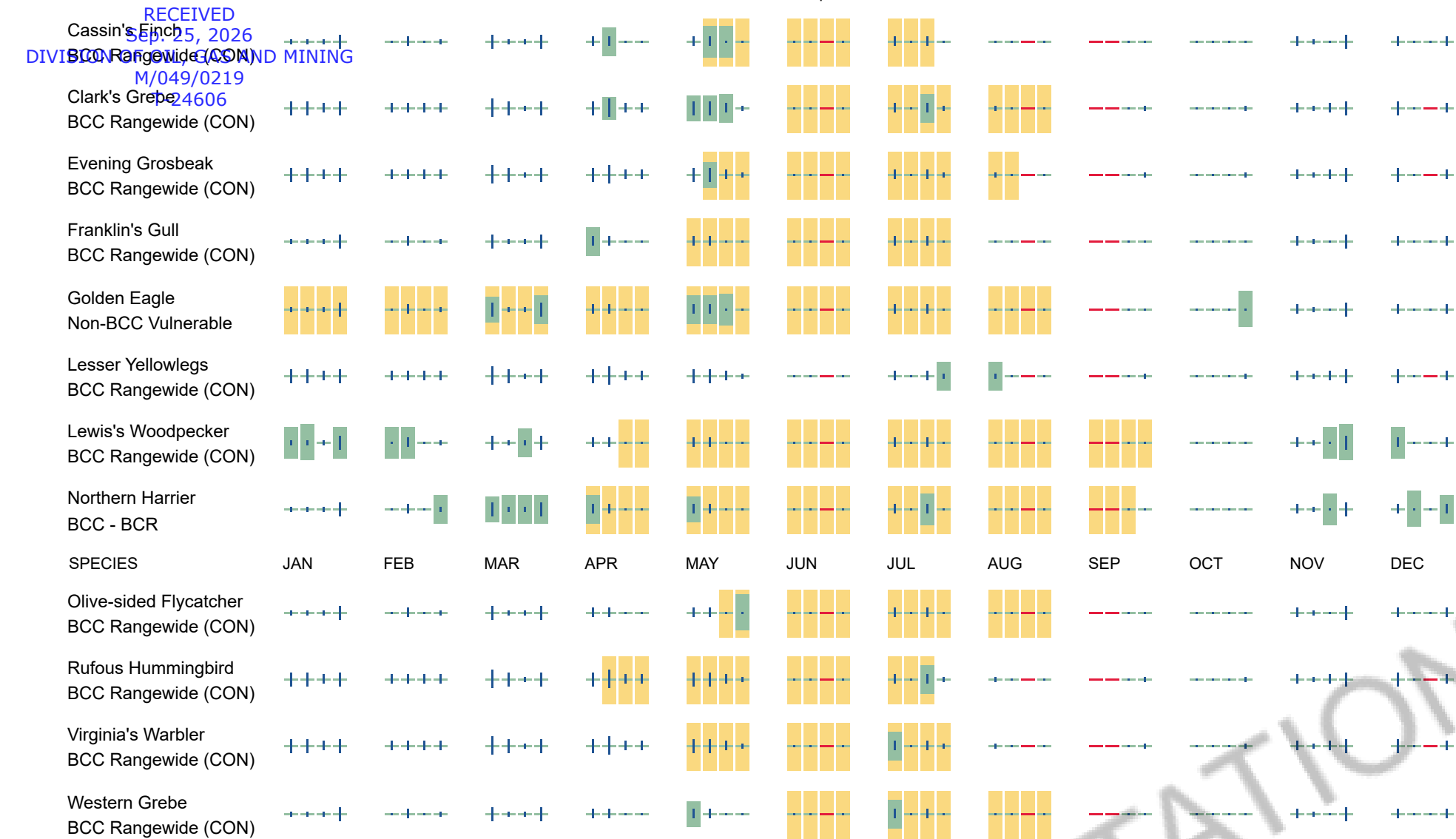
No Data (—)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Migratory Bird FAQs

Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds.

[Nationwide Avoidance & Minimization Measures for Birds](#) describes measures that can help avoid and minimize impacts to all birds at any location year-round. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is one of the most effective ways to minimize impacts. To see when birds are most likely to occur and breed in your project area, view the Probability of Presence Summary. [Additional measures](#) or [permits](#) may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of [Birds of Conservation Concern \(BCC\)](#) and other species that may warrant special attention in your project location, such as those listed under the Endangered Species Act or the [Bald and Golden Eagle Protection Act](#) and those species marked as “Vulnerable”. See the FAQ “What are the levels of concern for migratory birds?” for more information on the levels of concern covered in the IPaC migratory bird species list.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) with which your project intersects. These species have been identified as warranting special attention because they are BCC species in that area, an eagle ([Bald and Golden Eagle Protection Act](#) requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, and to verify survey effort when no results present, please visit the [Rapid Avian Information Locator \(RAIL\) Tool](#).

Why are subspecies showing up on my list?

Subspecies profiles are included on the list of species present in your project area because observations in the AKN for **the species** are being detected. If the species are present, that means that the subspecies may also be present. If a subspecies shows up on your list, you may need to rely on other resources to determine if that subspecies may be present (e.g. your local FWS field office, state surveys, your own surveys).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the [Avian Knowledge Network \(AKN\)](#). This data is derived from a growing collection of [survey, banding, and citizen science datasets](#).

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go to the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the [RAIL Tool](#) and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your “IPaC

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PROBABILITY OF PRESENCE SUMMARY” at the top of your results list), there may be nests present at some point within the timeframe specified. If “Breeds elsewhere” is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are [Birds of Conservation Concern](#) (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the [Bald and Golden Eagle Protection Act](#) requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially BCC species. For more information on avoidance and minimization measures you can implement to help avoid and minimize migratory bird impacts, please see the FAQ “Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds”.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the [NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#) project webpage.

Proper interpretation and use of your migratory bird report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list does not represent all birds present in your project area. It is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide implementation of avoidance and minimization measures to eliminate or reduce potential impacts from your project activities, should presence be confirmed. To learn more about avoidance and minimization measures, visit the FAQ "Tell me about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds".

Interpreting the Probability of Presence Graphs

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:

The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is $0.25/0.25 = 1$; at week 20 it is $0.05/0.25 = 0.2$.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the [National Wildlife Refuge](#) system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

RIVERINE
[R4SBA](#)

A full description for each wetland code can be found at the [National Wetlands Inventory website](#)

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tubercid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

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