Feasibility Report
for
Twining, Zap's, Porcupine, and Kachina Roads Improvements

Taos Ski Valley, New Mexico

Prepared For:

SHOPOFF | REALTY INVESTMENTS
Transforming Opportunity into Value

The Resort at Taos Ski Valley, LLC
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October 30, 2019

Rev. 1 January 3, 2020

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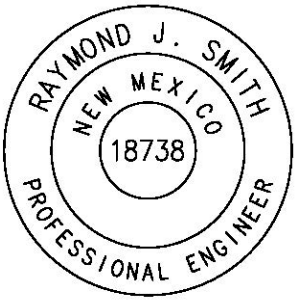
Appendices

I, Raymond J. Smith, a duly registered professional engineer in the State of New Mexico (registration #18738) have prepared this report and related documents and supervised the preparation of the enclosed exhibits. The information included is, to the best of my knowledge, accurate and consistent with professional practices in the State of New Mexico



Raymond J. Smith, P.E. December 31, 2019

Purpose and Scope

Miller Engineers, Inc. d/b/a Souder, Miller and Associates (SMA) was hired by The Resort at Taos Ski Valley, LLC (The Resort) to prepare this feasibility assessment for improvements along Twining Road, Zap's Road, Porcupine Road, and Kachina Road in the Village of Taos Ski Valley (The Village). The study will include evaluation of existing conditions based on criteria including road grade, horizontal alignment, horizontal sight distance, intersection sight distance, roadway width, shoulder grade, and roadway adjacent grade. The purpose of this study is to provide conceptual design for possible future road improvements to improve access to Kachina Road and improve road safety conditions. This feasibility report has been updated to discuss findings and changes to the proposed improvements from the field visit conducted on August 23rd, 2019.

Project Mapping

SMA initially prepared base mapping for the analysis from Twining Road to the intersection of Porcupine Road/Kachina Road using freely available topography data from USGS. Since the initial analysis, SMA has updated the topographical information with LIDAR data provided by The Village for the revised analysis of Twining Road, Zap's Road, Porcupine Road, and Kachina Road up to the Bavarian Restaurant/Phoenix Grill.

Review of Previous Information

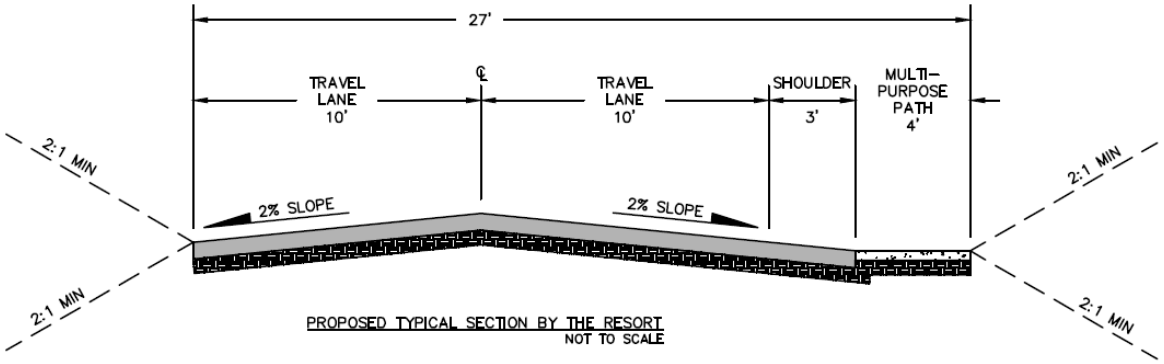
SMA received a summary of information for the study limits from Don Schieber. This summary provides valuable information on the history of improvements to the road as well as identifying areas of concern. SMA will use information from the document and observations from the site visit performed on August 23rd to evaluate existing conditions and identify improvement recommendations.

Site Visit

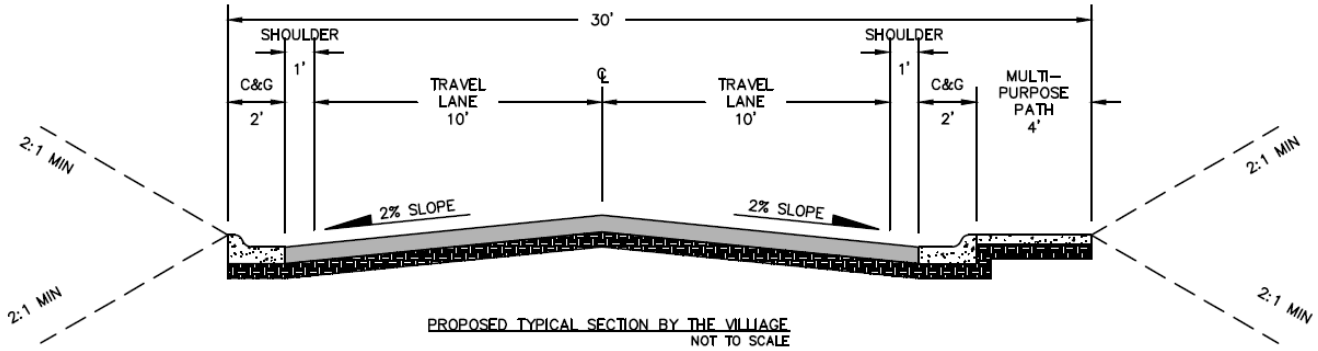
SMA utilized base mapping and information from the site visit on August 23rd to evaluate physical characteristics of the roadway.

Conceptual Design for Improvements

SMA will prepare two conceptual designs for the improvements to the roadway using Autodesk Civil 3D 2018 software. The designs will adhere to AASHTO design standards for a rural, local road and will be assumed to be a paved roadway only for Twining Road. Both designs will begin at the parking lot before O E Pattinson Loop and end at the Bavarian Restaurant on Kachina Road. The first design will incorporate The Village's proposed typical section up to Zap's Road, from which the design will transition to The Resort's proposed typical section. The second design will utilize only The Resort's typical section. SMA will submit conceptual plan and profile drawings to the client for review and approval. The proposed typical sections (for illustrative purposes only) for this project are included below.



PROPOSED TYPICAL SECTION BY THE RESORT
NOT TO SCALE



PROPOSED TYPICAL SECTION BY THE VILLAGE
NOT TO SCALE

Feasibility Report

SMA prepared this Feasibility Report, which will provide an evaluation of existing conditions, summary of the site visit, the conceptual designs, and the design criteria and assumptions.

The ownership of the land for the proposed alignment is beyond the scope of this report and does not evaluate right-of-way needs or property acquisition.

Site Visit to Twining Road

SMA attended a field meeting on August 23, 2019, with the Village Planning Director and Public Works Employees of the various roads to the Kachina Area to discuss existing conditions and proposed recommendations. During this site visit, existing conditions were observed to identify opportunities and constraints in completing roadway improvements.

Background

The Village of Taos Ski Valley is located about 15 miles northwest of the Town of Taos, NM and is in the high elevation of the Sangre de Cristo mountain range.

Access to the Village is by NM 150. The Village area itself is crisscrossed by a network of roads and driveways. However, primary access through the Village and to the resort property is by Thunderbird Road and Twining Road. Zap's Road and Porcupine Road connect Twining Road and Kachina Road.

The goal of this study is to determine the feasibility of improvements to Twining, Zap's, Porcupine, and Kachina Roads to improve safety and increase accessibility to commercial developments in the Valley. Twining Road currently is a main access road in the Valley, which has been noted to have steep roadways, sharp switchbacks, and—in the winter months—inadequate snow storage and vehicles sliding.

Existing Conditions

The project extents from Twining Road to Kachina Road are covered with approximately 60-70% vegetation with pine forest. Soils are generally cobbly loam with rock outcroppings.

Twining Road, Zap's Road, and Porcupine Road are existing access roads with steep slopes, narrow right-of-way and cabins located along stretches. The existing cross slopes are approximately 2:1. Kachina Road is also an existing access road with a 50-foot right-of-way but is not subject to slopes as steep or irregular as found along Twining, Zap's, and Porcupine Road.

Terrain

SMA initially used USGS 10-meter DEM data to map the existing topography in the area. LIDAR data provided by the Village of Taos Ski Valley was used to reevaluate the project area. Twining Road, Zap's Road, Porcupine Road, and Kachina Road are existing access roads with typically steep slopes, narrow right-of-way, and cabins located along stretches. The cross slopes on the mountain are approximately 1.5:1. A review of FEMA FIRM maps indicates that there are no designated flood plains in the area.

Vegetation

The hillside is covered with approximately 60-70% vegetation with pine forest. Vegetation within the project area can be described as a montane vegetation community dominated by a spruce/fir coniferous forest. The forest community exhibits old-growth characteristics with very large trees and dense understory with extensive blow-down. Travel across project area slopes can be described as difficult.

Soils

Soils in the area of the proposed alignment were obtained from the NRCS Web Soil Survey website. An Area of Interest was identified to encompass the roadway and the nearby hillside both above and below the alignment.

Native soils mapped in the project area consist of: Cryoborolls 0 to 8% slopes, Marosa-Rock outcrop complex very steep, Maroa-Rock outcrop complex very steep eroded, Paleboralfs-Cryochrepts-Rock outcrop association very steep, and Presa-Cryaquolls association steep.

Cryoborolls (CSC) is characterized as gravelly loam and very cobbly clay loam in the top three feet. The map unit composition is 80%, with 15% minor components. It has a low runoff classification and is well drained. It is in hydrologic soil group C.

Marosa-Rock outcrop complex (MSG & MSG2) is characterized as very cobbly sandy loam and very gravelly loamy sand in the top three feet. The profile of the rock outcrop is 0 to 60 inches to bedrock. The map unit composition is 50%, with 30% rock outcrop. It has a medium runoff classification and is well drained. It is in hydrologic soil group B.

Paleboralfs-Cryochrepts-Rock outcrop association, very steep (PAG) is characterized as cobbly sandy loam and very cobbly loamy sand in the top five feet. The profile of the rock outcrop is 0 to 60 inches to bedrock. The map unit composition is Paleforalfs 40%, Cryochrepts 30%, rock outcrop 20% and minor components 10%. It has a very high runoff classification and is well drained. It is in hydrologic soil group C.

A copy of the NRCS Web Soil Survey report is included in Appendix C of this report.

Review of Previous Information

SMA reviewed notes from Don Scheiber about historical road conditions within the project area. His comments helped pinpoint locations along Twining Road that may require attention. His notes are summarized below and have been associated with a roadway segment, intersection, or curve that this report analyzes later in the Feasibility Analysis section.

STA. 14+00.00 to 27+00.00—This portion of roadway has right-of-way of 30 feet and, in some places, cannot accommodate two-way traffic without the use of retaining walls.

Intersection 2: Phoenix Switchback/Burroughs Road: Area has been previously developed and contains stormwater culverts and inlets. Area is relatively flat but has grading issue below the intersection. Area could use better dust control than the current magnesium chloride and water truck solutions. Utility upgrades needed before paving.

STA. 32+40.00 to 42+50.00—This section also has right-of-way of 30 feet. Drainage structures and extensive retaining walls have been previously installed to maximize roadway within right-of-way. This area was rebuilt to have a reduced grade of 18-23%.

Curve 1—Retaining walls were used to reduce the grade to 14.5%. Existing conditions do not allow for any substantial alternations that would decrease this slope. There is confusion with guests about the continuation of Twining Road onto Zaps Road versus Upper Twining Road. Minor land acquisition may help with realignment at this intersection. The pond is 50% owned by the Village.

Curve 3 & 4—Right-of-way in this area increases to 40 feet and road grade increases to no more than 14.5% as Zaps Road transitions to Porcupine Road. Drainage improvements have continued up to this section. Existing conditions restrict decreasing the grade in this area.

STA. 69+50.00 to 78+38.55—Right-of-way increases to 50’. This area could use drainage improvements and is likely a good candidate for repaving.

Design Criteria and Assumptions

The conceptual design of the road adhered to AASHTO design standards for a rural, local road and was analyzed with DEM data. This initial analysis attempted to address most existing grading, curve, and intersection conditions according to AASHTO. The overall feasibility of an AASHTO-compliant roadway appears to be challenging, constructability-wise as well as coordinating with the existing residences and natural features.

The design utilizes LIDAR data and attempts to address specific portions of the roadway that may not conflict with residences or natural features to improve roadway sections as much as feasibly possible. While the entirety of the roadway may not be able to completely adhere to AASHTO standards, select improvements to the roadway, as suggested from site visits and review of the planset, will attempt to be designed in as much accordance to AASHTO as possible to minimize difficulties when driving, particularly during the winter season.

The standards listed in the table below are based on an AASHTO design speed of 25 miles per hour and very low traffic volumes. AASHTO standards were also compared to the Village of Taos Ski Valley development ordinance. Where there was conflicting information, the more stringent criteria were used. The maximum slope is assumed to be 12%, which is a maximum per Village development standards. The design criteria are shown in the following table.

Table 1 - Twining Road Improvements
AASHTO and Village Design Standards

Slopes	Lane Width	Shoulder Slope	Shoulder Width	Horizontal Curve Radius	Vertical Curve (Ka)	Stopping Sight Distance
0.5% Min	9-ft Min	6:1 Min	2-ft Min	70 ft Min*	11.1	155 ft
12% Max	12-ft Max	3:1 Max	6-8 ft Preferred		12	

*Smaller curve radius requires super elevation

Feasibility Analysis—with Adherence to AASHTO and Usage of DEM Data

Roadway Grading

The extents of the initial analysis for Twining Road began at STA. 14+00.00 and ended at STA. 77+43.00. Note that the Village of Taos Ski Valley is currently in the beginning stages of a project from about STA. 0+00.00 to about STA. 43+00.00 and may limit the necessity to address the following concerns up to approximately STA. 43+00.00 (the Beaver Pond). The end of the project has now been extended from the initial analysis to address potential changes past STA. 77+43.00 to continue south on Kachina Road to The Bavarian. This region is discussed further in the following section “Site Visit Notes—Select Improvements and Usage of LIDAR Data.”

According to the topography retrieved from the USGS.gov site, five segments of roadway appear to contain very steep grades above 12%—up to about 42%. The total project area has an average grade of 9.5%, and the roadway outside these five segments generally follow the 9.5% grade. The approach for possible grading improvements was focused on these challenging segments and the possible conflicts in them.

STA. 20+50.00 to 29+00.00- This segment of roadway is residence-heavy and contains the Coyote Lane/O E Pattinson Loop intersection. Grades on this portion of the road range up to 20-33% but may be smoothed to about 10%. However, this creates large portions of roadway significantly above the original elevation. The 10% grade between approximate stations 23+80.00 to 28+20.00 create an elevation increase of over 20' across the noted 440' length. The intersection of Twining Road and Coyote Lane/O E Pattinson Loop is located at about 26+50.00 which is one of the largest fill points in this segment (~Δ45'). While this segment of Twining Road can be adjusted to meet grading requirements, the required fill and elevation difference for the adjusted roadway may be too great for constructability and could conflict with the nearby residences. The following table lists the nearby residences and intersections and its possible conflicts.

Table 2 – Twining Road Improvements
Features and Conflicts in Road Segment 20+50.00 to 29+00.00

ID	Est. Station	Notes
A1	20+10.00 R	Residence may be within/affected by grading up to 70'
A2	20+15.00 L	Driveway may require realignment if Coyote Lane is realigned
I1	20+75.00	Intersection may require realignment (Fill <Δ5')
A3	21+05.00 L	Residence may be within/affected by grading up to 70'; Driveway may require realignment if Coyote Lane is realigned
A4	22+00.00 L	Residence may be within/affected by grading up to 70'; Driveway may require realignment (Fill ~Δ 10')
A5	22+20.00 R	Residence may be within/affected by grading up to 70'; Driveway may require realignment if O E Pattison Loop is realigned
A6	24+00.00 R	Residence may be within/affected by grading up to 70'; Residence may require relocation (Fill ~Δ 30')
A7	25+20.00 L	Residence may be within/affected by grading up to 70'; Residence may require relocation (Fill ~Δ 45')
I2	26+50.00	Intersection may require realignment (Fill ~Δ 45')
A8	26+50.00 L	Residence may be within/affected by grading up to 70'; Driveway may require realignment if Phoenix Switchback Road is realigned
A9	27+20.00 L	Residence may be within/affected by grading up to 70'; Residence may require relocation (Fill ~Δ 40')
A10	28+00.00 R	Residence may be within/affected by grading up to 70'; Residence may require relocation (Fill ~Δ 30')
A11	28+20.00 L	Residence may be within/affected by grading up to 70'; Residence may require relocation (Fill ~Δ 25')
A12	29+50.00 L	Residence may be within/affected by grading up to 70'

STA. 32+40.00 to 42+50.00-This segment of roadway contains residences and the southern end of the Twining Road/Cliff Hanger Loop, and it terminates before the roadway reaches the Beaver Pond. Analysis of the segment before and after the Beaver Pond appears to show that the two segments could be analyzed as a single roadway that is at about a 10% grade. In the interest of creating a potential point of inflection, of sorts, and to maintain the integrity of the Beaver Pond for now, the single segment has been divided into the 32+40.00 to 42+50.00 segment and the following 46+50.00 to 55+00.00 segment.

The roadway between 32+40.00 to 42+50.00 contains slopes up to 25% that can be averaged to about 12%. This segment has cut and fill sections with cut up to 35' and fill up to 25'. There are five residences noted to have possible conflict with improvements made to this section, and an additional two have been included for the area around the Beaver Pond. The tables below list the nearby residences and the intersection in this area and notes possible conflicts. Note Table 3 contains the analysis for the "Two Segment Analysis" which assumes the 12% grade from 32+40.00 to 42+50.00. For comparison, Table 4 has been included to show elevation differences with a 10% grade (from 32+40.00 to 54+84.00—and the table truncates to 46+00.00) between the two scenarios and includes residences B6 and B7.

Table 3 – Twining Road Improvements
Features and Conflicts in Road Segment 32+40.00 to 42+50.00
with "Two Segment Analysis" –12% Grade

ID	Est. Station	Notes
B1	34+25.00 L	Residence may be within/affected by grading up to 70'; Driveway may require realignment (Fill <Δ10')
B2	36+00.00 L	Residence may be within/affected by grading up to 70'; Driveway may require realignment to Cliff Hanger Loop (Fill ~Δ 25')
B3	37+75.00 L	Residence may be within/affected by grading up to 70'
I3	39+40.00 L	Intersection may require realignment (Cut <Δ10')
B4	39+50.00 L	Residence may be within/affected by grading up to 70'; Driveway may require realignment (Cut <Δ 10')
B5	43+00.00 L	Residence may be within/affected by grading up to 70'

Table 4 – Twining Road Improvements
Features and Conflicts in Road Segment 32+40.00 to 46+00.00
With "One Segment Analysis" – 10% Grade

ID	Est. Station	Notes
B1	34+25.00 L	Residence may be within/affected by grading up to 70'; Driveway may require realignment (Fill <Δ5')
B2	36+00.00 L	Residence may be within/affected by grading up to 70'; Driveway may require realignment to Cliff Hanger Loop (Fill ~Δ 20')
B3	37+75.00 L	Residence may be within/affected by grading up to 70'
I3	39+40.00 L	Intersection may require realignment (Cut ~Δ30')
B4	39+50.00 L	Residence may be within/affected by grading up to 70'; Driveway may require realignment (Cut ~Δ 30')
B5	43+00.00 L	Residence may be within/affected by grading up to 70'
B6	43+50.00 L	Residence may be within/affected by grading up to 70'; Residence may require realignment (Cut ~Δ 20')
B7	45+00.00 L	Residence may be within/affected by grading up to 70'; Residence may require realignment (Cut ~Δ 15')

STA. 46+50.00 to 55+00.00 – This segment contains two of the sharp horizontal curves as well as an intersection to Upper Twining Road. The proposed slope of the roadway is about 8%. The slope could be increased to 12% if the end station was changed to 52+50.00. Increasing the slope could reduce impact to C2, C3, and C4 and should no longer affect C5-C8. Note that the analyzed 8% slope will allow for greater flexibility in design to Curve 1 and Curve 2. When considering the design for the curves,

horizontal geometry changes such as an increased radius will reduce the total length of the roadway and will therefore affect the slope. 12% slopes could reduce impact to residences along this segment but at the cost of curve design.

Table 5 – Twining Road Improvements Features and Conflicts in Road Segment 46+50.00 to 55+00.00 with 8% Grade		
ID	Est. Station	Notes
I5	47+00.00	Driveway may require realignment (Fill <Δ5')
C1	47+00.00 R	Residence may be within/affected by grading up to 70'
C2	50+75.00 R	Residence may be within/affected by grading up to 70'; Residence may require relocation (Cut ~Δ 30')
C3	52+00.00 R	Residence may be within/affected by grading up to 70'; Residence may require relocation (Cut ~Δ 25')
C4	52+00.00 L	Residence may be within/affected by grading up to 70'; Residence may require relocation (Cut ~Δ 25')
C5	53+25.00 L	Residence may be within/affected by grading up to 70'; Residence may require relocation (Cut ~Δ 20')
C6	54+75.00 R	Residence may be within/affected by grading up to 70'; Residence may require realignment (Cut ~Δ 5')
C7	54+75.00 L	Residence may be within/affected by grading up to 70'; Residence may require realignment (Cut ~Δ 5')
C8	55+00.00 R	Residence may be within/affected by grading up to 70'; Residence may require realignment (Cut ~Δ 5')

STA. 58+50.00 to 66+00.00 – This segment contains slopes varying up to about 35%. Three portions of this roadway contain steep slopes, and the grade between the noted stations can average about 10%. This segment of road contains two of the noted sharp horizontal curves (Curve 3 and Curve 4) as well as three driveways along the roadway.

Table 6 – Twining Road Improvements Features and Conflicts in Road Segment 60+75.00 to 66+00.00 with 9.5% Grade		
ID	Est. Station	Notes
D1	58+50.00 R	Residence may be within/affected by grading up to 70'
D2	60+00.00 R	Residence may be within/affected by grading up to 70'; Driveway may require realignment (Cut ~Δ5')
D3	62+75.00 L	Residence may be within/affected by grading up to 70'; Driveway may require realignment (Fill ~Δ5')

STA. 69+50.00 to 78+38.55 – This segment contains slopes up to 42%. The proposed slope would combine a sag and crest in the roadway to reduce the grade to about 10%. This segment of roadway also contains one of the sharp curves to be assessed. A grade of 10% should allow for limited restriction in geometric design on the curve.

Table 7 – Twining Road Improvements
Features and Conflicts in Road Segment 60+75.00 to 66+00.00 with 10% Grade

ID	Est. Station	Notes
E1	73+20.00 L	Residence may be within/affected by grading up to 70'; Driveway may require realignment (Fill <Δ5')
E2	74+00.00 L	Residence may be within/affected by grading up to 70'; Driveway may require realignment (Fill ~Δ15')

Horizontal Curves

Considering the above Roadway Grading improvements, the grades of the sharp curves along Twining Road can each be reduced to about 10% or less. However, incorporating further improvements to the horizontal curves (such as an increased radius) can decrease the overall length of the segment, therefore increasing the grade. When considering potential improvements to these curves, the maximum grade of 12% is still considered.

For approximately the first half of the study area, cabins occupy both sides of Twining Road at relatively frequent intervals. As Twining Road continues to Kachina Road (as Zap's Road and Porcupine Road), buildings become sparser but could interfere with proposed horizontal curve geometry, vertical alignment with roadway-to-driveway, or horizontal realignment. The most problematic horizontal curves in the study area are listed below in Table 8 (see Exhibit 1). These curves exhibit a sharp radius, steep grade, or both.

Table 8 – Twining Road Improvements
Existing Twining Road Curve Geometry

Curve #	Approx. Station	Radius (ft)	Approx. Grade	Sight Distance (ft) (Uphill)	Sight Distance (ft) (Downhill)	Ordinance (ft)
1	46+80.00	29	8%	140	170	58
2	49+00.00	21	28%	125	390	42
3	60+00.00	63	3%	142	165	47
4	62+50.00	20	40%	120	527	40
5	70+00.00	19	17%	132	209	37

Table 9 – Twining Road Improvements Proposed Twining Road Curve Geometry w/o Radii Changes						
Curve #	Approx. Station	Radius (ft)	Approx. Grade	Sight Distance (ft) (Uphill)	Sight Distance (ft) (Downhill)	Ordinance (ft)
1	46+80.00	29	8%	140	170	58
2	49+00.00	21	8%	140	170	42
3	60+00.00	63	10%	140	175	52
4	62+50.00	20	10%	140	175	40
5	70+00.00	19	10%	140	175	36

Incorporation of a 70’ radius on each of the sharp curves on Twining Road could increase the slope by about 0.5% to an average of 10% across the length of the project area. After adjusting the radii on these curves, improvements to the roadway grade along Twining Road must be reevaluated. The challenges and feasibility between the modified-radii alternative and non-modified curve alternative are very similar, as the largest cut/fill in the both alternatives are about 45’.

Though the vertical alignment of both alternatives may be similar, the modified-curve alternative has the additional challenge of realigning the roadway. However, realigning Twining Road to include 70’ radii curves could help the feasibility for the roadway to include lanes, shoulder, snow storage, etc., though it is still subject to slope requirements and the feasibility of tying into the hillside above and below Twining Road. Features that may be affected by the modified-curve alternative are included in Table 10, below.

Table 10 – Twining Road Improvements Features Near Horizontal Curves with 70’ Radius		
Curve #	Approx. Station	Notes
1	46+80.00	Intersection of Upper Twining Road with Twining Road; Nearby driveway but should not threaten residence.
2	49+00.00	No known conflict
3	60+00.00	Nearby driveway but modified curve may benefit residence
4	62+50.00	Nearby driveways but modified curves may benefit residences
5	70+00.00	No known conflict

Intersections

There are six intersections along Twining Road at O E Pattinson Loop, Phoenix Switchback/Burroughs Road, Cliff Hanger Loop, Upper Twining Road, and Kachina Road. Visibility issues along Twining Road may be a result of steep slopes, sharp curves, and sight obstructions. Visibility issues may be resolved by clearing obstructions such as trees along the AASHTO required distance. At O E Pattinson Loop and Burroughs Road, there is a residence at each that obstructs the sight requirements. Roadway realignment may not address the sight requirement due in part by residence locations; variance in design requirements may be necessary to not impact residences.

Table 11 – Twining Road Improvements
Intersection Sight Distance Geometry

Intersection (Twining @)	SSD	Intersection SD (left)	Intersection SD (right)	Notes	
Intersection #1 O E Pattinson Loop	155	308’ (6%+)	216’ (-6%+)	Trees obstruct; Residence obstructs	
Intersection #2 Phoenix Switchback	155	308’ (6%+)	216’ (-6%+)	Trees obstruct	
Intersection #2A Burroughs Road	155	252’ (-6%+)	264’ (6%+)	Trees obstruct; Residence obstructs	
Intersection #3 Cliff Hanger Loop – North	155	308’ (6%+)	216’ (-6%+)	Trees obstruct	
Intersection #4 Cliff Hanger Loop – South	155	308’ (6%+)	216’ (-6%+)		
Intersection #5 Upper Twining Road	155	252’ (-6%+)	264’ (6%+)	Trees obstruct	
Intersection #6 Kachina Road	155	252 (-6%+)	264’ (6%+)	Trees obstruct	

Site Visit Notes—Select Improvements and Usage of LIDAR Data

Incorporating more accurate, LIDAR data will allow SMA to reassess project concerns and update CAD work. The focus of the project is to start around STA. 43+00.00, continue past the previous EOP at STA. 77+43.00, continue past the Twining Road and Kachina Road intersection, and start a new Kachina Road Alignment beginning at the intersection (with new alignment stationing) at STA. 10+00.00 to Deer Lane at STA. 50+91.65. The Village of Taos Ski Valley is in the process of another project on Twining Road between approximately STA. 0+00.00 to STA. 43+00.00. Considerations for improvements in this area should be restricted as this portion of Twining Road is likely to change and possibly invalidate observations noted in the Feasibility Analysis and Site Visit Notes. However, notes that include possible improvements along the Twining Road Alignment from STA. 0+00.00 to STA. 43+00.00 will be included in this section. The typical section for the roadway from STA. 0+00.00 to STA. 42+00.00 was considered to be two 10' lanes with Type B curb and gutter with a 4' multipurpose lane on the right (outside) and slopes tied to existing at 2:1. The sections can be seen in Appendix D.

The previously proposed improvements to Twining Road (feasible or otherwise) were extensive and encourage focusing on individual improvements that would create the most value to the area when considering construction costs, existing residencies, and terrain.

STA. 0+00 TO STA. 13+50

"Cut to reduce to approximately 10%. May need Forest Service permission to grade."
"[8+50] is already at an acceptable grade. Topo is likely off."
"Maintain approximate original grade and pave."

The new LIDAR data shows the grades in this area are vastly different from the original DEM data. Aside from a small peak at 5+25, the existing roadway nearly follows the proposed grades with the most fill required of about 6' across 500' of roadway. There are no residences along the 500' stretch of roadway.

STA. 13+50 TO STA. 23+00

"Smooth out existing grade and pave. Match existing elevation at intersection with Phoenix Switchback."
"Fill and match grade at intersection with Phoenix Switchback."

The new LIDAR data shows that the roadway has minimal "fill" requirements in this area that appeared to be problematic with the DEM data. The currently proposed profile shows a difference of about 8' at 26+50 where the Phoenix Switchback intersection would be.
The LIDAR data shows that the range of 18+00 to 22+00 is very up-and-down and contains access to about 3 residencies and the intersection of O E Pattinson Loop at 20+50. The cut requirements could be as high as 7' in this range, creating possible need to realign driveways or O E Pattinson Loop.

STA. 28+00

"Existing retaining walls on both sites with uncooperative property owners."

STA. 29+50 TO STA. 43+25

"Guardrail along entire section. Also need storm drain/drainage."

STA. 41+50 TO STA. 43+50
"Widen wall with retaining wall."

STA. 42+50 TO STA. 46+50
"Consider realigning by encroaching into Beaver Pond."
"Raise grade by +/- 5'."

STA. 49+00 TO STA. 59+50
"Consider paving"

STA. 50+50 TO STA. 59+00
"Raise road grade here so the "S"-Turn can be reduced."

STA. 59+00 TO STA. 65+00
"Smooth out grade as much as possible. Need storm drains."

STA. 65+00 TO STA. 67+25
"Straighten out road section."

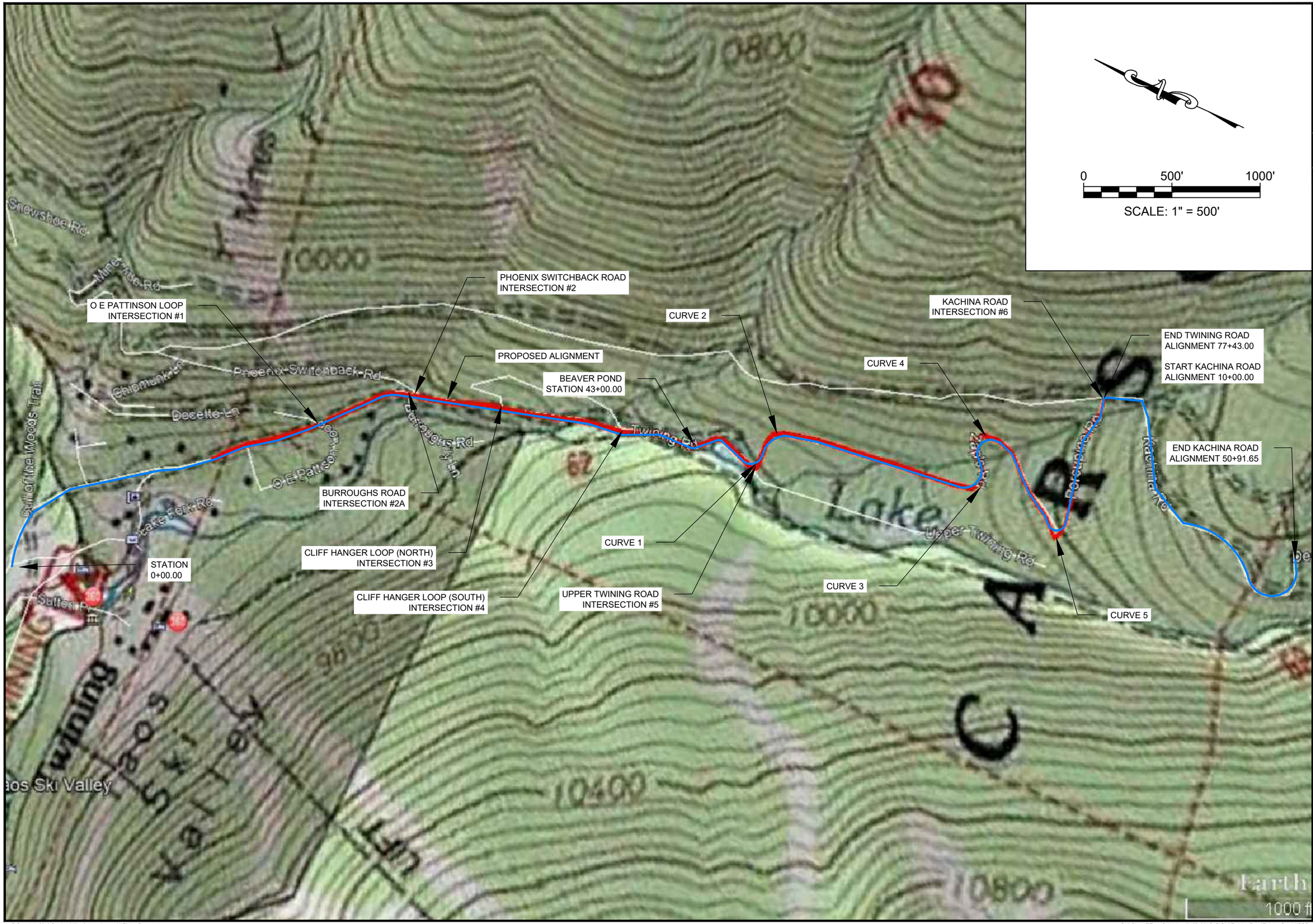
STA. 67+50 TO STA. 69+50
"Install barriers to stop cars but still allow for snow to be pushed off the road."

STA. 71+50 TO STA. 72+50
"Add retaining wall [to the right side of the road] to widen out the curve."

STA. 72+50 ONTO KACHINA ALIGNMENT
"Add retaining wall [to the left side of the road] to wide out the curve."

APPENDIX A

USGS TOPOGRAPHIC MAP



Rev #	Date	Description

SOUDER, MILLER & ASSOCIATES
5454 Vence Avenue NE, Suite D
Albuquerque, NM 87113
Phone (505) 299-0942 Toll-Free (877) 299-0942 Fax (505) 293-3430
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TAOS
SHOPOFF

SHOPOFF TAOS SKI VALLEY
TAOS, NEW MEXICO
PROPOSED ALIGNMENT WITH USGS MAPPING
TWINING ROAD

Designed	Drawn	Checked
JMC	CLW	RJS

Date: October 19

Scale: Horiz: NTS
Vert: NTS

Project No:

EXH 1

P:\9-Shopoff Taos Ski Valley (9427120)\CAD\Civil\Twining Road\Twining Road USGS exhibit.dwg, CYO, 10/8/2019 10:09 AM

APPENDIX B

FEMA FIRMETTE MAP

National Flood Hazard Layer FIRMette

FEMA

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

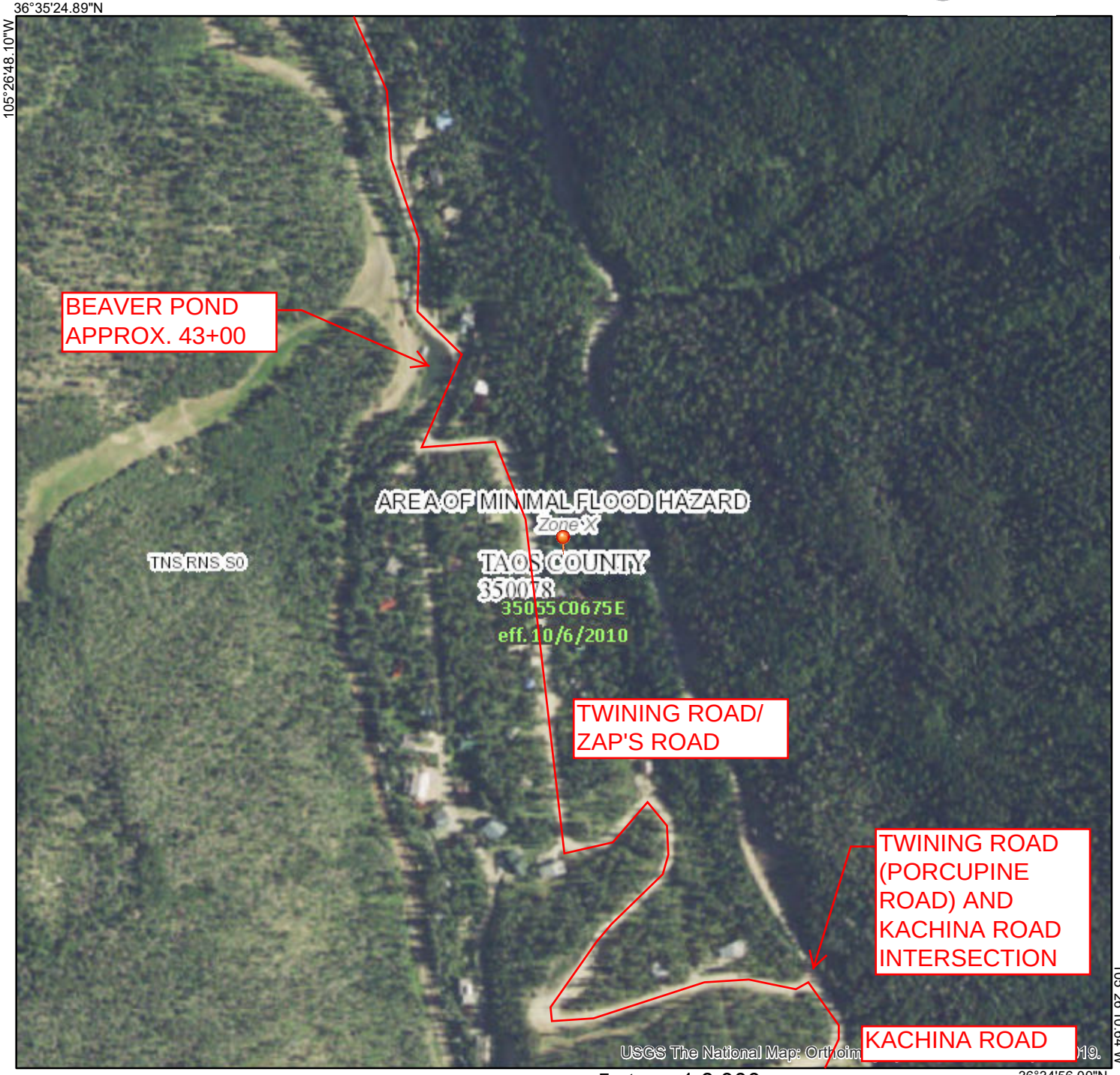
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/31/2019 at 4:45:38 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

National Flood Hazard Layer FIRMette

FEMA



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
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OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/31/2019 at 4:39:15 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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National Flood Hazard Layer FIRMette

FEMA

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X*
	Effective LOMRs
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	Coastal Transect
	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
MAP PANELS	Digital Data Available
	No Digital Data Available
	Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/31/2019 at 4:38:03 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX C

NRCS WEB SOILS SURVEY

United States Department of Agriculture

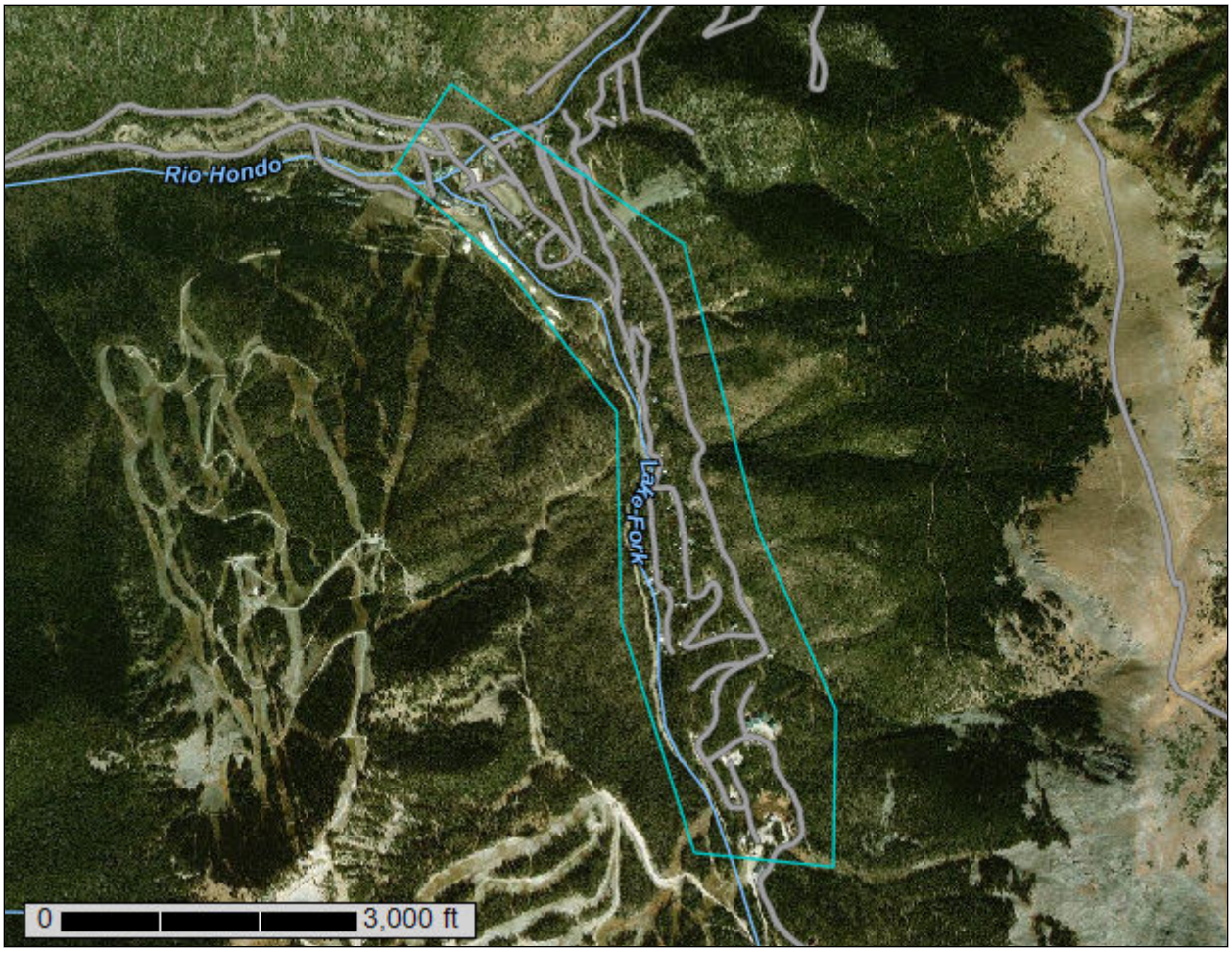
NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Taos County and Parts of Rio Arriba and Mora Counties, New Mexico

9427120 Twining to Kachina



October 21, 2019

Preface

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

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

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

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

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

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

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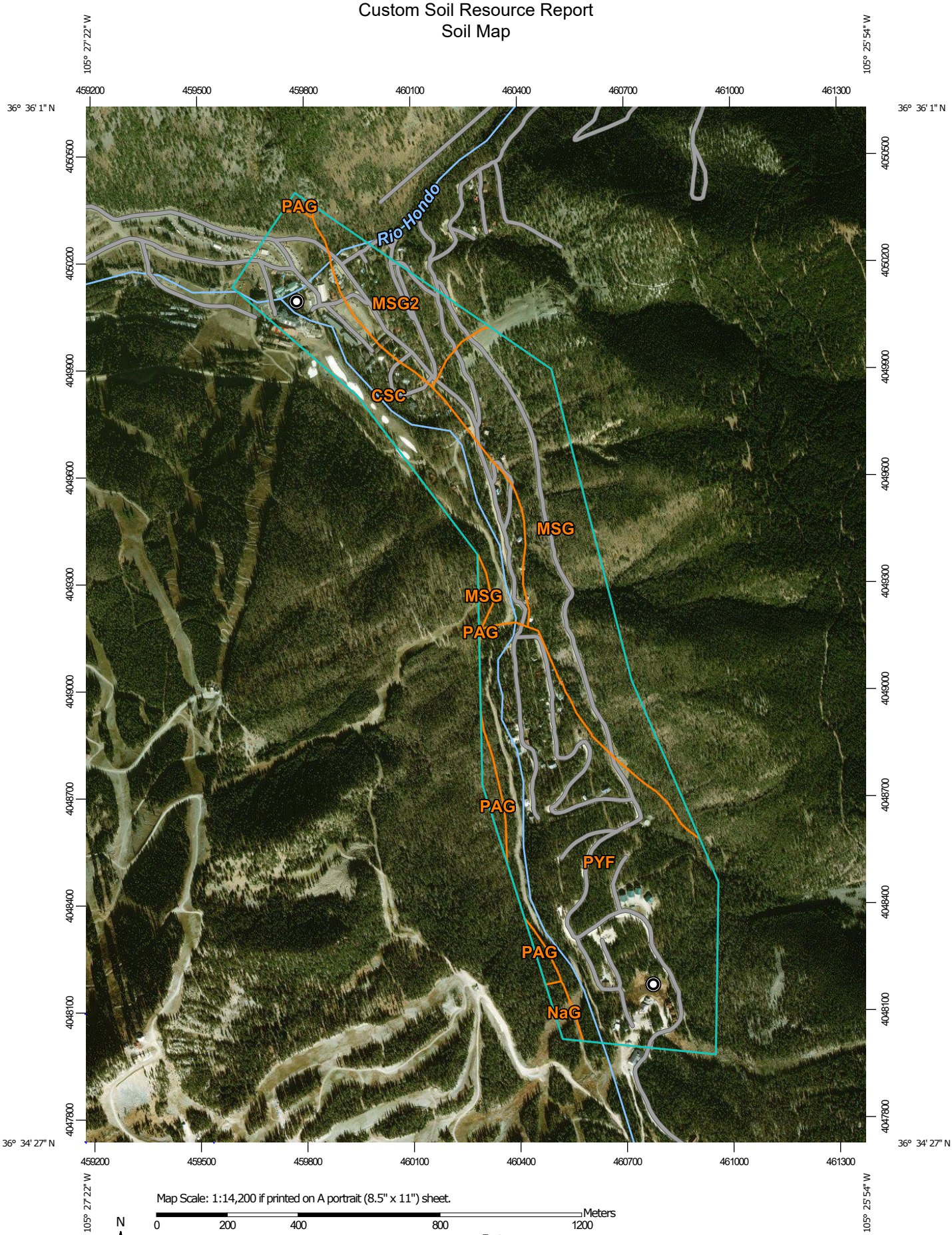
Contents

Soil Map

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

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

Soil Survey Area: Taos County and Parts of Rio Arriba and Mora Counties, New Mexico
Survey Area Data: Version 14, Sep 17, 2019

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

Date(s) aerial images were photographed: Jun 30, 2011—Feb 6, 2017

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CSC	Cryoborolls, 0 to 8 percent slopes	58.4	21.0%
MSG	Marosa-Rock outcrop complex, very steep	71.6	25.7%
MSG2	Marosa-Rock outcrop complex, very steep, eroded	23.0	8.3%
NaG	Nambe cobbly loam, 40 to 80 percent slopes	2.2	0.8%
PAG	Paleboralfs-Cryochrepts-Rock outcrop association, very steep	4.9	1.8%
PYF	Presa-Cryaquolls association, steep	118.3	42.5%
Totals for Area of Interest		**278.4**	**100.0%**

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not

mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

Taos County and Parts of Rio Arriba and Mora Counties, New Mexico

CSC—Cryoborolls, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: k1dr
Elevation: 8,500 to 11,500 feet
Mean annual precipitation: 20 to 30 inches
Mean annual air temperature: 34 to 45 degrees F
Frost-free period: 40 to 75 days
Farmland classification: Not prime farmland

Map Unit Composition

Cryoborolls and similar soils: 80 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cryoborolls

Setting

Landform: Mountain slopes, valley floors, valley sides
Landform position (three-dimensional): Mountainbase, talf
Down-slope shape: Concave, convex
Across-slope shape: Concave, convex
Parent material: Colluvium derived from granite and/or residuum weathered from granite

Typical profile

H1 - 0 to 8 inches: gravelly loam
H2 - 8 to 33 inches: very cobbly clay loam
H3 - 33 to 60 inches: very gravelly sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.21 to 0.71 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: Mountain Valley Dry (F048AY014NM)
Hydric soil rating: No

Minor Components

Cryaquolls

Percent of map unit: 13 percent
Landform: Mountain valleys
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Mountain Valley Dry (F048AY014NM)
Hydric soil rating: Yes

Cryoborolls

Percent of map unit: 1 percent
Ecological site: Mountain Valley Dry (F048AY014NM)
Hydric soil rating: No

Riverwash

Percent of map unit: 1 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

MSG—Marosa-Rock outcrop complex, very steep

Map Unit Setting

National map unit symbol: k1fq
Elevation: 9,000 to 12,000 feet
Mean annual precipitation: 32 to 37 inches
Mean annual air temperature: 30 to 41 degrees F
Frost-free period: 30 to 60 days
Farmland classification: Not prime farmland

Map Unit Composition

Marosa and similar soils: 50 percent
Rock outcrop: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Marosa

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium derived from granite and/or residuum weathered from igneous and metamorphic rock

Typical profile

H1 - 0 to 3 inches: very cobbly sandy loam
H2 - 3 to 34 inches: very gravelly loamy sand

H3 - 34 to 44 inches: extremely gravelly clay loam
H4 - 44 to 60 inches: extremely cobbly sandy clay loam

Properties and qualities

Slope: 50 to 80 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
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
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Mountain Valley Dry (F048AY014NM)
Hydric soil rating: No

Description of Rock Outcrop

Typical profile

R - 0 to 60 inches: bedrock

Properties and qualities

Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Unranked

Minor Components

Nambe

Percent of map unit:
Ecological site: Mountain Valley Dry (F048AY014NM)
Hydric soil rating: No

MSG2—Marosa-Rock outcrop complex, very steep, eroded

Map Unit Setting

National map unit symbol: k1fr
Elevation: 9,000 to 12,000 feet
Mean annual precipitation: 32 to 37 inches
Mean annual air temperature: 30 to 41 degrees F
Frost-free period: 30 to 60 days
Farmland classification: Not prime farmland

Map Unit Composition

Marosa and similar soils: 50 percent
Rock outcrop: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Marosa

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium derived from granite and/or residuum weathered from igneous and metamorphic rock

Typical profile

H1 - 0 to 2 inches: very cobbly sandy loam
H2 - 2 to 12 inches: very gravelly loamy sand
H3 - 12 to 60 inches: extremely cobbly sandy clay loam

Properties and qualities

Slope: 50 to 80 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
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
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A

Ecological site: Mountain Valley Dry (F048AY014NM)
Hydric soil rating: No

Description of Rock Outcrop

Typical profile
R - 0 to 60 inches: bedrock

Properties and qualities
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Unranked

Minor Components

Nambe
Percent of map unit:
Ecological site: Mountain Valley Dry (F048AY014NM)
Hydric soil rating: No

NaG—Nambe cobbly loam, 40 to 80 percent slopes

Map Unit Setting
National map unit symbol: k1gf
Elevation: 9,000 to 12,000 feet
Mean annual precipitation: 32 to 37 inches
Mean annual air temperature: 30 to 41 degrees F
Frost-free period: 30 to 60 days
Farmland classification: Not prime farmland

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

Description of Nambe

Setting
Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Alluvium derived from granite and gneiss

Typical profile

H1 - 0 to 5 inches: cobbly loam
H2 - 5 to 30 inches: very cobbly sandy loam
H3 - 30 to 60 inches: very cobbly sandy loam

Properties and qualities

Slope: 40 to 80 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
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
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: Mountain Valley Dry (F048AY014NM)
Hydric soil rating: No

Minor Components

Marosa

Percent of map unit: 15 percent
Ecological site: Mountain Valley Dry (F048AY014NM)
Hydric soil rating: No

PAG—Paleboralfs-Cryochrepts-Rock outcrop association, very steep

Map Unit Setting

National map unit symbol: k1gn
Elevation: 8,600 to 13,000 feet
Mean annual precipitation: 25 to 37 inches
Mean annual air temperature: 28 to 43 degrees F
Frost-free period: 30 to 80 days
Farmland classification: Not prime farmland

Map Unit Composition

Paleboralfs and similar soils: 40 percent
Cryochrepts and similar soils: 30 percent
Rock outcrop: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paleboralfs

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Colluvium derived from granite and gneiss and/or residuum weathered from granite and gneiss

Typical profile

H1 - 0 to 14 inches: cobbly sandy loam
H2 - 14 to 60 inches: very cobbly loamy sand

Properties and qualities

Slope: 40 to 80 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Medium
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
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: Mountain Valley Dry (F048AY014NM)
Hydric soil rating: No

Description of Cryochrepts

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Colluvium derived from granite and gneiss and/or residuum weathered from granite and gneiss

Typical profile

H1 - 0 to 11 inches: cobbly loam
H2 - 11 to 60 inches: very cobbly loam

Properties and qualities

Slope: 35 to 40 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very high
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
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: Mountain Valley Dry (F048AY014NM)
Hydric soil rating: No

Description of Rock Outcrop

Typical profile

R - 0 to 60 inches: bedrock

Properties and qualities

Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Unranked

Minor Components

Penitente

Percent of map unit: 10 percent
Ecological site: Subalpine Grassland Dry (R048AY011NM)
Hydric soil rating: No

PYF—Presa-Cryaquolls association, steep

Map Unit Setting

National map unit symbol: k1gr
Elevation: 9,000 to 12,000 feet
Mean annual precipitation: 20 to 37 inches
Mean annual air temperature: 30 to 40 degrees F
Frost-free period: 40 to 60 days
Farmland classification: Not prime farmland

Map Unit Composition

Presa and similar soils: 50 percent
Cryaquolls and similar soils: 30 percent

Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Presa

Setting

Landform: Valley trains
Landform position (three-dimensional): Mountainbase
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Colluvium derived from sandstone and shale and/or residuum weathered from sandstone and shale

Typical profile

H1 - 0 to 7 inches: cobbly loam
H2 - 7 to 54 inches: very gravelly loam
H3 - 54 to 76 inches: extremely stony sandy loam

Properties and qualities

Slope: 5 to 50 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.71 to 2.13 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: Mountain Valley Dry (F048AY014NM)
Hydric soil rating: No

Description of Cryaquolls

Setting

Landform: Mountain valleys
Landform position (three-dimensional): Mountainbase
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite and gneiss

Typical profile

H1 - 0 to 8 inches: gravelly loam
H2 - 8 to 33 inches: very cobbly sandy clay loam
H3 - 33 to 60 inches: very cobbly loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained

Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.71 to 2.13 in/hr)
Depth to water table: About 10 to 20 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B/D
Ecological site: Mountain Valley Dry (F048AY014NM)
Hydric soil rating: Yes

Minor Components

Cryoborolls

Percent of map unit: 10 percent
Ecological site: Mountain Valley Dry (F048AY014NM)
Hydric soil rating: No

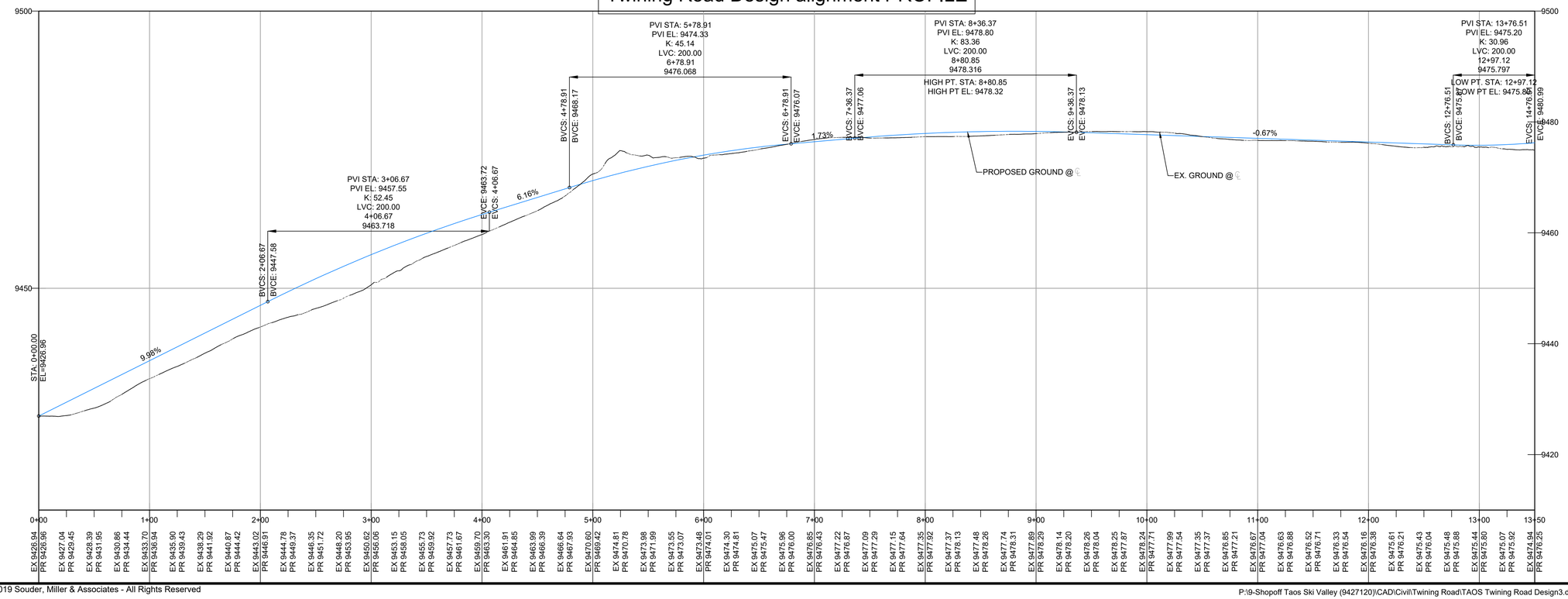
Nambe

Percent of map unit: 10 percent
Ecological site: Mountain Valley Dry (F048AY014NM)
Hydric soil rating: No

APPENDIX D

TWINING ROAD IMPROVEMENTS PLAN AND PROFILE SHEETS

Twining Road Design alignment PROFILE



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Designed	Drawn	Checked
CYO	SAT	RJS

Date: October 2019

Scale: Horiz: 1"=50'
Vert: 1"=10'

Project No:

Sheet: 1

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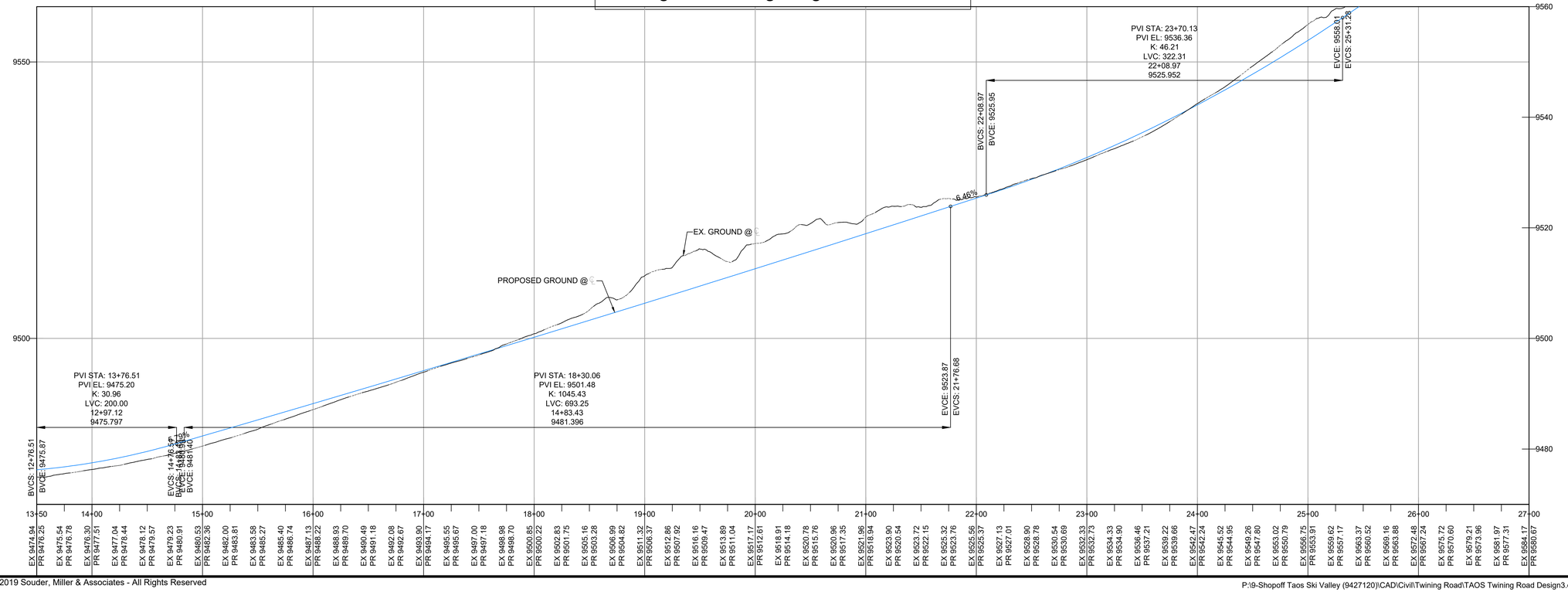

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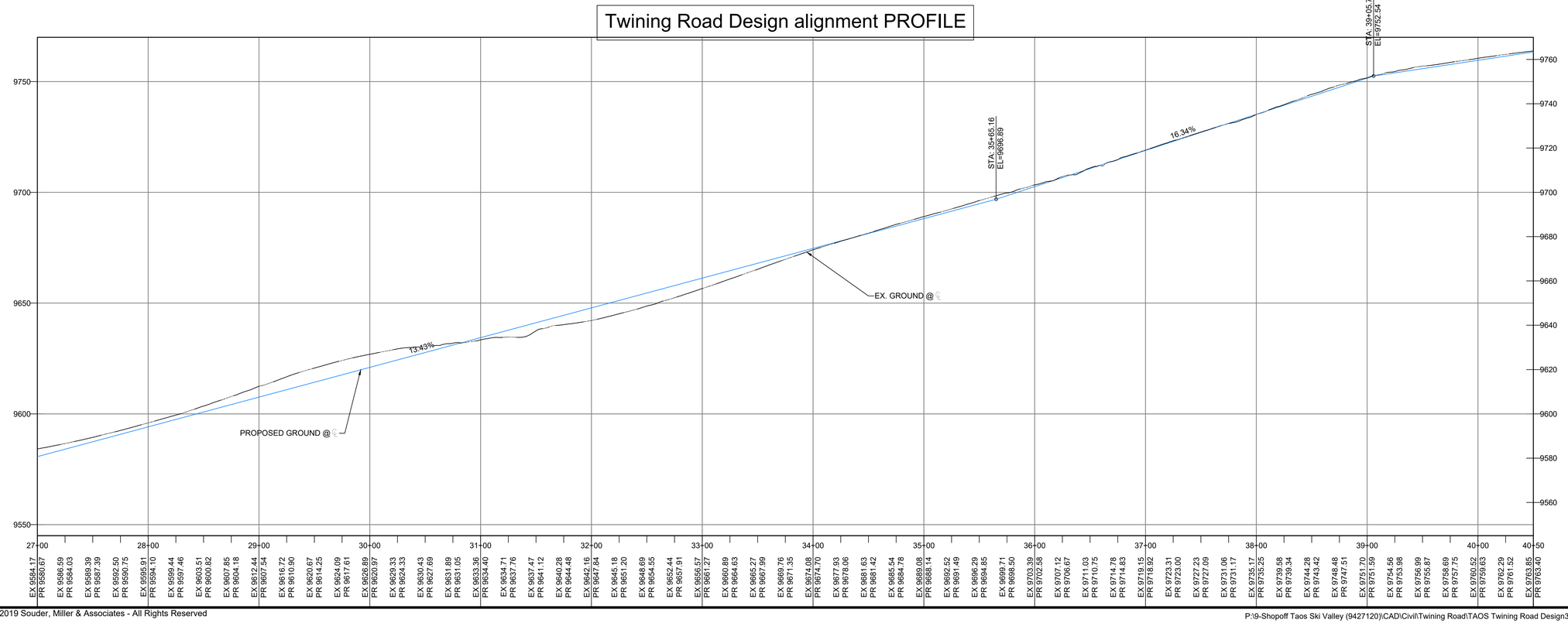

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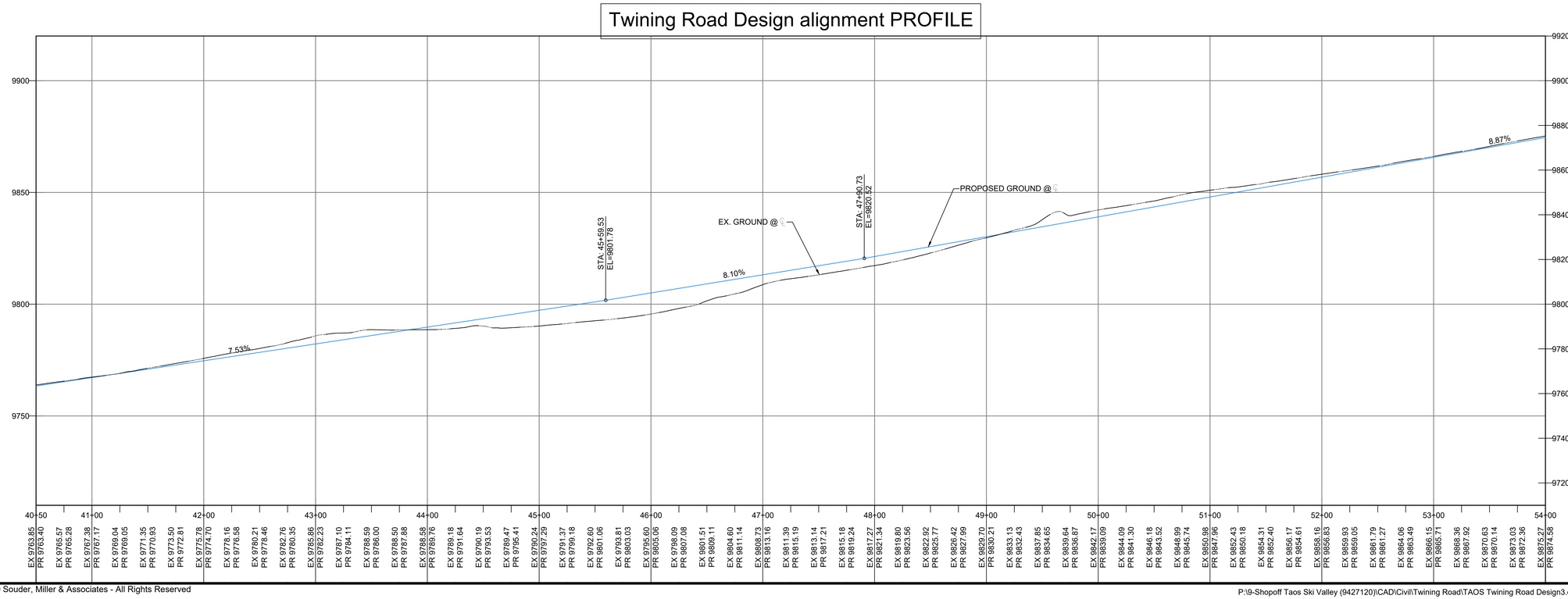

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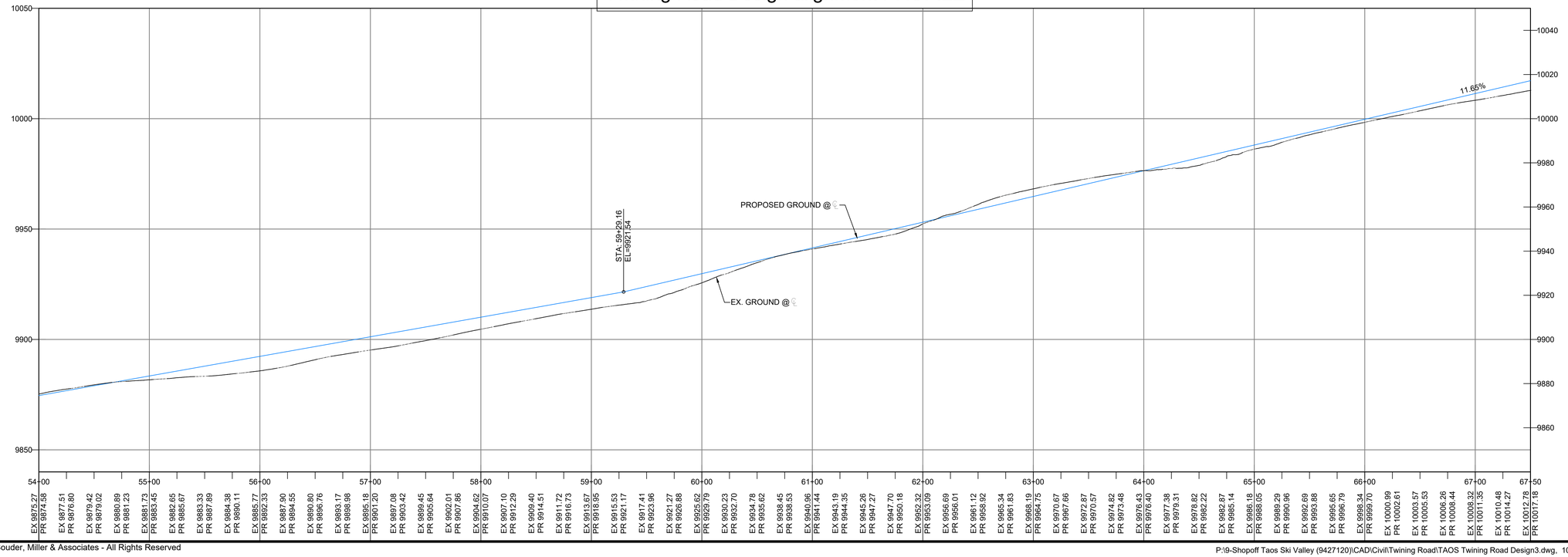

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CYO	SAT	RJS

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Vert: 1"=25'

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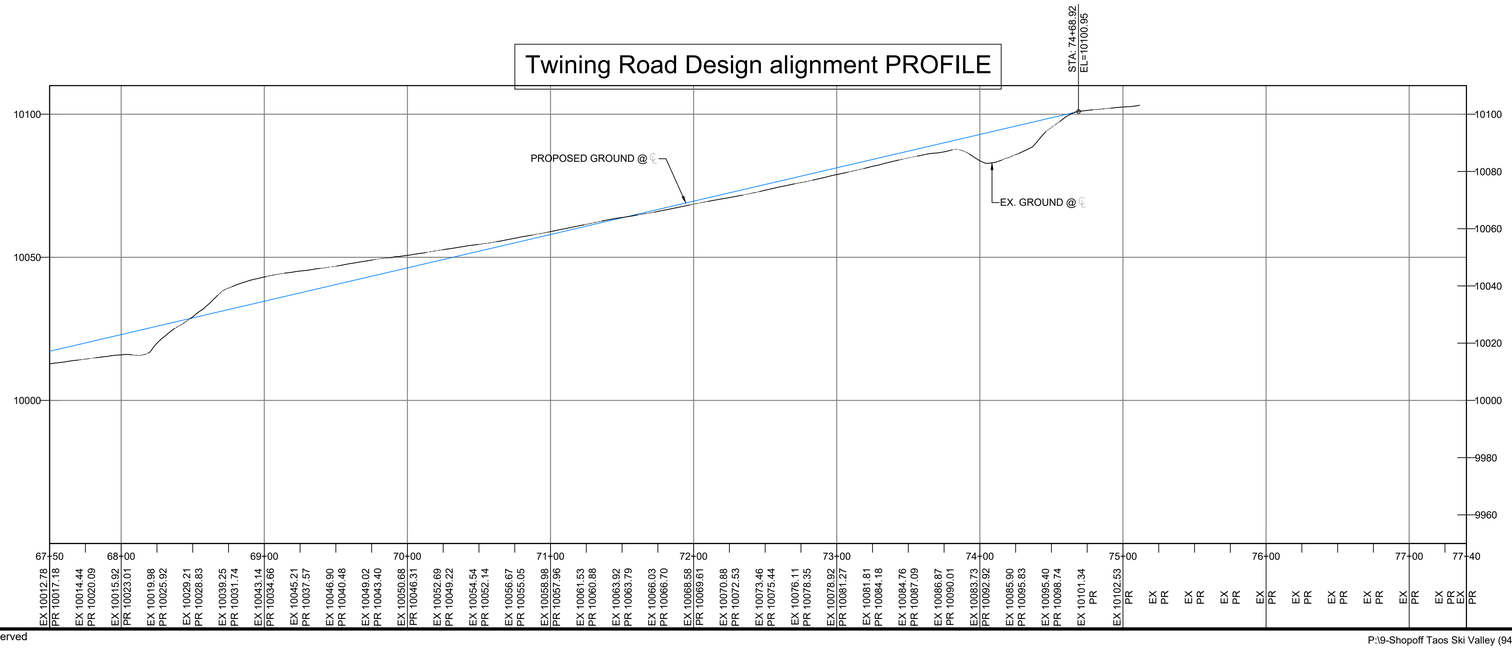
Sheet: 5

Twining Road Design alignment PROFILE



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