THE VILLAGE OF Taos Ski Valley

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PLANNING & ZONING COMMISSION:
Thomas P. Wittman, Chair
Henry Caldwell
Richard Duffy
Yvette Klinkmann
Susan Nichols
J. Christopher Stagg
Jim Woodard

VILLAGE ADMINISTRATOR:
John Avila

DIRECTOR OF PLANNING & COMMUNITY DEVELOPMENT:
Patrick Nicholson

VILLAGE CLERK:
Ann Marie Wooldridge

PLANNING & ZONING COMMISSION REGULAR MEETING AGENDA

Monday, March 6, 2023 1:00 P.M.
Via Zoom TeleConference
See www.vtsv.org for information to attend the meeting
TAOS SKI VALLEY, NEW MEXICO

AGENDA

I. CALL TO ORDER & ROLL CALL

II. APPROVAL OF THE AGENDA

III. APPROVAL OF THE MINUTES OF THE FEBRUARY 6, 2023 P&Z COMMISSION MEETING

IV. OLD BUSINESS

V. NEW BUSINESS

A. Discussion: Review of draft report - Snow Avalanche Hazard Analysis and Mapping for the Village of Taos Ski Valley by Wilbur Engineering, Inc.

VI. MISCELLANEOUS

A. Sub-committee Formation Land Use Development Code Update

VII. ANNOUNCEMENT OF THE DATE, TIME, AND PLACE OF THE NEXT MEETING

VIII. ADJOURNMENT

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PLANNING & ZONING COMMISSION
REGULAR MEETING DRAFT MINUTES

Monday, February 6, 2023 1:00 P.M.
Via Zoom TeleConference
See www.vtsv.org for information to attend the meeting
TAOS SKI VALLEY, NEW MEXICO

MINUTES

I. CALL TO ORDER & ROLL CALL

Commission Chair Wittman called the meeting to order at 1:00 p.m. Commission members Wittman, Caldwell, Duffy, Klinkmann, Stagg and Woodard were present. Commission member Nichols logged in before item V. A.

II. APPROVAL OF THE AGENDA

MOTION: to approve the agenda as written
MOTION: Commissioner Stagg **SECOND:** Commissioner Duffy
PASSED: 6-0

III. APPROVAL OF THE MINUTES OF THE NOVEMBER 14, 2022 P&Z COMMISSION MEETING

MOTION: to approve the minutes as presented
MOTION: Commissioner Stagg **SECOND:** Commissioner Duffy
PASSED: 6-0

IV. OLD BUSINESS

No items of old business

Note: Commission Member Nichols logged in at 1:06 p.m.

V. NEW BUSINESS

A. Consideration to Approve Resolution 2023-526 Concerning Planning Commission Meetings and Notice Required.

Village Clerk Ann Wooldridge advised the Commission that this Resolution is a routine matter providing for the conduct and procedures of Commission meetings.

MOTION: to approve Resolution 2023-526
MOTION: Commissioner Stagg **SECOND:** Commissioner Duffy
PASSED: 7-0

B. PUBLIC HEARING: Consideration to Approve a Conditional Use Permit at 112 Sutton Place for the Reconstruction of the Hotel Saint Bernard by Taos Ski Valley, Inc.

Chair Wittman announced the procedures for the public hearing.

Staff Report: Planning Director Nicholson introduced the agenda item and described the application process. He stated that the application was deemed complete in November 2022 but the hearing of the application was deferred from the December 5, 2022 Commission meeting at the request of the Applicant. Mr. Nicholson stated that the proposed project would consist of three buildings including a luxury hotel with two fine dining restaurants at the south end of Sutton Place. The location is within the Village Core zone. The plans as submitted comply with Village design guidelines. Mr. Nicholson called the Commission's attention to the requirements of Ordinance No. 22-030 for approval of a conditional use permit (CUP). Mr. Nicholson stated that the project as presented complies with most but not all of the relevant guidelines, and therefore the Planning Department recommends approval of the CUP with the conditions set out in the Staff Report, reflecting (1) presently inadequate Village water supply to support the completed project; (2) development impact fees to be imposed for the project, the exact figure yet to be determined, including any request for credits; (3) off-site parking as originally proposed has been revised to provide that 44 of the required spaces will be provided on an expanded site with a lot line adjustment to provide the necessary area; (4) Applicant needs to address pedestrian safety issues on Sutton Place; (5) avalanche safety measures for which Applicant has provided a study, but still needs to provide a structural analysis of anticipated forces in the event of an avalanche; (6) drainage plan and stormwater pollution prevention plan yet to be provided; (7) Village costs for any outside expert review will be paid by the Applicant; (8) the Village's Public Works Director advises that at present there is adequate wastewater treatment capacity to support the proposed project; (9) preliminary plans as presented comply with roof height requirements, but this will be re-evaluated when final detailed plans are received; and (10) the newly revised site plan places a parking lot adjacent to a U.S. Corps of Engineers designated wetland, presenting a possible need for a Section 404 permit from the Corps of Engineers. Staff recommends approval with the following conditions as reflected in the Staff Report: (1) revised streetscape and roadway improvements to address pedestrian safety on Sutton Place, with all improvements to be completed before issuance of a certificate of occupancy; (2) condition removed and to be addressed later; (3) condition removed and to be addressed later; (4) lot line adjustment to be completed before issuance of a certificate of compatibility; (5) avalanche hazard engineering analysis by a New Mexico certified engineer; (6) condition regarding off-site parking changed to require a showing that no Section 404 permit is required, or alternatively providing such a permit; (7) snow roof retention system to be independently evaluated by the Village; (8) any substantive changes to be approved by the Commission, and other changes by the Planning Director; (9) conditional use permit will expire 2 years from date of issue if no building permit has been issued.

Commissioner Klinkmann requested that Commissioner Stagg recuse himself from this matter because he is employed by the Applicant.

Applicant's Presentation: Carl Pearson, Associate Principal of Hart Howerton, introduced the Applicant's visual (slide) presentation.

Peter Talty of TSVI described the application process to date, since the application was originally submitted on August 1, 2022. He described the Applicant's efforts to move forward while retaining elements of the character and history of Taos Ski Valley. He stated that the intent was to recreate to a significant extent the experience of the former Hotel Saint Bernard (HSB). This application does not request a variance or change of use. He introduced the project team that has been working on the HSB project.

Carl Pearson described project core goals to (1) create improvements to elevate the ski experience; (2) revitalize and improve the HSB while maintaining its spirit and character; (3) provide public amenities to draw skiers and year-round visitors; (4) elevate Village dining, nightlife and wellness experience; (5) improve the guest experience; and (6) add value, energy and activity to the Village with increased accommodation. He discussed the project's integration into the revitalization of the Village core and its relation to future anticipated projects. He described the planned increase from 28 residential (hotel) units in the old HSB to 53 residential units in the three structures of the new project. He described the landscaping and planting plans for the HSB project. He described the planned vehicle and pedestrian circulation plans, and the use of valet parking for hotel guests. He described the HSB's integration into the foot of the ski slope for access between the hotel and the slopes. He described the general scope of snowmelt plans covering many outdoor areas. Mr. Pearson stated that the new HSB would provide increased public areas, both interior and exterior, as well as re-creating key elements of the old HSB such as the original dining room and bar. He described the intent to use the Allée Mayer between the HSB and Snakedance for additional pedestrian access, protected by bollards that can be removed in the event emergency access by vehicles is necessary. He described the parking design with 65 valet parking spaces (including three handicapped spaces) on the lower level of the HSB and an additional 44 spaces for staff and overflow valet parking. The exterior parking conforms to the necessary setback from the nearby wetland area. With the removal of Mogul Medical from the area the Applicant anticipates opening up the passageway for vehicles along the extension of Sutton Drive onto the property, improving traffic and pedestrian safety. The intent is for the new HSB buildings to fit within the viewscape and be consistent in scale with existing structures in the Village Core zone. Mr. Pearson presented examples from other locations of materials and approaches that will be used to create the feeling of an alpine ski resort. The building height is consistent with restrictions in the Village's zoning ordinance. The roof design is intended to hold most snow on the roof and prevent it sliding off onto public areas.

Omeed Mollaian of Vertex Engineering described engineering enhancements for routing of pedestrians and traffic, the plans for utilities to be routed into and within the HSB site, and drainage plans including (a) drainage from the roof and hard surfaces on the site, routed into a regional detention pond, and (b) routing of water to both east and west of the site from "soft" areas without hard surfaces.

Carl Pearson and Peter Talty concluded the Applicant's presentation by reiterating that the intent is to honor the history of the Village while adding a hospitality component to make it attractive for year-round activities.

Chair Wittman inquired about how staff would access HSB from the parking area at the foot of Strawberry Hill. Mr. Pearson indicated that staff would probably go back and forth in the area adjacent to the Gondolita next to the new Chateau Mayer, or they might be brought by shuttle service.

Commissioner Caldwell inquired about access to the area of Lift 1. Mr. Pearson described the intent to create a new path from the Gondolita area up a stairway next to extended Sutton Place to reduce the potential conflict between pedestrians and vehicles.

Public questions: From Bob G: How will trucks make deliveries to the HSB and how will they turn around? Mr. Pearson answered that trucks would be limited to a length of 22 feet, and that they had done tests to ensure that they could turn around and also enter the building to the interior loading area.

From Mary Tingerthal, an owner at Snakedance Condominiums: How will the Applicant address the difficult intersection of Sutton Place and the private entrance road near Snakedance and the Gondolita? Mr. Talty stated that Applicant was reducing the present grade, as well as removing the perpendicular parking presently in front of Mogul Medical to widen the effective roadway, and that snowmelt will be directed to a French drain. Applicant also anticipates that during most times there will be less traffic than at present because of the valet parking.

From Kent Forte: Can applicant address the present ski-in, ski-out arrangements? Mr. Talty stated that Applicant was not happy with the proposed parking area at the foot of Strawberry Hill, which was required by the Village. Mr. Pearson stated that skier access to Edelweiss and the Gondolita Plaza would be retained, but perhaps modified.

From Trudy DiLeo: Can fire engines get down the Allée Mayer? Mr. Pearson stated that they could, as could other emergency vehicles, with the removal of the bollards to allow that access.

PUBLIC HEARING:

Peter Talty spoke in favor of the project and stated that it would be beneficial for the Village.
Carl Pearson spoke in favor and emphasized that the Applicant was trying to achieve a balance between the need for new facilities while honoring the previous circumstances of the Village and the residents and honored citizens of the past.
Eduardo Sampere spoke in favor of the project. He said that he saw a real effort to honor the old HSB and the special place that it was for him, his family and others.
Lawrence Peterson, Construction Manager for Bradbury Stamm Construction, spoke in favor of the project. He stated that his company was enthusiastic about the project, which will employ hundreds of tradesmen, and his that they will use local workers and businesses during the construction process.
Anthony Rodman spoke in favor of the project. He said that it was essential to move forward with well-conceived projects like this to bring new life into the Village.
David Norden of TSVI spoke in favor of the project. He believes that the project preserves the heritage of the old HSB and helps to preserve the essence of the sport of skiing. He requested that the parking condition be removed to preserve the sledding hill and for aesthetic reasons, and stated that there was no need for it because of other available parking areas.
Chaz Rocky of TSVI spoke in favor of the project. The plans are well developed and reflect well on the

history of HSB. He also feels the added parking is not necessary.
Monique Mayer Jacobson spoke in favor of the project. She agrees with her late father that HSB and the ski mountain are inextricably linked in the history of Taos Ski Valley.
Bob Coroon spoke in favor of the project. He believes the project is important because right now there is a lack of night life and dining, and also for the tax revenues that will be produced.
Jay Lazarus, Glorieta Geoscience, spoke in favor of the project. There is plenty of water supply available; the problem is a faulty distribution system. The wetlands are not an issue because of prior approval of their delineation by the Corps of Engineers, and they have an approving letter from the Corps of Engineers. There not be any dredged or fill materials into a wetland.
Joseph Canepa, Canepa & Vidal P.A., spoke in favor of the project. He has skied on the mountain for almost 45 years and is pleased to see the way that the history and nature of the old HSB is being honored.
Andrea Heckman spoke in favor of the project. She was on Jean Mayer's staff for 44 years, and she agrees that the HSB is extremely important to the ski area. She agrees that no additional parking is needed and stated that deliveries are downloaded from larger trucks onto smaller ones that can be accommodated, and other issues can be resolved. The important thing is to get on with the project.

No one spoke against the project.

MOTION: To approve the CUP with further examination of the parking issue and that it be further addressed at a future time with the hope that the extra parking can be eliminated.
MOTION by Commissioner Nichols; **SECOND** by Commissioner Caldwell.
DISCUSSION:
Mr. Nicholson stated that the Planning Department also is not very happy about the parking solution proposed by the Applicant. The Village is aware that the water issue is a distribution issue. Corps of Engineers condition is because of the late submittal and lack of documentation from the Applicant. Commissioner Duffy stated that he thought the project was well done and well presented and he would support it. Commissioner Klinkmann inquired what would be necessary to resolve the issues with availability of water. Mr. Nicholson said that a great deal of work was needed to resolve problems with leaking pipes in the distribution system, which could take one to three years. Commissioner Klinkmann asked whether there was a traffic study done on the anticipated traffic increase due to the project. Mr. Nicholson stated that no such study was done. Commissioner Caldwell requested clarification whether the motion included elimination of all of the Planning Director's proposed conditions for approval. Commissioner Nichols said that she would like to eliminate the condition related to water supply. Mr. Nicholson inquired how the need for parking would be met if the additional parking area proposed by the Applicant was eliminated. Mr. Talty stated that the original parking plan as submitted in August 2022 included different provisions for designation of parking in other areas, similar to other businesses in the Village.
Mary Tingerthal stated that she generally supports the project but that now is the time to look at details and her primary concern is related to streetscape design and traffic management, and provisions for that are insufficient. There must be removable bollards on both ends of the Allée Mayer to avoid traffic entering and needing to back out. More time is needed for study. Trudy DiLeo stated that she agrees with everything Mr. Nicholson has said about a cautious approach to the project. She inquired why the public safety commission was no longer involved to make recommendations. Mr. Nicholson stated that it was a matter of timing and trying to accommodate the Applicant. Ms. DiLeo

asked whether there was enough water to start the building process. Mr. Nicholson stated that there appeared to be enough water for construction. Jay Lazarus added the water conditions if put in place would amount to a de facto moratorium on further building. Commissioner Caldwell observed that the water issue is a long-standing problem the significance of which has only become obvious recently. There is no lack of water; it just needs to be delivered to the appropriate places. He believes the problem can be resolved. He favors removing the conditions related to water supply and development fees—as proposed by Mr. Nicholson.

Commissioner Woodward stated that he would be inclined to approve the CUP without any conditions. Eduardo Sampere observed that there is more than one parking person per guest room, which appears to him to be more than sufficient.

Mr. Pearson clarified that there will be bollards on both ends of Allée Mayer. The civil engineers have used standard engineering programs to ensure that there will be an adequate turning radius for trucks. Mr. Lazarus added that water use during the construction period would be primarily during the off-season. Mr. Talty stated that the various landowners ought to be able to work out the parking and traffic issues by all sitting down together, and the Applicant was willing to do that, but it should not be a permit condition. TSVI is working with the Village to resolve the water supply issues, and is seeking $5,000,000 funding from the State to help fund the necessary work. The contingencies proposed by the Village are a serious problem for the Applicant and could affect the construction schedule.

MOTION TO AMEND: Commissioner Nichols, to amend her motion to remove all conditions. Commissioner Woodward stated that he would second the motion to amend. The amendment proposed by Commissioner Nichols did not get approval from the Second of the original motion.

MOTION WITHDRAWN: Commissioner Nichols was permitted to withdraw her original motion.

MOTION: To approve the conditional use plan without conditions.

MOTION by Commissioner Woodward; **SECOND** by Commissioner Duffy.

DISCUSSION:

Mr. Canepa requested that his Objections and Responses filed with the Commission on February 1, 2023 be entered as a part of the record. Permit from the Army Corps of Engineers is not necessary. Francie Parker stated that she was very disappointed in the proposal to summarily dismiss the recommendations of the staff. She believes Commissioner Caldwell is attempting to protect the Village with regard to the issues relating to availability of water. Water is a primary concern of many Village residents. The infrastructure problems should be addressed before an additional burden is added to the system. Ms. Tingerthal suggests that if the motion is adopted the Commission should at least go on record as proposing that the parties try to get together to resolve their differences.

Public Safety Officer Virgil Vigil stated that he was concerned about traffic safety due to the expected increase in pedestrians.

Commissioner Caldwell inquired whether issuance of a permit with no conditions amounted a "will serve" letter to the Applicant. The Chair advised that under those circumstances water was no longer an issue in the application.

Village Counsel Appel stated that in his view the Village has a general obligation to provide water to users within the Village, including this project and other potential projects. Mr. Nicholson recommended withdrawing the water availability question as a condition for this CUP.

Mr. Appel stated that the Village could potentially be held liable for damages if water was not supplied when it should have been available.

Village Administrator John Avila stated that he does have concerns about the traffic and safety issues.

Commissioner Klinkmann stated that she strongly agrees that safety concerns are a problem that needs to be addressed, and should be a part of the CUP process. Commissioner Woodward stated that he believes any traffic problems that may arise with this project can be addressed by TSVI. Mr. Talty pledged that TSVI was willing to sit down with other nearby property owners to address any potential problems and describe TSVI's proposed solutions. He also stated that the Applicant was willing to wait until the end of the project (certificate of occupancy stage) to address availability of adequate water. He believes the problem will be resolved in three years.
Jalmar Bowden, Village Building Inspector, asked about the status of proposed conditions and whether they would arise in later stages. Mr. Pearson summarized the proceedings of the meeting to this point. Francie Parker inquired whether a certificate of occupancy could be denied on the basis that there is an inadequate water supply to serve the new structure. Chair Wittman stated that a CO could be held back under those circumstances.

VOTE: A vote was initiated and the voice vote was unclear.

ROLL CALL VOTE:

Commission Caldwell:	**Nay**
Commissioner Duffy:	**Aye**
Commissioner Klinkmann:	**Nay**
Commissioner Stagg:	**Aye**
Commission Chair Wittman:	**Nay**
Commissioner Woodward:	**Aye**
Commissioner Nichols:	**Aye**

NOTE: Commissioner Nichols was contacted by telephone because her Zoom connection had been unexpectedly disconnected. Her vote was audibly made and recorded.

PASSED by a vote of 4-3

VI. MISCELLANEOUS: There were no items under Miscellaneous.

VII. ANNOUNCEMENT OF THE DATE, TIME, AND PLACE OF THE NEXT MEETING

Clerk Wooldridge announced that the next regular meeting will be March 6, 2023, at 1:00 p.m.

VIII. ADJOURNMENT

MOTION: To adjourn

MOTION: Commissioner Woodward **SECOND:** Commissioner Duffy **PASSED:** 7-0

Chair Wittman declared the meeting adjourned.

DRAFT

SNOW AVALANCHE
HAZARD ANALYSIS
AND MAPPING

for

THE VILLAGE OF TAOS SKI VALLEY
TAOS COUNTY, NEW MEXICO, USA

Prepared for:

Village of Taos Ski Valley
PO Box 100
Taos Ski Valley, NM 87525

Prepared by:

Wilbur Engineering, Inc.
Durango, Colorado

February 27, 2023

WILBUR ENGINEERING, INC.

150 East 9 St., Suite 201 • Durango CO 81301
(970) 247-1488 • chris@mearsandwilbur.com

February 27, 2023

Patrick Nicholson
Planning Director
Village of Taos Ski Valley
PO Box 100
Taos Ski Valley, NM 87525
Via email Via email

RE: DRAFT Avalanche Hazard Mapping and Recommendations
The Village of Taos Ski Valley, New Mexico

Dear Mr. Nicholson:

This Draft Report and accompanying Preliminary Maps are intended to guide the village in addressing risks associated with development in potential avalanche terrain. The mapping builds on previous work and incorporates new data, methods and research to improve the quality of maps compared to the village's existing Avalanche Hazard Maps prepared by Arthur I. Mears, P.E., Inc. in 2001.

I recommend that you, your staff and all other stakeholders review this report and maps. I welcome any new information or feedback and will take it into account prior to finalizing the report and maps.

I have enjoyed working on this project. We hope that this provides the information that you need at this time. If you have any questions, please contact me.

Sincerely,
Wilbur Engineering, Inc.

Chris Wilbur, P.E.

Contents

List of Figures

Avalanche Hazard Maps

Appendixes

1. Background

This report describes a site-specific avalanche hazard mapping study for the Village of Taos Ski Valley. Figure 1 shows a site location map.

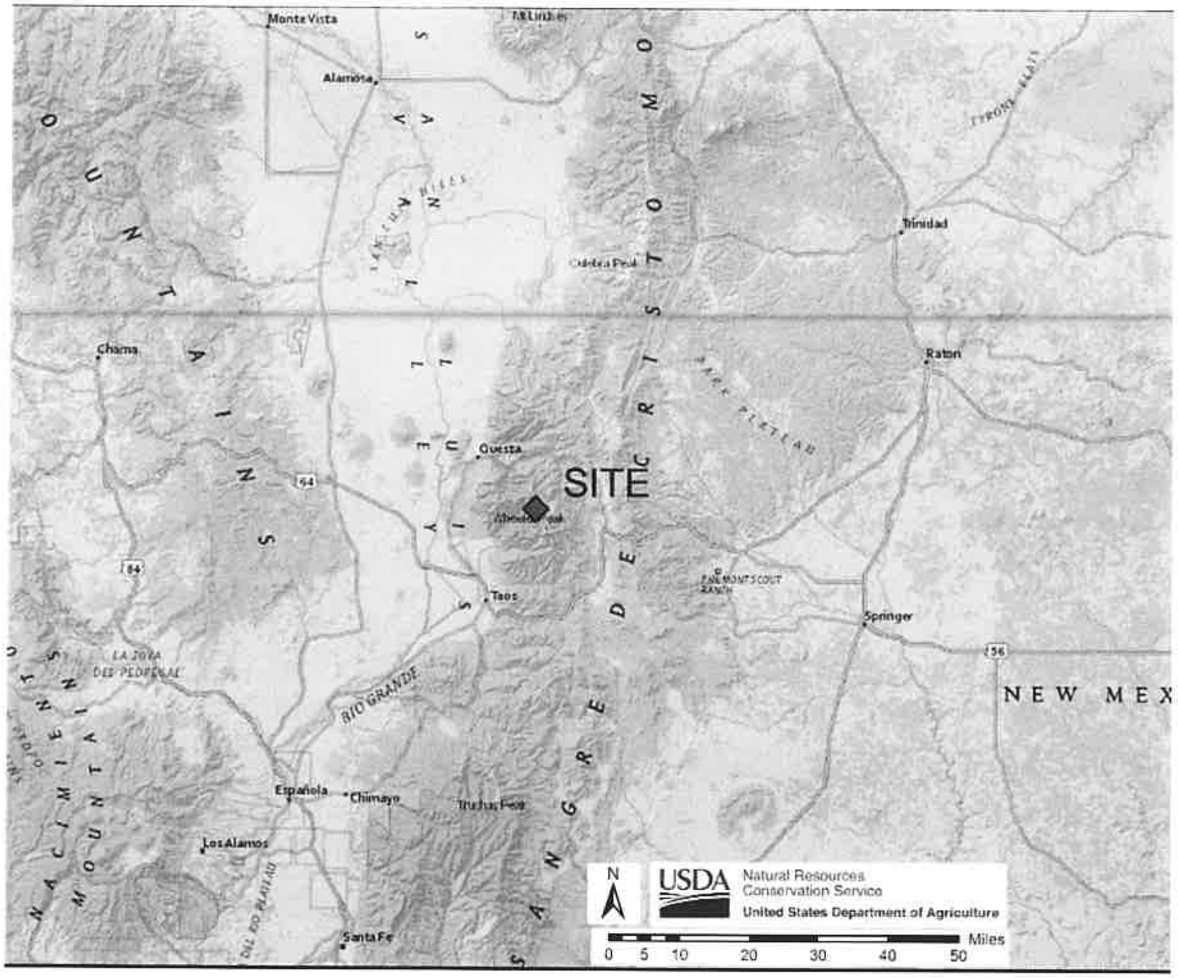

Figure 1 – Site Location

2. *Objectives*

This report has the following **objectives**:

1. Describe the regional snow and avalanche climate.
2. Determine the runout limits of snow avalanches with average return periods of 100-years and 300-years or annual exceedance probabilities of 1.0 percent and 0.3-percent;
3. Describe methods used to develop the Avalanche Hazard Map.
4. Delineate Avalanche Zones as defined in this report.
   a. High Hazard (Red) – frequent or high energy[1] avalanches zones.
   b. Moderate Hazard (Blue) – low frequency and low-medium energy[2].
   c. Low Hazard (Yellow) – areas subject to low probability/low energy dense flowing avalanches or medium-frequency/low energy powder avalanche impacts[3].
5. Describe avalanche risks in relation to the land use, along with uncertainties, and recommendations for mitigating avalanches hazards within and near the defined hazard zones.
6. Provide information and guidance on the existing avalanche ordinance and potential future revisions.

3. *Limitations*

This report also has the following **limitations**, which must be understood by all those relying on the results, conclusions, and recommendations:

1. Avalanches larger than the mapped avalanche runouts are possible, even though the probabilities are low.
2. This study is site and time specific; it should not be applied to adjacent lands nor should it be used without updating in the future when additional data and improved methods become available.
3. The avalanche hazard boundaries are based on current topography, vegetation and climatic conditions. Changes in any of these conditions could increase or decrease the avalanche hazard.

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[1] The *Red Zone* is an area where avalanches have a return period of 30 years or less or produce impact pressures of 600 lbs/ft^2 or greater on a flat surface normal to flow.
[2] The *Blue Zone* is defined as an area where avalanches have a return period ranging from 30 to 100 years (3% to 1.0% annual probability) and where avalanches produce impact pressures of less than 600 lbs/ft^2 on a flat surface normal to flow.
[3] The *Yellow Zone* is defined as an area where avalanches have estimated average return periods between 100 and 300-years and powder pressures are less than 60 psf.

4. Site specific mitigation of structures including buildings, roads, and parking areas are beyond the scope of this study.
5. This report does not address avalanche risks to persons traveling, working in or recreating in avalanche terrain. This type of avalanche risk must be addressed with an ongoing operational avalanche plan that includes weather and snowpack monitoring, forecasting and temporary mitigation measures, such as terrain and road closures.

4. Methods

The avalanche hazard mapping and recommendations presented in this report are based on:

1. Site observations made during snow-free conditions by Chris Wilbur, P.E. on September 15 and 16, 2022 and January 13, 2023.
2. Analysis of aerial photos of various dates and sources (Taos Ski Valley, USGS, NAIP, Google Earth, Bing);
3. Review of historic weather data, include data from Taos Ski Valley, Inc., and the Powderhorn Snotel site.
4. Terrain analysis using 2015 LiDAR data from the USGS National Map and 1-foot topographic maps based on 2021 LiDAR data from Taos Ski Valley, Inc.
5. Application of statistical avalanche runout models.
6. Avalanche dynamic modeling with the Swiss program, RAMMS, Version 1.80 utilizing a digital elevation model (DEM) developed from the LiDAR data.
7. Avalanche dynamic modeling of the suspension component with the Swiss program, RAMMS:Extended, version 2.7.90.
8. A review of published documents on the effects of forests on avalanche processes.
9. Our local and regional knowledge of terrain, climate and avalanche hazards.

5. Snow Climate

The Taos Ski Valley and Sangre de Cristo mountains are characterized by a continental snow climate typical of high elevations in northern New Mexico. Average annual precipitation at the Village of Taos Ski Valley is 20.5 inches and average snowfall is about 146 inches. Average January low and high temperatures are 4°F and 21°F, respectively. Precipitation generally increases and temperatures decrease at higher elevations. This relatively dry, sunny snow climate commonly has a shallow weak early-season snowpack that can persist throughout the winter and spring. The weak lower snowpack can become overloaded by snow slabs that form during large storms and wind events, resulting in instability and widespread natural and triggered avalanche activity. Weather and climate data are presented in Appendix A.

6. Avalanche Terrain

Figure 2 shows a slope-angle map and derived from the USGS 2015 LiDAR data. Figure 3 shows an aspect map. The orange and red colors on the slope map indicate potential avalanche starting zones. Most avalanche starting zones[4] have slope angles of between 30 and 45 degrees. Northerly aspects that will accumulate a deeper and colder snowpack than other aspects. Southerly aspects will hold less snow causing surface roughness to reduce the probability and size of avalanches. Prevailing winds will transport snow onto NE through SE aspects. Less common easterly winds can load starting zones above timberline on the east side of the Lake Fork.

Avalanche tracks[5] at the site range from incised gullies to sub-planar slopes. Some of the lower tracks turn abruptly at the main valley. The avalanche runout zones[6] include relatively steep channels, valley bottoms and debris fans. Many of the runout zones at the site are relatively steep (>10-degrees) due to forests inhibiting the release of large avalanches. Exceptions occur above timberline and in disturbed areas such as the Mineslide path.

Figure 3 shows evidence of an undocumented large avalanche at the Northside that destroyed forests at the site in the early 1960s. This avalanche might have occurred during a major avalanche cycle in the southern Rocky Mountains that occurred in late January 1962. An avalanche cycle in the mid-1990s also extended into forested terrain at the southern end of the map area.

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[4] The *Starting Zone* of an avalanche is the area where snow releases, accelerates and increases in mass.
[5] The *Track* of an avalanche is the area where maximum velocity and mass are attained.
[6] The *Runout Zone* is the area where avalanches decelerate, deposit and come to a stop.

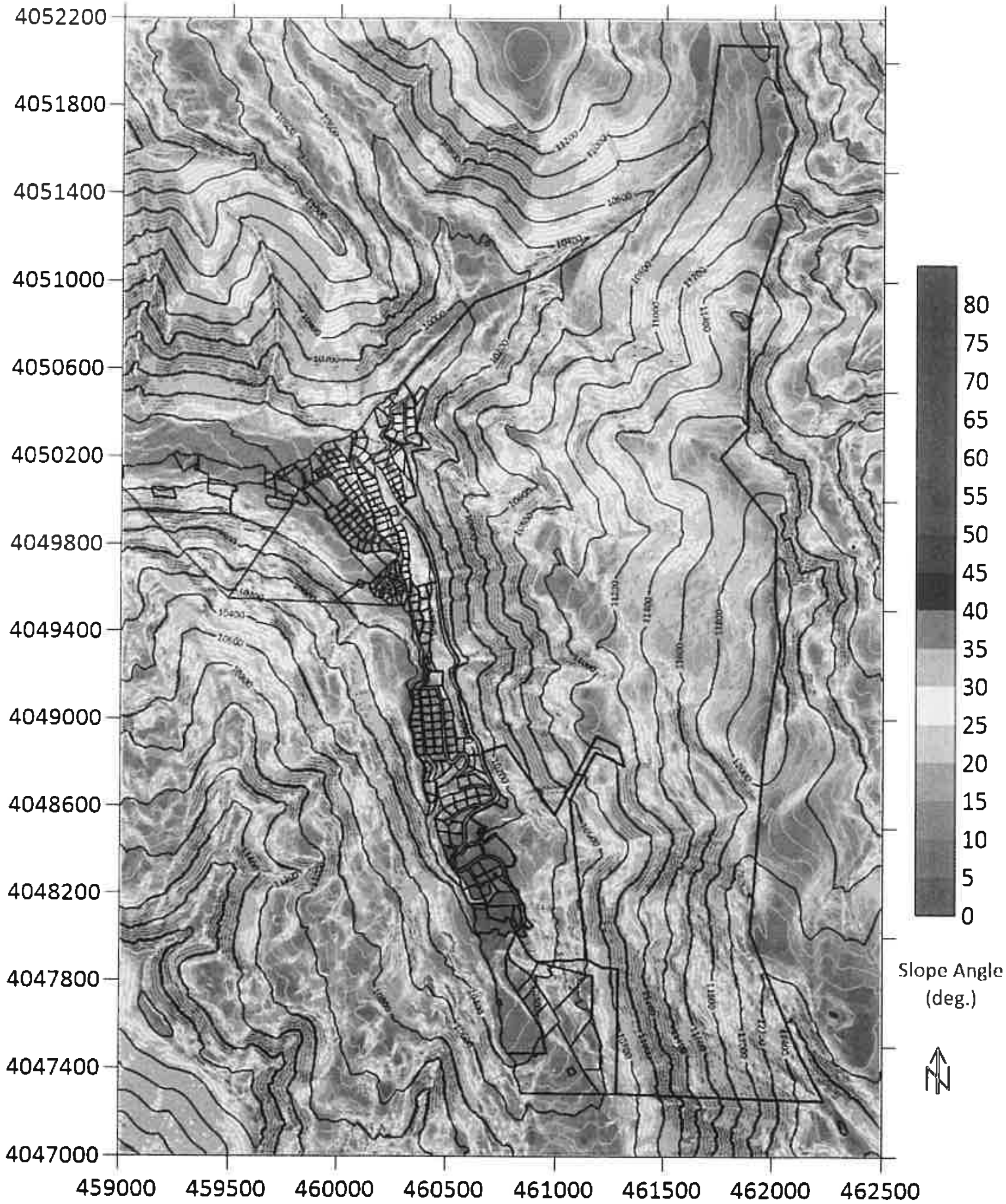


Figure 2 – Slope Map

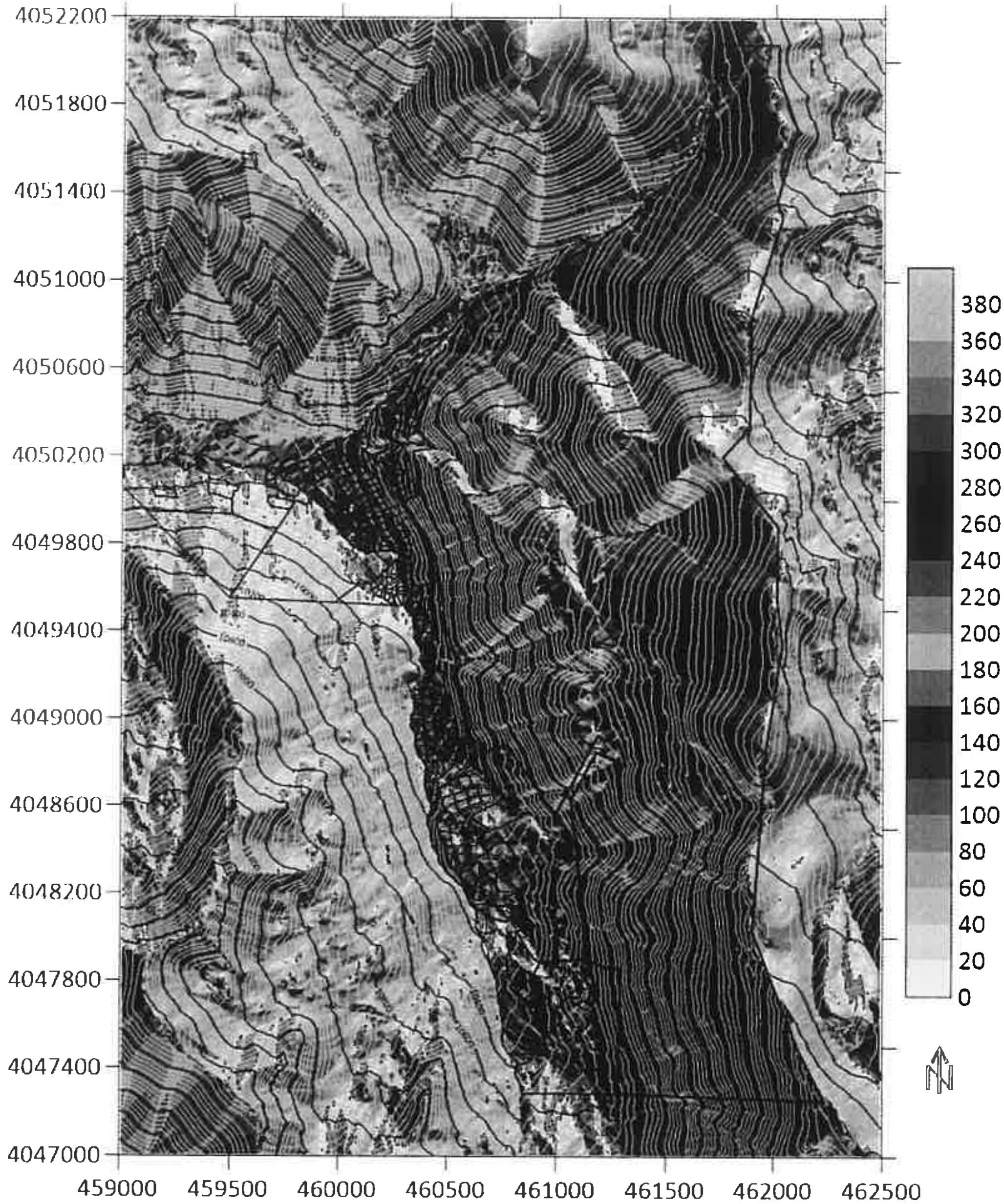


Figure 3 –Aspect Map

1962

2021

Figure 4 – 1962 Arial Image of Trim Line near Jean's Meadow
(Sources: USGS 9-8-1962 Flight, Google Earth, 5-16-2021)

7. Statistical Avalanche Runout Models

We applied statistical avalanche runout models from eight avalanche climates to estimate potential ranges of extreme (100 to 300-year average return periods) avalanche runout distances for selected paths (Ref. 4). These models use a centerline profile of the avalanche path and incorporate the "beta-point" which is the location where the slope angle decreases to 10-degrees. No regional or site-specific models exist for the Taos Ski Valley area, so the statistical models are intended only as a supplemental method to bracket likely ranges of extreme runouts.
Figure 4 shows centerline profiles with mapped and modeled runouts of selected avalanche paths.

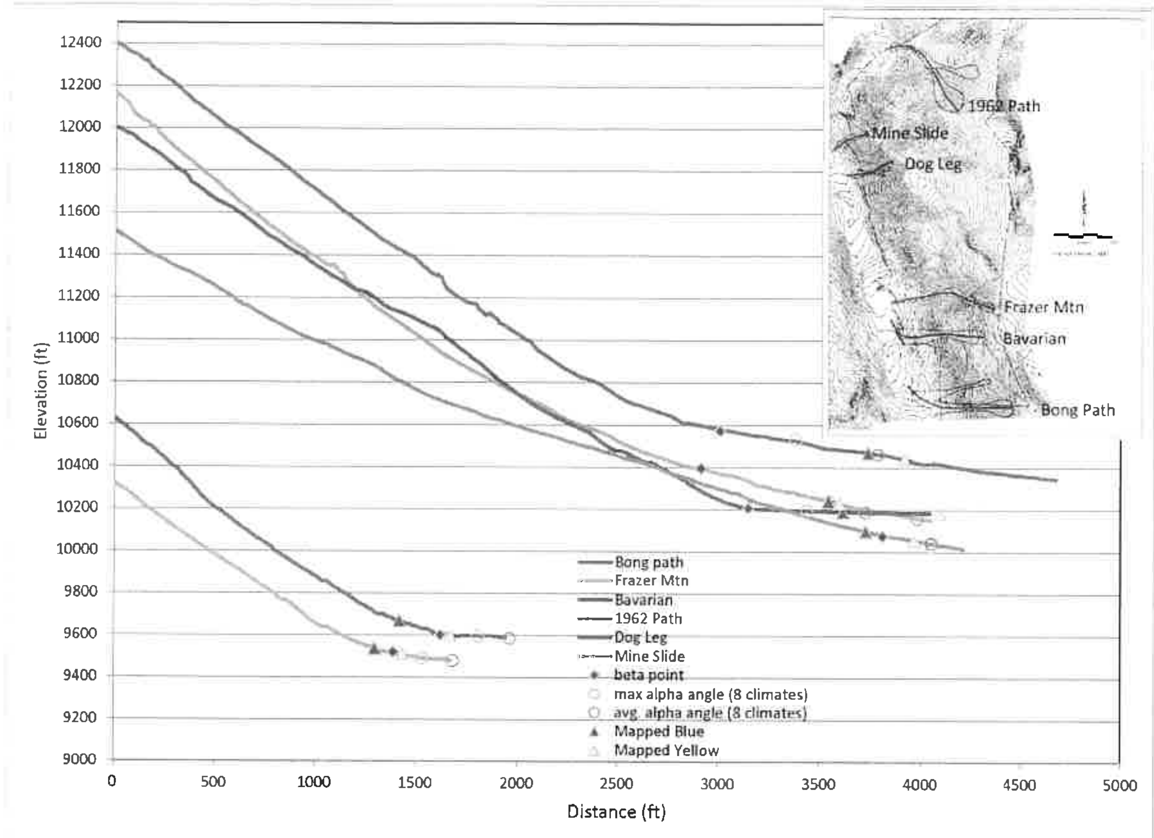


Figure 5 – Avalanche Profiles and Locations

8. *Forest Conditions*

The role of forests in preventing snow avalanches in steep terrain has long been recognized in Europe where destructive avalanches resulted from tree removal for buildings and firewood. More recently, fires and logging operations in the U.S. and Canada have led to a better understanding of the role of forests in avalanche prevention and mitigation. The following factors have been found to reduce avalanche release frequencies, sizes and runout distances:

1. Tree canopy coverage, especially conifers, influences snow accumulation depth and variability; Tree canopy disrupts snowpack structure and reduces crusts continuous weak layers; Tree canopy changes energy balance caused by incoming and outgoing radiation resulting in a generally stronger snowpack;

2. Tree trunks anchor the snowpack in *starting zones* by mechanical resistance to creep, glide and slab failure. This effect is dependent on relatively high density of medium-large trees per acre.
3. Forests in the *track* and *runout zones* have a relatively small effect on runout distance compared to the above factors. The effects of friction and energy dissipation due to forest impacts in avalanche tracks and runout zones generally decrease with increasing avalanche mass.

The combination of factors listed above cause healthy conifer forests to be more effective than deciduous or mixed forests, or snags at preventing avalanche release. A decrease in forest density and canopy coverage can result from several causes, including insect mortality, forest fire and blowdown.

The forest fire history of the upper Rio Hondo watershed is described in Ref. 2, including a map of a high-severity fire that impacted much of the site in 1842 during a severe drought. The 1842 fire burned bristlecone pines near timberline. The report includes several historic (~1903) photos indicating severe burn areas at the Northside and the east side of the Lake Fork of the Rio Hondo. Figure 5 shows a historic photo of Twining and the Mineslide path.

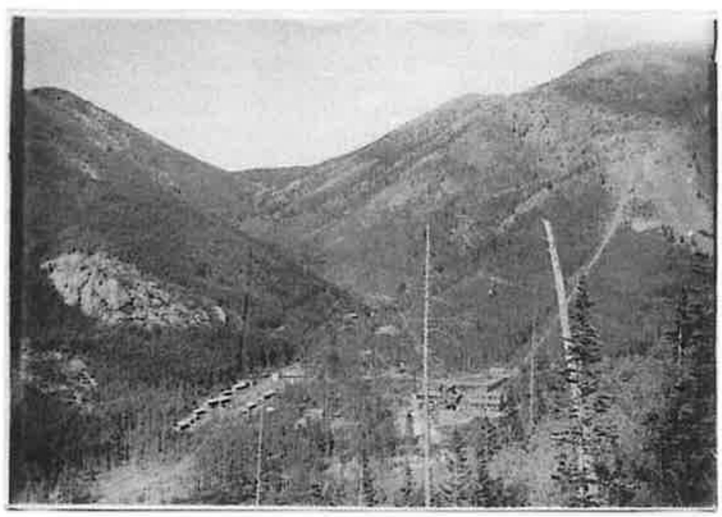


Figure 6 – Historic Photo of Mineslide and Northside Area
(Source: USFS interpretive sign, © private photo)

A major forest blowdown event occurred in mid-December 2021, destroying and damaging numerous buildings in Taos county, resulting a county-wide state of emergency declaration. Thousands of trees were blown down above Twining Road near the Bavarian Restaurant, the Phoenix, Lift 4 and on both sides of the valley up the William's Lake trail. Figure 6 shows a map of the blowdown area near the site. Figure 7 shows a photo of the blowdown area taken in August 2022.

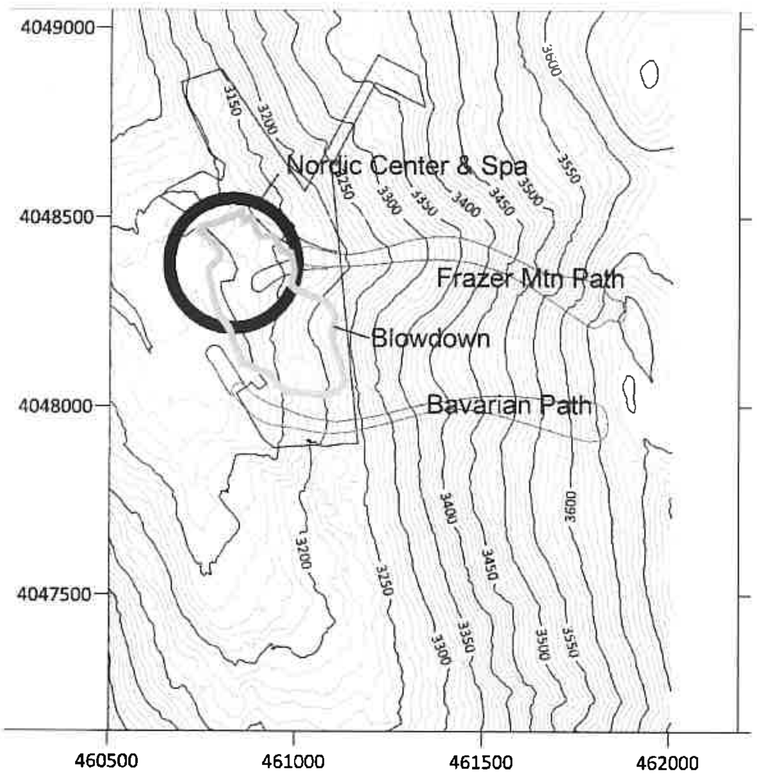


Figure 7 – Map of December 2021 Severe Blowdown Area
(Source DEI Report; Avalanche Paths from Mears 2000 Maps)

A Forest Management Plan for the Northside at Taos Ski Valley was prepared in 2020 by Dolecek Enterprises Inc. (DEI), Forest Management Specialists (Ref. 3). The plan describes declining forest heath over the last 30 years at the Northside at Taos Ski Valley and throughout the Southwest. The Northside at Taos Ski Valley is classified as a very high fire risk, with potential for severe fire intensity on the New Mexico Fire Risk Portal. The DEI Report includes a prescription for the 1962 avalanche path starting zone based on the high basal area (238) and its location above the Bull of the Woods spring.

Figure 8 – Photo of December 2021 Blowdown Area
(Chris Wilbur Photo, August 2022)

We observed areas of thinning during our field observations, including lop and pile in potential avalanche starting zones. Figure 9 shows a forest canopy height from the Frontside derived from 2015 LiDAR data. Figure 9 shows a canopy height map form the Northside. Additional forest and vegetation photos and their locations are shown in Appendix B.

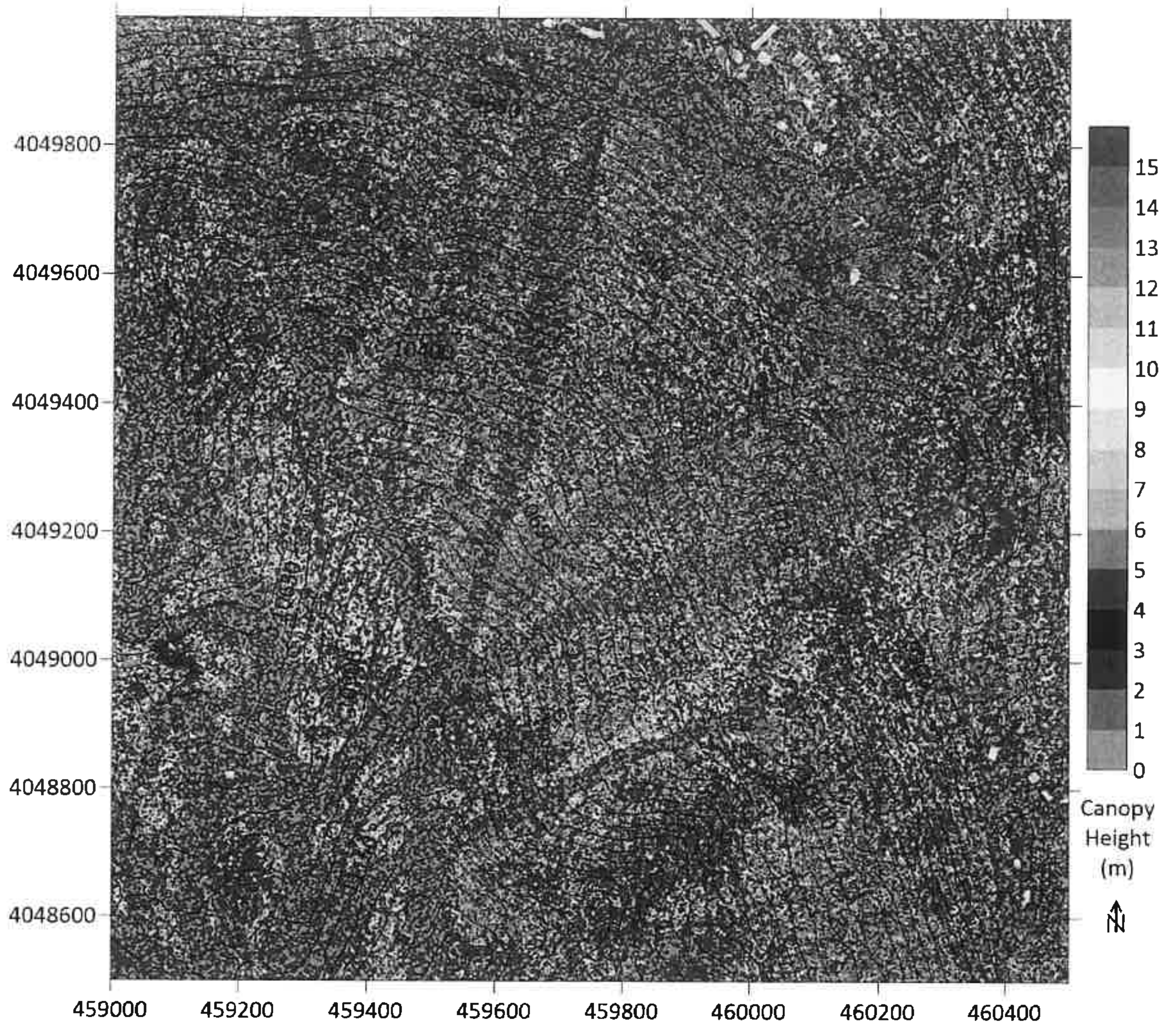


Figure 9 – Frontside Canopy Height
(derived from 2015 LiDAR data, WGS 84, UTM Zone 13N, 0.5m res. grid)

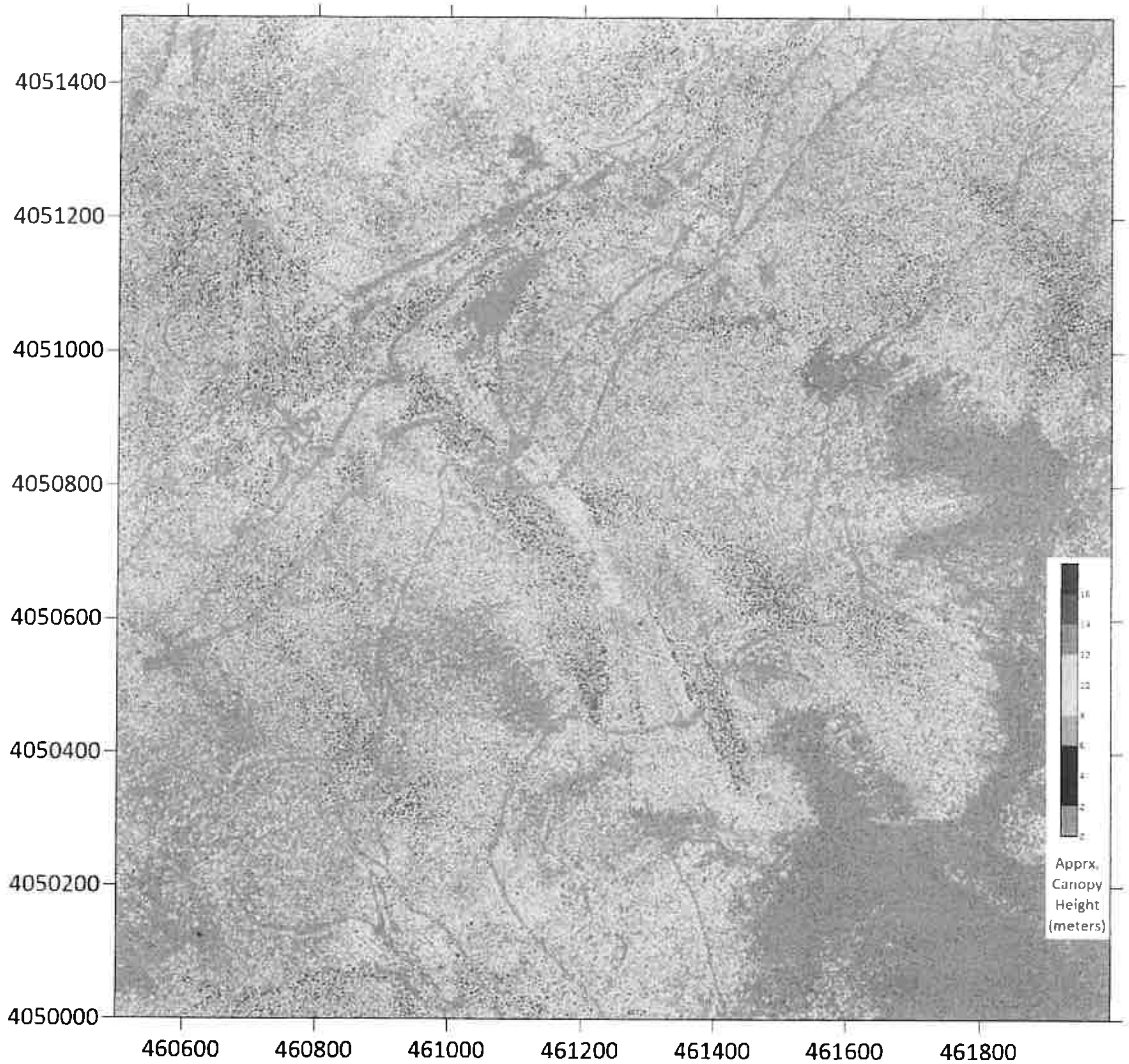


Figure 10 – Northside 1962 Path and Adjacent Areas Canopy Height
(derived from 2015 LiDAR data, WGS 84, UTM Zone 13N, 0.5m res. grid)

9. Avalanche Dynamics Modeling

We used the Swiss avalanche dynamics program RAMMS to evaluate flow directions, flow thicknesses, velocities and runouts for the various potential avalanche starting zones and paths. We applied a range of parameters to evaluate sensitivity and the influence of release areas, friction and flow regimes. Friction parameters were based on calibration guidelines provided in the RAMMS Version 1.7.2 User Manual and based on elevation, avalanche size, terrain shape and return period. High elevation friction parameters (greater than 1500 meters in Switzerland) were assumed due to relatively dry cold snowpack conditions. We included cohesion and forest friction to improve calibration for small forested paths. The model calibration was based on our experience with other avalanches, including documented historic avalanches at Taos Ski Valley.

Figure 9 shows representative model results for the dense flowing core of the 100-year avalanche. Figure 10 shows representative model results for the suspension component of a 100-year avalanche. Model input assumptions and additional results are presented in Appendix C.

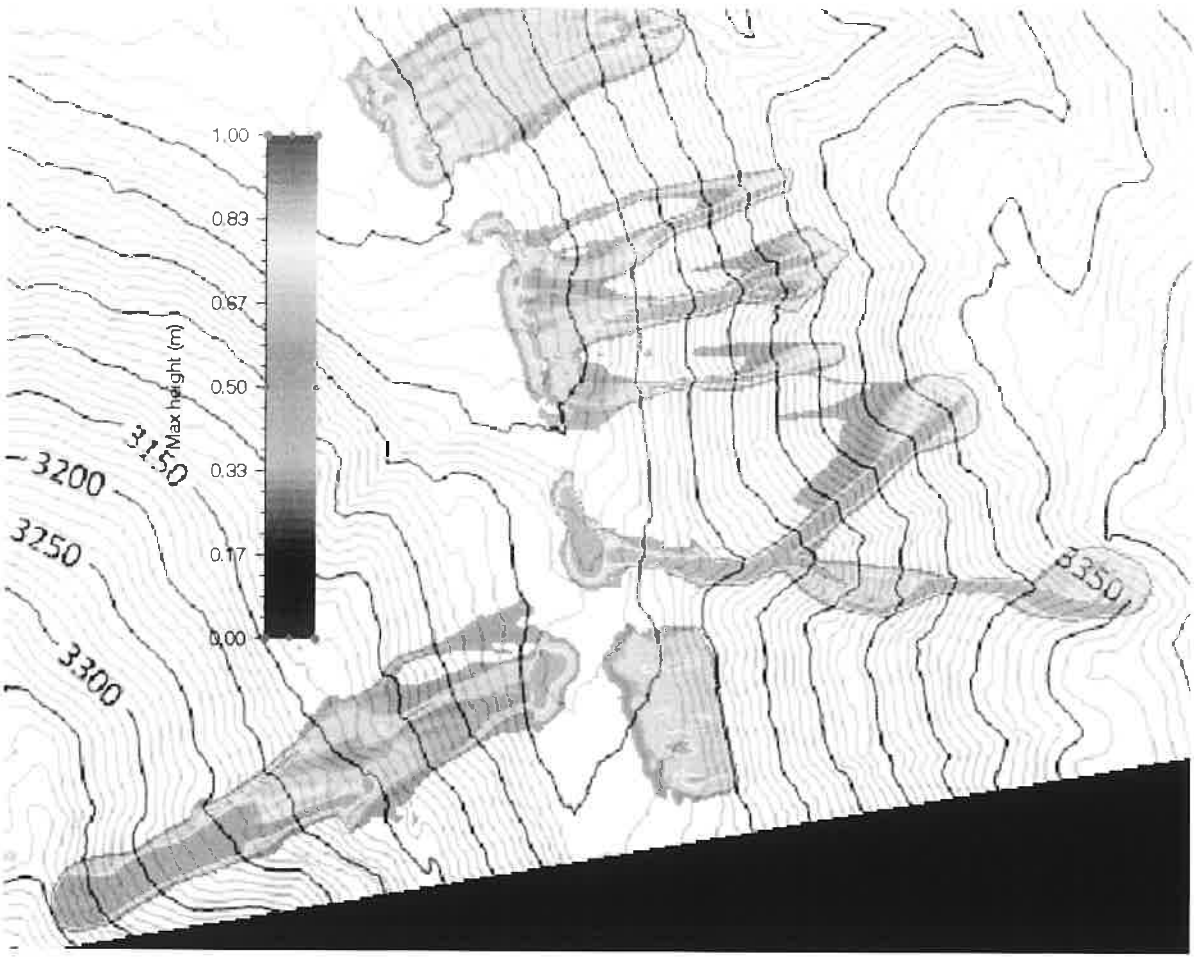


Figure 11 – Representative RAMMS Model Results

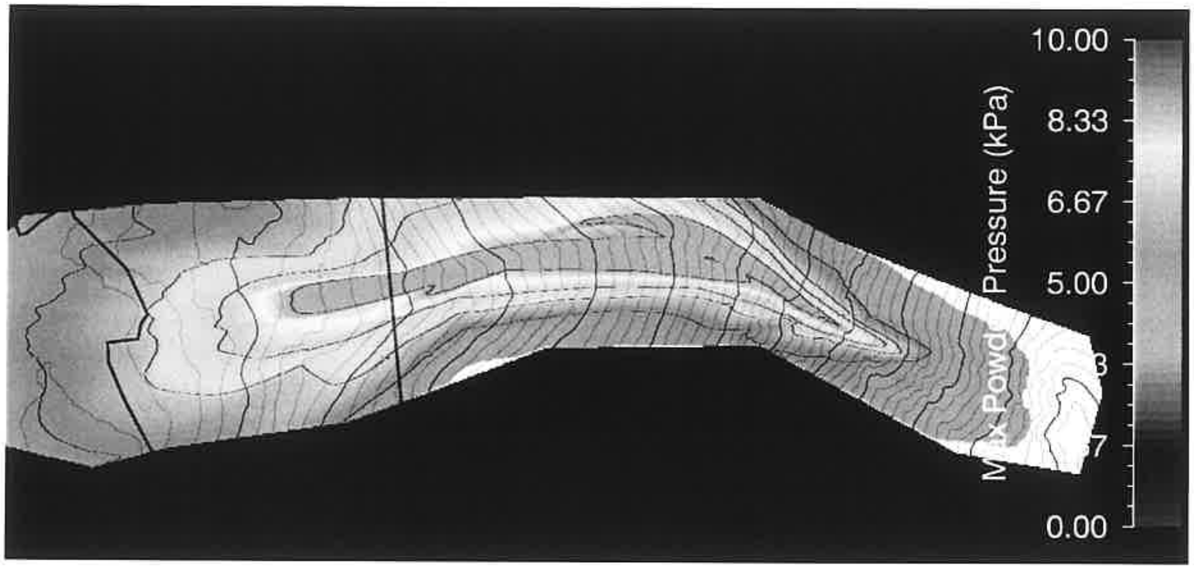


Figure 12 – Representative RAMMS:Extended Model Results for Suspension Layer

10. Findings

Based on the methods described in this report, we developed Avalanche Hazard Maps for the entire village limits (Maps 1 through 5). The avalanche hazard zone definitions are consistent with those in the report by Arthur I. Mears, P.E., Inc. *Snow Avalanche Mapping and Zoning with Land Use Recommendations,* prepared for the Village of Taos Ski Valley in 2001, except that the Yellow (Low) Avalanche Hazard Zone has been added. The Red and Blue Zone definitions are unchanged.

Each of the methods used to develop the avalanche hazard maps was weighted based on our relative confidence in the method. Weighting was similarly high for field vegetation observations, aerial image analysis, terrain analysis and dynamics modeling. Statistical methods were underweighted primarily due to forests that inhibit avalanche releases and the relatively low snow depths on southerly aspects.

Fire mitigation measures in many areas steeper than 30 degrees exceed the level of forest density that is needed to prevent avalanche releases. As a result, the frequency and size of avalanches in these areas is likely to increase compared to historic conditions. Over time as the forest grow, the hazards may decrease and approach historic levels. The Avalanche hazard maps reflect current forest conditions, including thinning that has occurred to date. Prevention of high-intensity fires in the starting zones is critical because complete loss of forest in the starting zones would change the hazard boundaries.

Snow compaction and layer disruptions from ski area operations will significantly reduce the frequencies and sizes of avalanches with return periods up to about 30-years. Between return periods of 30- and 100-years declining reductions in hazard will occur. Compaction operations' effects on 300-year avalanches will be negligible.

11. Uncertainties

There are several sources of uncertainty that could affect current and future avalanche hazards. We describe these briefly below.

Avalanche Processes

Avalanche mapping science has advanced considerably in recent years, but it is still an immature science. The latest avalanche dynamics models under development consider snow temperature and avalanche flow regimes in a thermodynamic context, which has relevance in a warming climate. However, large uncertainties exist about the input parameters and applicability to various snow-avalanche climates. This high elevation-low latitude snow climate differs from those in Europe where much of the science and models were developed.

Data and Records

The historic records are very limited, incomplete and private records are not readily available.

Climate

Avalanches of concern for land use planning are affected by forest conditions (especially in the starting zones), snow temperatures, precipitation intensities and snowpack structure. These factors are likely to change over time in a warming climate. Combined, some climate factors offset others, but any of them could result in higher frequencies and magnitudes of unusually long-running avalanches. There are large uncertainties, but it is likely that avalanche frequency-magnitudes will change over time. It is our opinion that avalanche hazards in this snow climate may increase in the next decades due to increases in storm intensities, precipitation and winds. Warming temperatures may have the effect of allowing thicker snow slabs to accumulate on low to modest angle starting zones (30-35 degrees) before large releases. Such avalanches will have long runouts for both wet and dry releases.

Forest Conditions

The high-elevation, subalpine forests play a crucial role in avalanche mitigation on all aspects. Current forest conditions on many steep northerly slopes (>30-degrees) prevent the release of large avalanches. Loss of forests caused by fire, blowdown, clearing or any other cause will adversely affect the avalanche hazards at the site, increasing the frequency and magnitude of avalanches. Conversely, active management of tree densities, ages, species and ground cover could maintain current avalanche hazards levels, or reduce hazards. While efforts to improve forest health are planned and underway, it is impossible for us to predict future forest conditions.

12. Avalanche Risk

The following information is intended to provide context for the recommendations provided in the following section of this report, especially as they relate to hazard zoning, land use, occupied buildings, and exposure to avalanche hazards.

Avalanche risk is defined as the probability of injury, death or losses caused by an avalanche. Risk can be expressed as the product of probability, magnitude, exposure and vulnerability. Each component contributes to the risk.

$$R = f(P, M, E, V)$$

Risk, R, can be reduced to an acceptable level by reducing any one or more of the risk factors. Zoning maps reflect the probability-magnitude elements. Land use decisions (dwelling locations and unit-density) and mitigation designs (structural, architectural, civil) affect the exposure and vulnerability components. Exposure (E) is includes both time and numbers of people or value of resources for a given location. Exposure can be reduced by structural and architectural designs that place high occupancy uses in protected areas. This is particularly important for outdoor uses such as hot tubs and entries. Vulnerability (V) is the resistance to loss. Persons inside of avalanche-proof buildings have a high level of protection, but outside of buildings, vulnerability can be high. Vulnerability for persons outside of buildings is best managed by designs and user awareness that minimize the time of exposure. The entire design team should be aware that design decisions impact the level of avalanche risk in and near hazard zones.

Each component of risk involves uncertainties. The probability-magnitude uncertainties for avalanche hazards are generally larger than the uncertainties for vulnerabilities due to the short historic record and limitations of avalanche mapping science.

13. Recommendations

Land Use

1. No occupied or valuable structures should be constructed in the Red Avalanche Hazard Zones.
2. Occupied and valuable structures should be located outside of the Blue and Yellow Zones, wherever practical.
3. No critical structures should be constructed in the Blue or Yellow Zones. Critical structures include emergency response facilities (police, fire, ambulance, clinics), hospitals and schools.
4. No high-occupancy structures (hotels, apartments, auditoriums, etc.) should be constructed in the Blue Zones.
5. If low-occupancy, residential or commercial structures are constructed in the Blue Avalanche Hazard Zones, they should be located as low as practical in the Blue Zone and designed to withstand avalanche impact and static loads. Avalanche loads cannot be determined until the location, geometry and orientation of the structures are known.
6. Occupied structures in the Yellow Avalanche Hazard Zone should be designed to withstand avalanche impact and static loads, including stagnation pressures from the suspension component (powder blast), which can act to heights of 100-feet or more. Avalanche loads cannot be determined until the location, geometry and orientation of the structures are known.
7. Site and architectural designs should address avalanche hazards in the Blue and Yellow Zones. Building entries and outdoor living spaces, especially hot tubs and heated outdoor spaces, should be placed in protected areas away from the avalanche-facing side of the building. Windows and doors on the uphill side should be avoided or designed for impact.
8. All utilities in avalanche zones should be buried. Gas lines, utility meters and fire hydrants in avalanche zones should be protected to prevent damage.
9. It is possible to achieve a high level of avalanche protection for building occupants inside specially designed, reinforced buildings, but persons and pets outside will not be protected. Therefore, it is prudent for occupants and guests of residential buildings in and near avalanche hazard zones to become educated and keep current on local avalanche conditions, including the local and regional avalanche danger forecasts. However, reliance upon forecasts and avoiding

avalanche zones during elevated avalanche danger conditions can reduce, but not eliminate avalanche risk, especially to persons outside of buildings.

Avalanche Ordinance

The following is from Ordinance 17-030:

SECTION 7. GENERAL PROVISIONS.

Part 6. Avalanche Design Requirements

Prior to the Village issuing a building permit for the construction of a new, freestanding building to be occupied by one or more persons, the applicant must provide the following to the Village for review by the Planning Officer:

1. A written report analyzing the potential avalanche hazards and the potential physical forces, if any, created thereby upon the proposed improvement or structure, and;

2. A structural analysis of the proposed building or structure prepared and sealed by a New Mexico licensed engineer reflecting an engineering analysis and design which states that the design of the building or structure can withstand the potential force from an avalanche as set forth in the avalanche report referred above. This analysis shall be required only if the referenced report indicates that an avalanche hazard exists.

3. The issuance of a building permit by the Village shall not be construed to mean that the Village agrees that the proposed building will withstand an avalanche.

The ordinance does not incorporate the 2001 Avalanche Hazard Maps or distinguish between different hazard zones. In the U.S., local jurisdictions determine restrictions and requirements for development in avalanche zones. The ranges of restrictions vary from none or few to severe. These are policy decisions that have significant impacts on public and private properties. We offer some general guidelines and recommendations:

1. The recommendations in the previous section should be incorporated, including distinguishing between hazard zones and allowable land uses, particularly for the Red Zone.
2. The issue of non-conforming structures (e.g. unreinforced buildings in Blue Zones) should be addressed by informing owners and occupants and addressing future additions, improvements or avalanche defenses prior to issuing building permits.
3. The ordinance should allow for review and adjustment of avalanche zones based on analyses by a qualified avalanche professional.

4. We recommend incorporating avalanche maps into the ordinance with mechanisms for variances and/or amendments to the avalanche maps.
5. We recommend requiring that new construction does not adversely impact avalanche hazards on adjoining and downhill properties, including public roads and utilities.
6. We recommend developing a list of criteria for reviewing developments in avalanche zones.

It might be helpful to review avalanche ordiances from other jurisdictions, including Vail Colorado, Pitkin County Colorado, Ketchum, Idaho and Blaine County. Idaho.

Forest Protection

We recognize that fire mitigation is a high priority for the village and the region. The fact that thinning measures may increase avalanche hazards has been accounted for in the Avalanche Hazard Maps. Table 1 summarizes literature related to forest density and avalanche release. Based on published literature and our experience, we recommend that thinning be limited to the minimum conifer tree densities for trees 6" diameter and larger per Figure 11 to the maximum extent practical. Deciduous and dead/snag tree densities should be double those shown in Figure 11 for avalanche protection. Tree spacing should be relatively even and staggered to avoid fall-line clearings longer than about 50 to 100-feet of slope distance.

Table 1 - Protection Forest Guidelines

	Reference	slope angle	min. diameter (in)	trees per acre	avg spacing (ft)	canopy cover (%)	Comments
2	McClung & Schaerer	gentle	-	200	15	-	refers to mechanical prevention of trunks; no canopy effects
		steep	-	400	10	-	
3	Schneebli	32-42 deg	6	70-180	16-25	30-80	Swiss field study of 5 forest types; extreme events not represented
4	Weir	-	5-6	400	10	-	Cedar-hemlock forest interior B.C.
5	Jamieson	-	6	80	23	-	References Swiss data

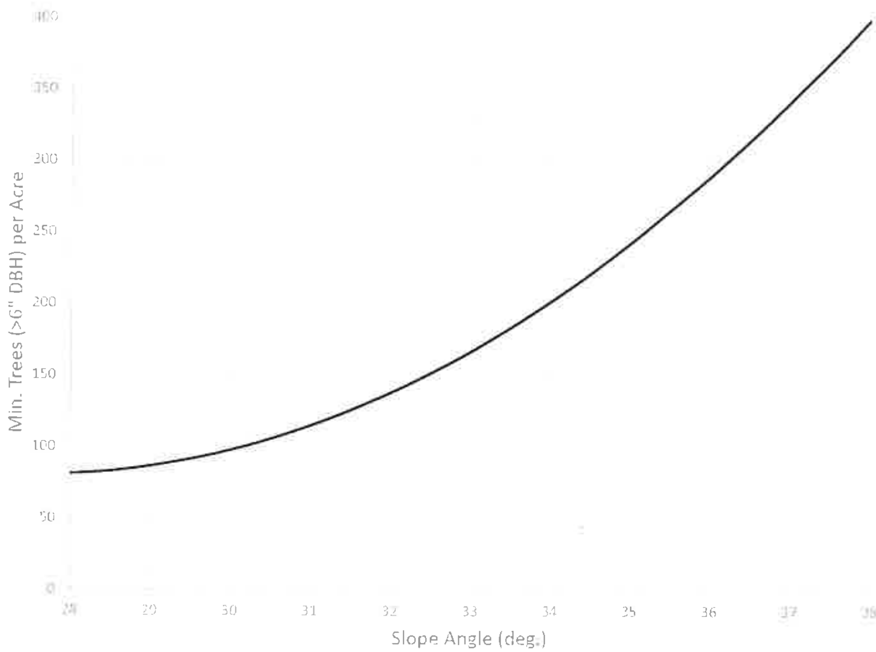


Figure 13 – Minimum Conifer Densities vs. Slope for Avalanche Protection

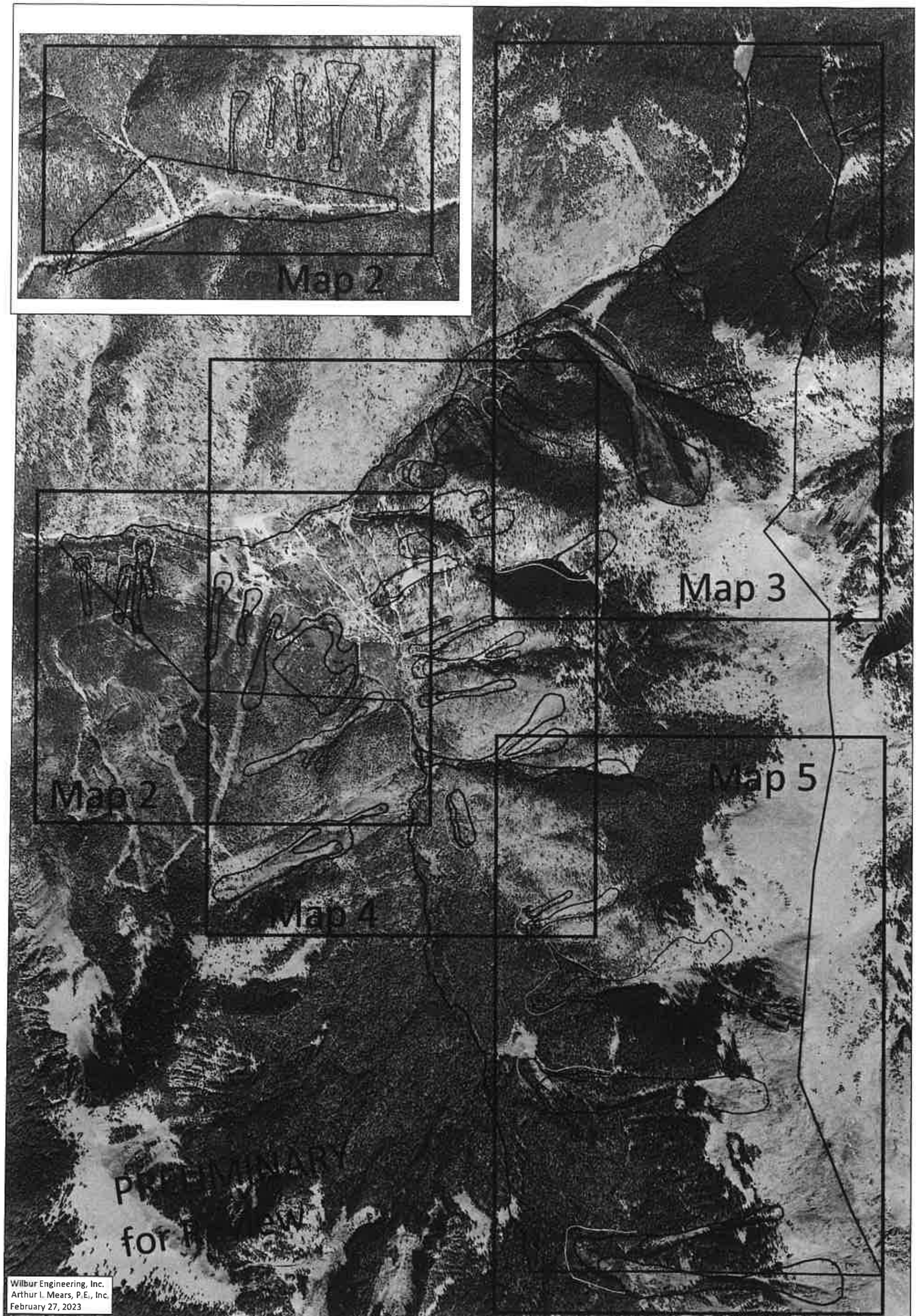
14. References

1. Johnson, Lane B. and Margolis, Ellis Q., *Surface Fire to Crown Fire: Fire History in the Taos Valley Watersheds, New Mexico, USA,* Fire 2019, 2, 14; doi:10.3390/fire2010014 www.mdpi.com/journal/fire
2. Dolecek Enterprises Inc., Northside at Taos Ski Valley, Forest Management Plan, 2020.
3. Jamieson, Bruce (editor), 2018*, Planning Methods for Assessing and Mitigating Snow Avalanche Risk*, Canadian Avalanche Association.
4. McClung, David & Schaerer, Peter, 2006, *The Avalanche Handbook*, 3rd edition, The Mountaineers.
5. Schneebli, Martin & Meyer-Grass, Martin, 1992, *Avalanche Starting Zones Below the Timberline Structure of Forest*, International Snow Science Workshop.
6. Weir, Peter, 2002, *Snow Avalanche Management in Forested Terrain*, BC Ministry of Forests Land Mgmt. Handbook 55.
7. Teich, M., Bartelt, P., Grêt-Regamey, A. and Bebi, P.,2012. Snow avalanches in forested terrain:Influence of forest parameters, topography and avalanche

characteristics on runout distance. Arctic, Antarctic, and Alpine Research 44(4), 509-519.

15. Warranty

You as my client should know that while our company can and does attempt to uphold high professional standards, the state of scientific and engineering knowledge is incomplete, and does not permit certainty. The complex phenomena involved in avalanches cannot be perfectly evaluated and predicted, and methods used to predict avalanche behavior change as new research becomes available. While we can and will offer our best professional judgment, we cannot and do not offer any warranty or guarantee of results.



NOTES

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2. The avalanche hazard zones are based on 2021 and 2015 LiDAR topography.
3. Land use constraints and recommendations for Red, Blue and Yellow avalanche zones are described in the report.
4. Off-site Avalanche Hazard Zones are subject to revision and should not be relied upon for any purpose.
5. Site boundary is approximate and based on Village of Taos Ski Valley GIS data and is not survey grade.
6. Image from USGS 1962 flight.

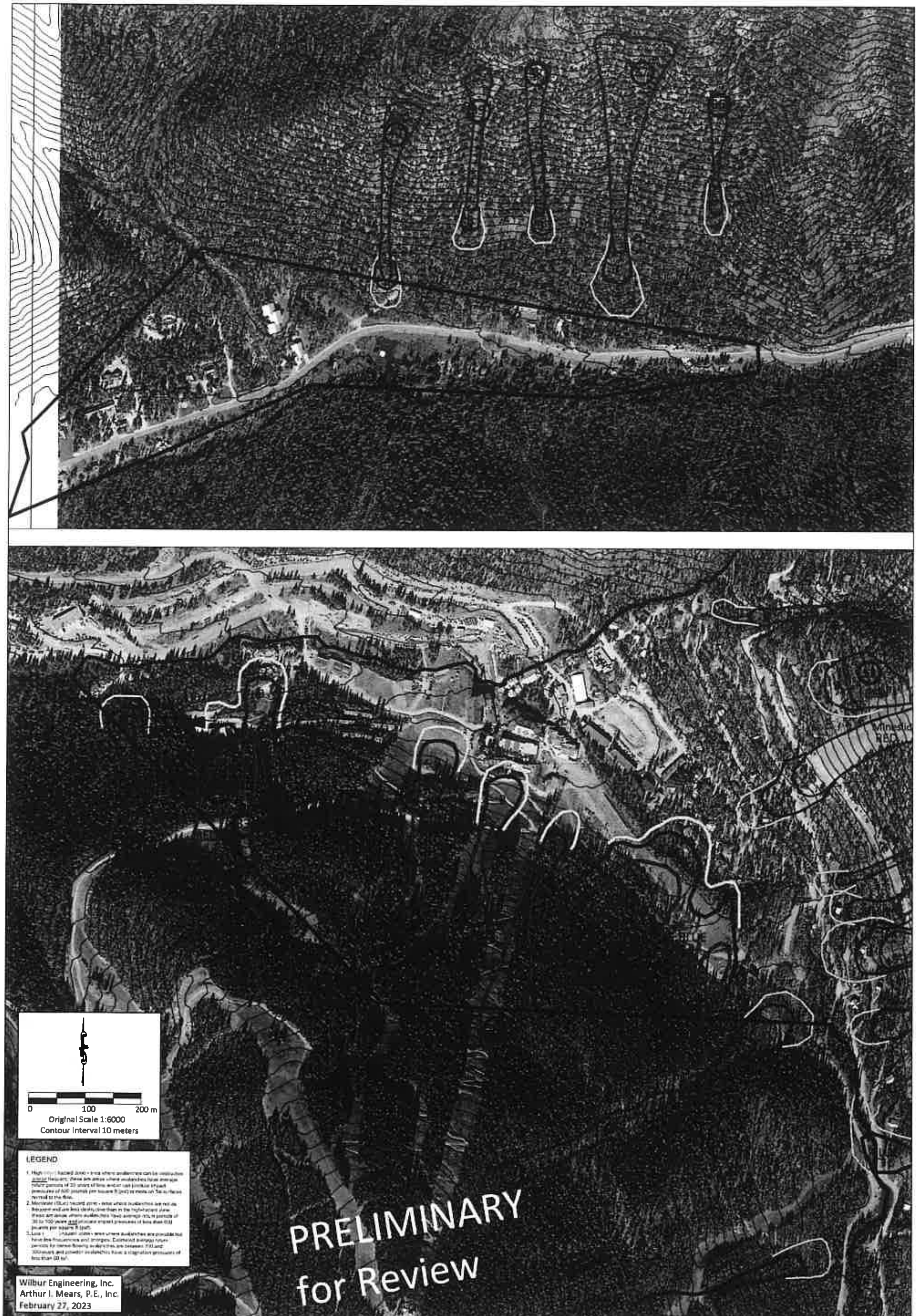
Avalanche Hazard Map

Index Map

Village of Taos Ski Valley, New Mexico, USA

Map

1



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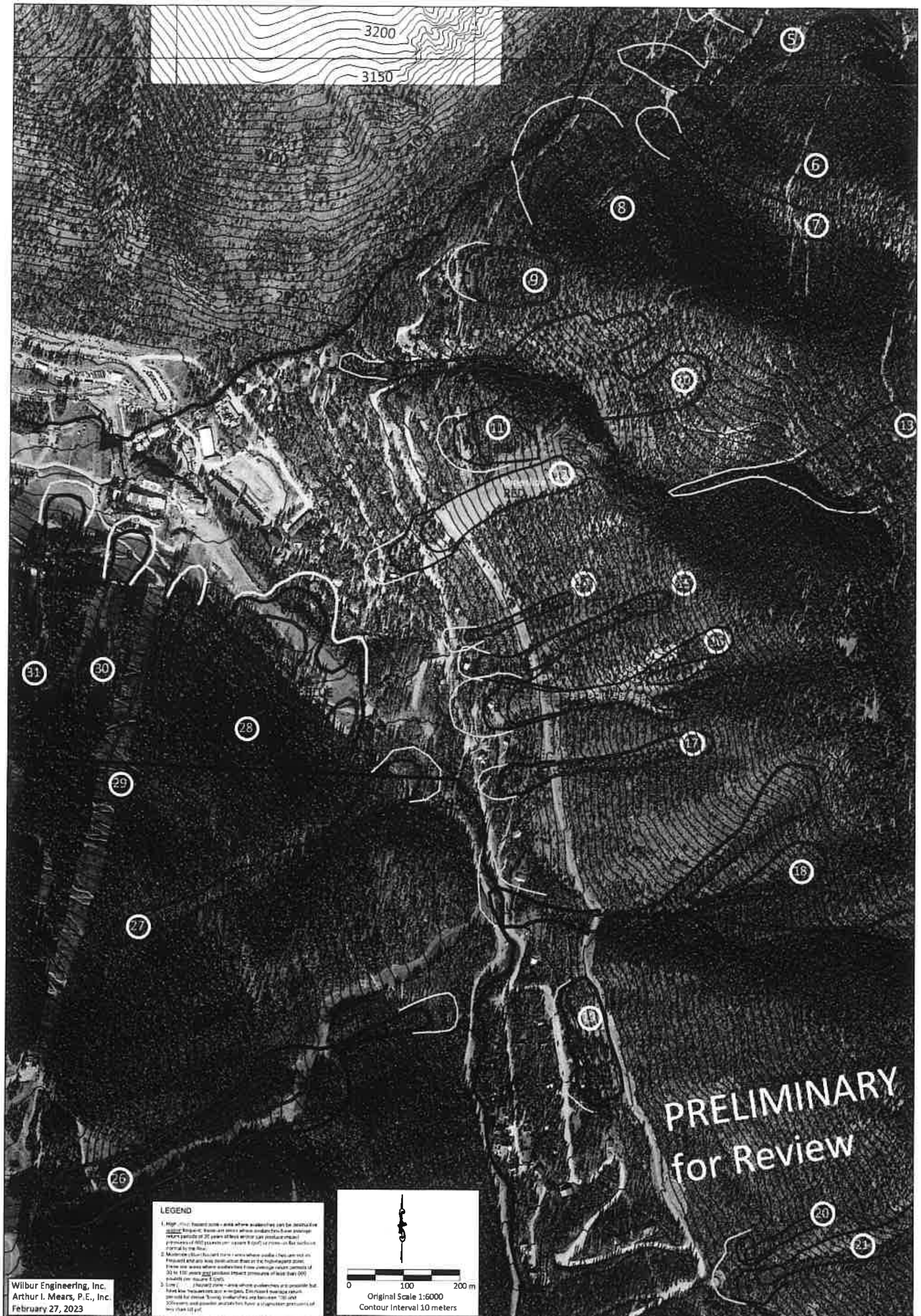
Avalanche Hazard Map

Amizette & Frontside

Village of Taos Ski Valley, New Mexico, USA

Map

2



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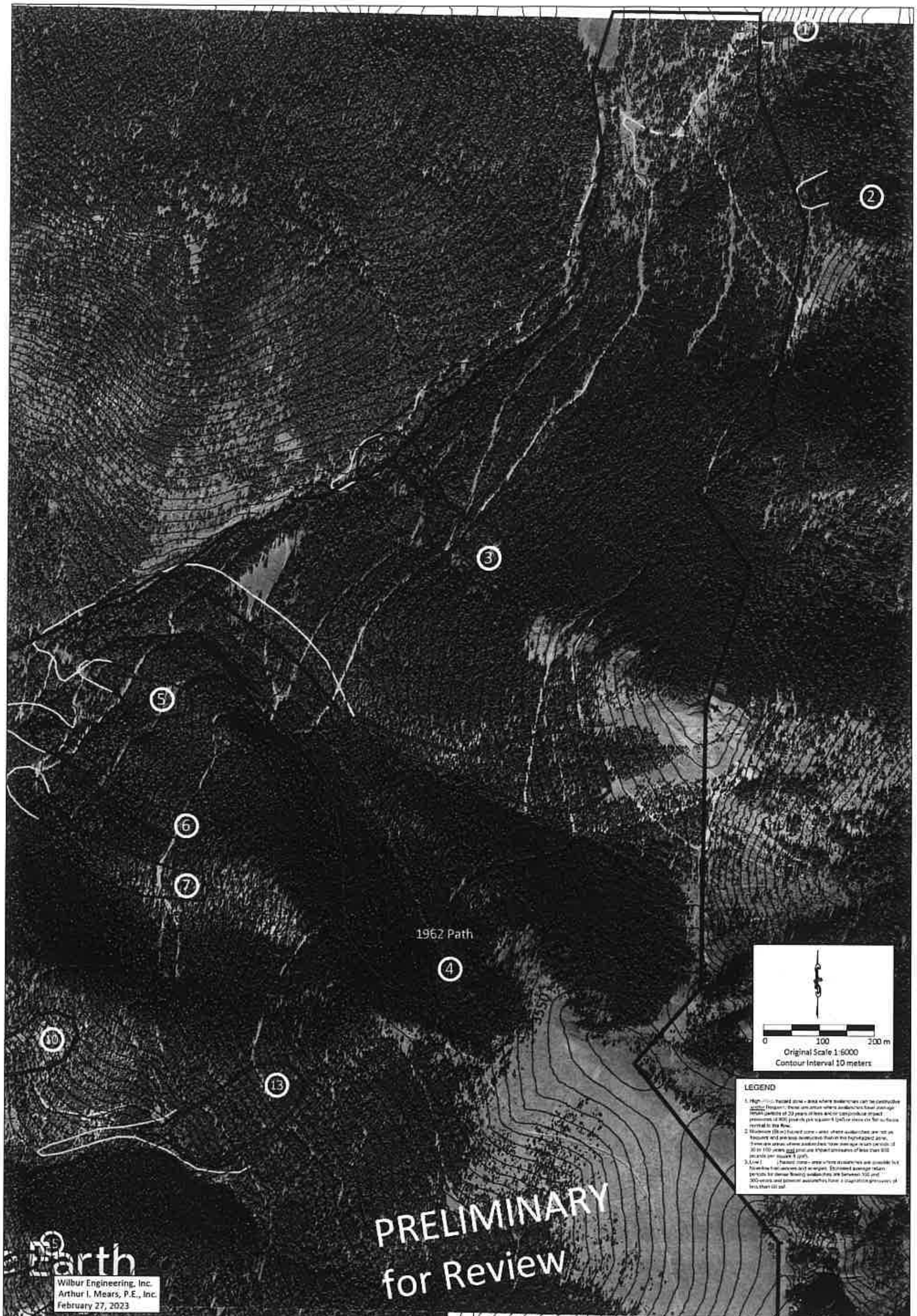
Avalanche Hazard Map

Village Center

Village of Taos Ski Valley, New Mexico, USA

Map

3



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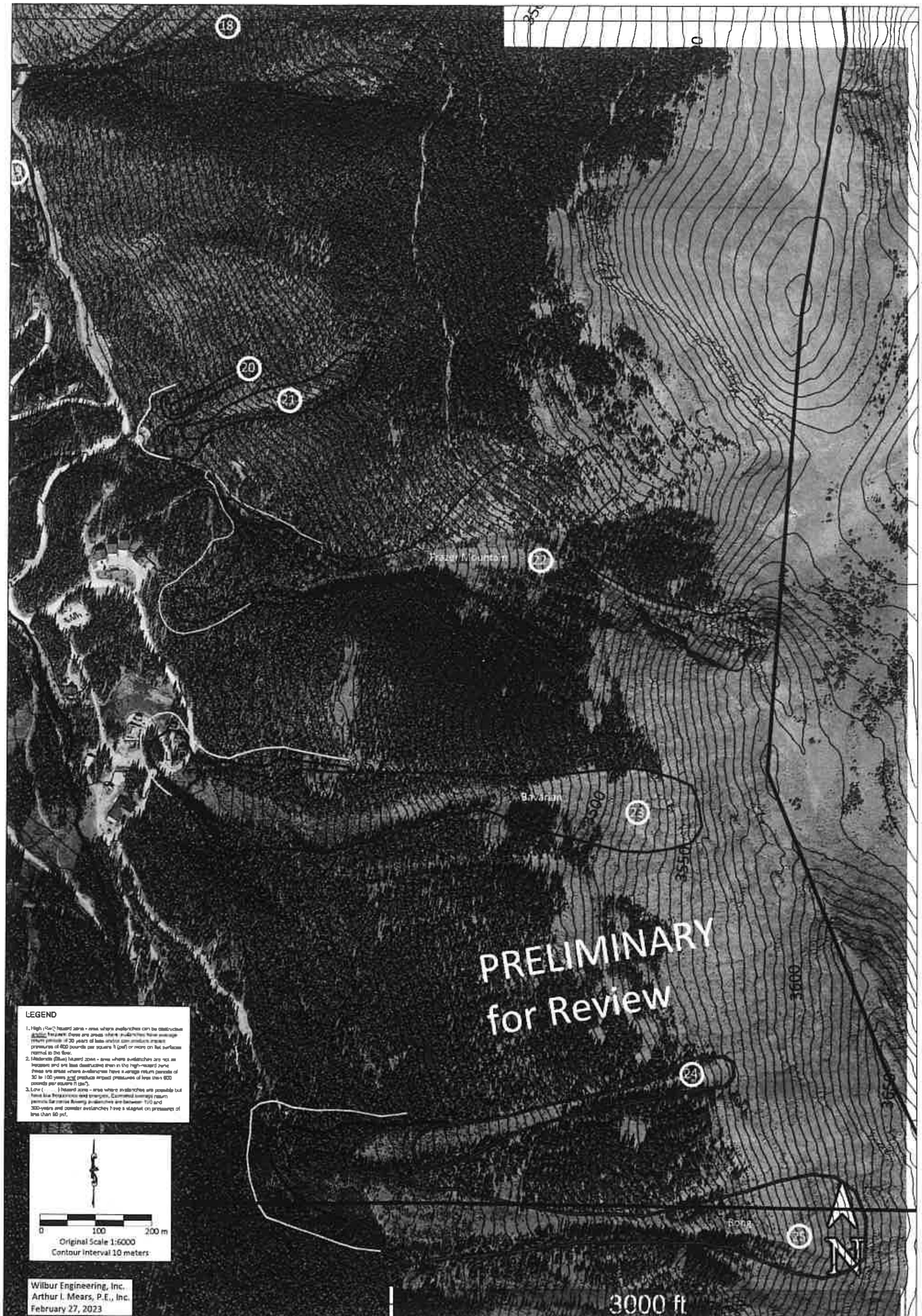
Avalanche Hazard Map

Northside

Village of Taos Ski Valley, New Mexico, USA

Map

4



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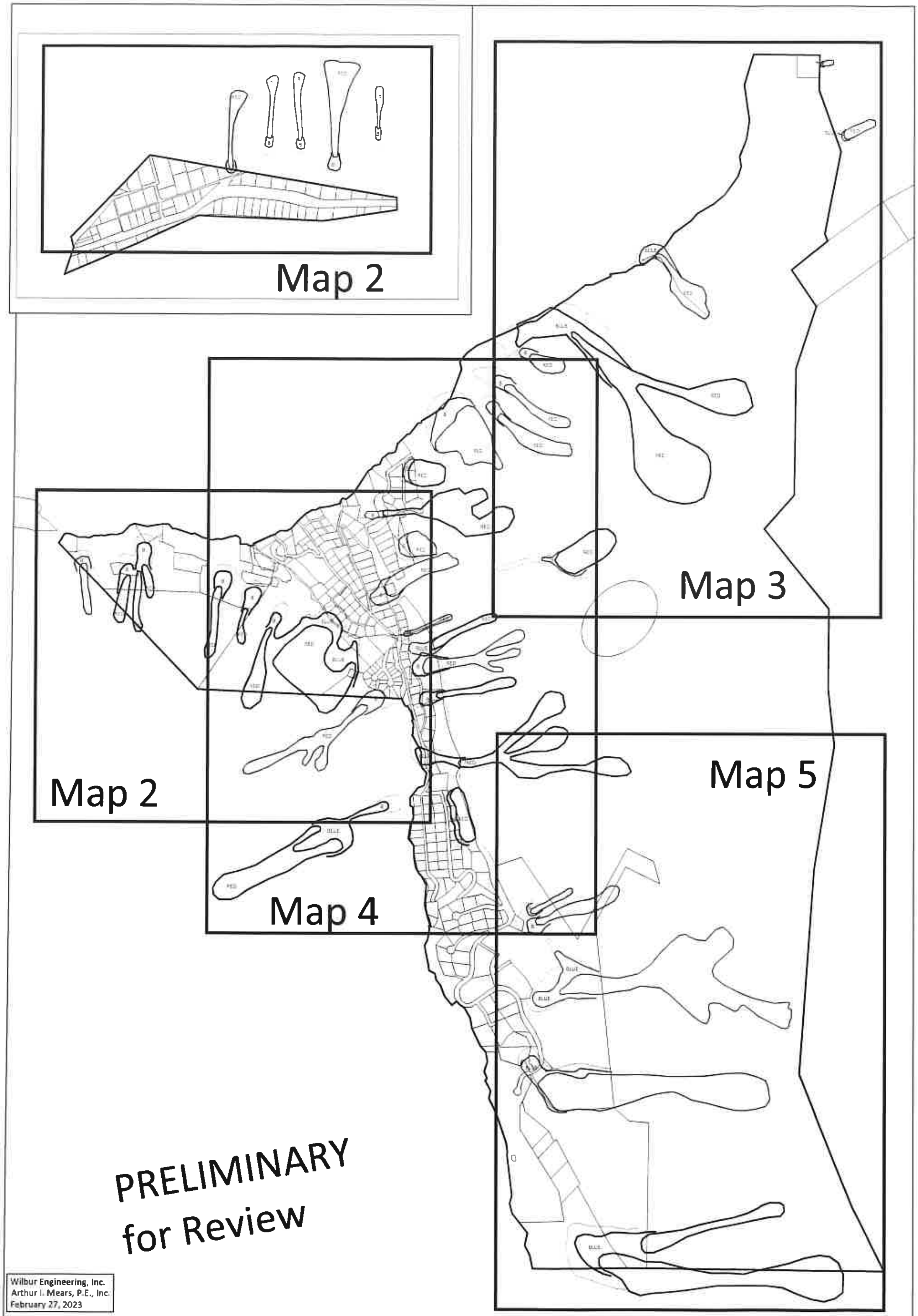
Avalanche Hazard Map

Lake Fork

Village of Taos Ski Valley, New Mexico, USA

Map

5



Wilbur Engineering, Inc.
Arthur I. Mears, P.E., Inc.
February 27, 2023

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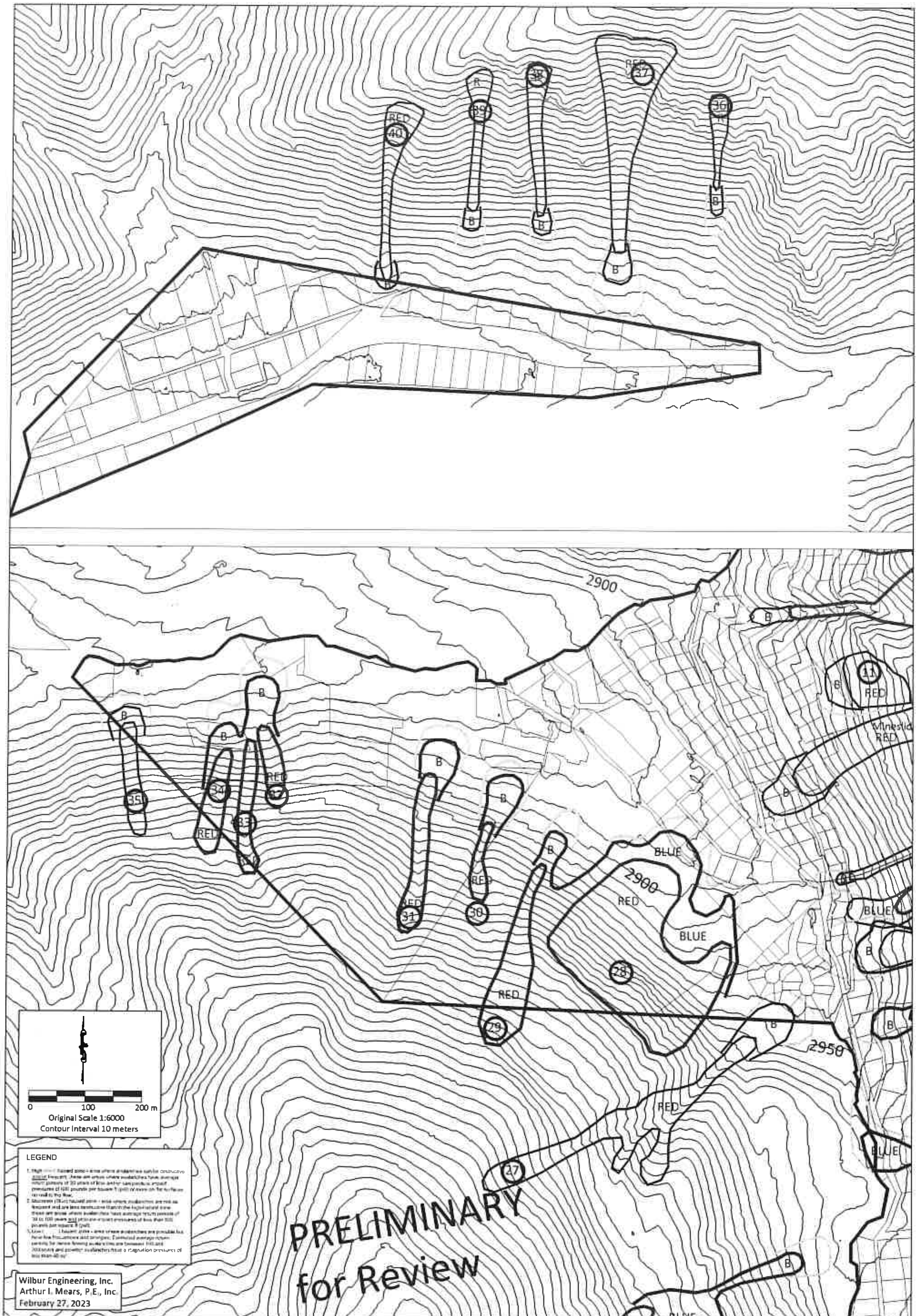
Avalanche Hazard Map

Index Map

Village of Taos Ski Valley, New Mexico, USA

Map

1



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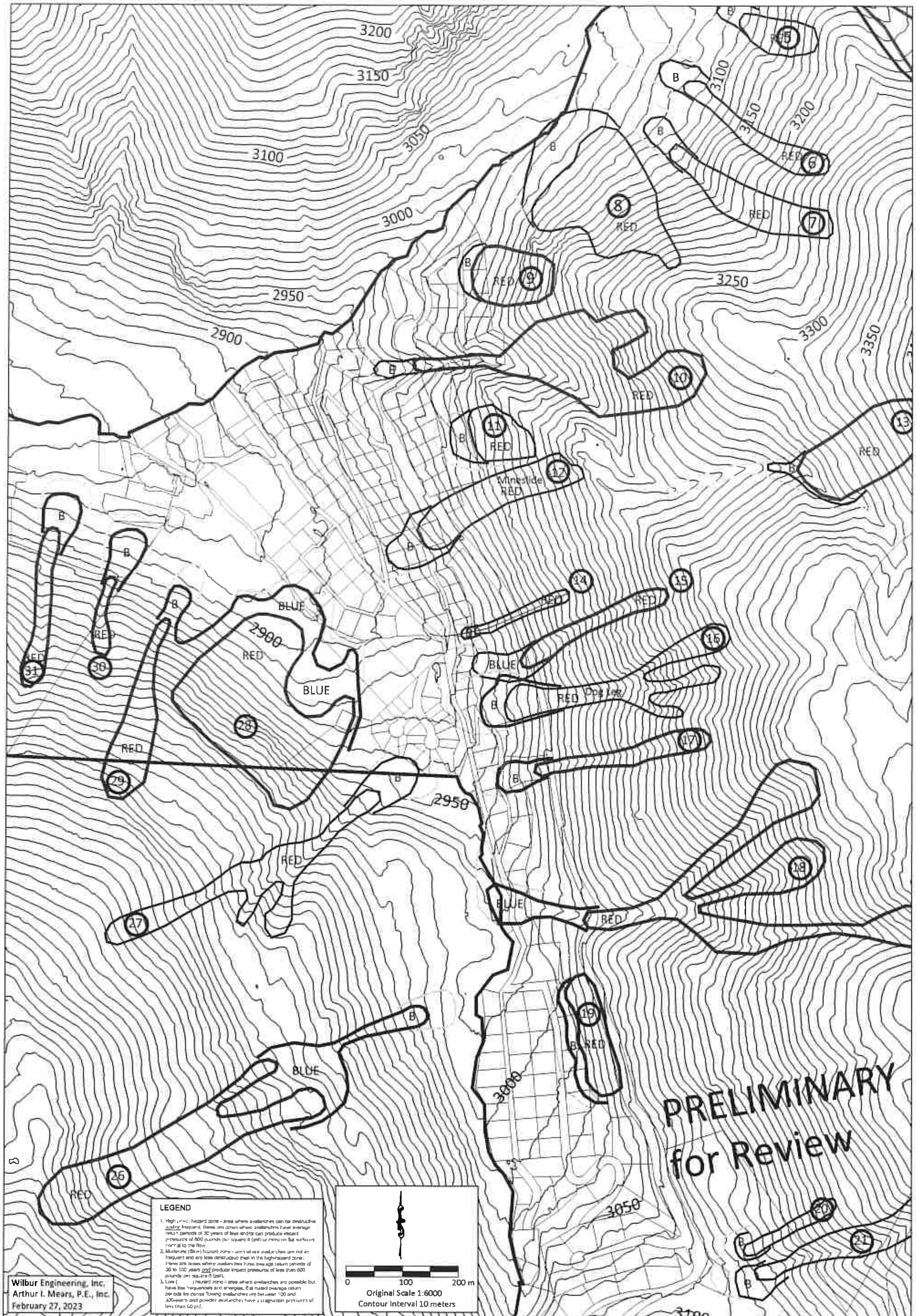
Avalanche Hazard Map

Amizette & Frontside

Village of Taos Ski Valley, New Mexico, USA

Map

2



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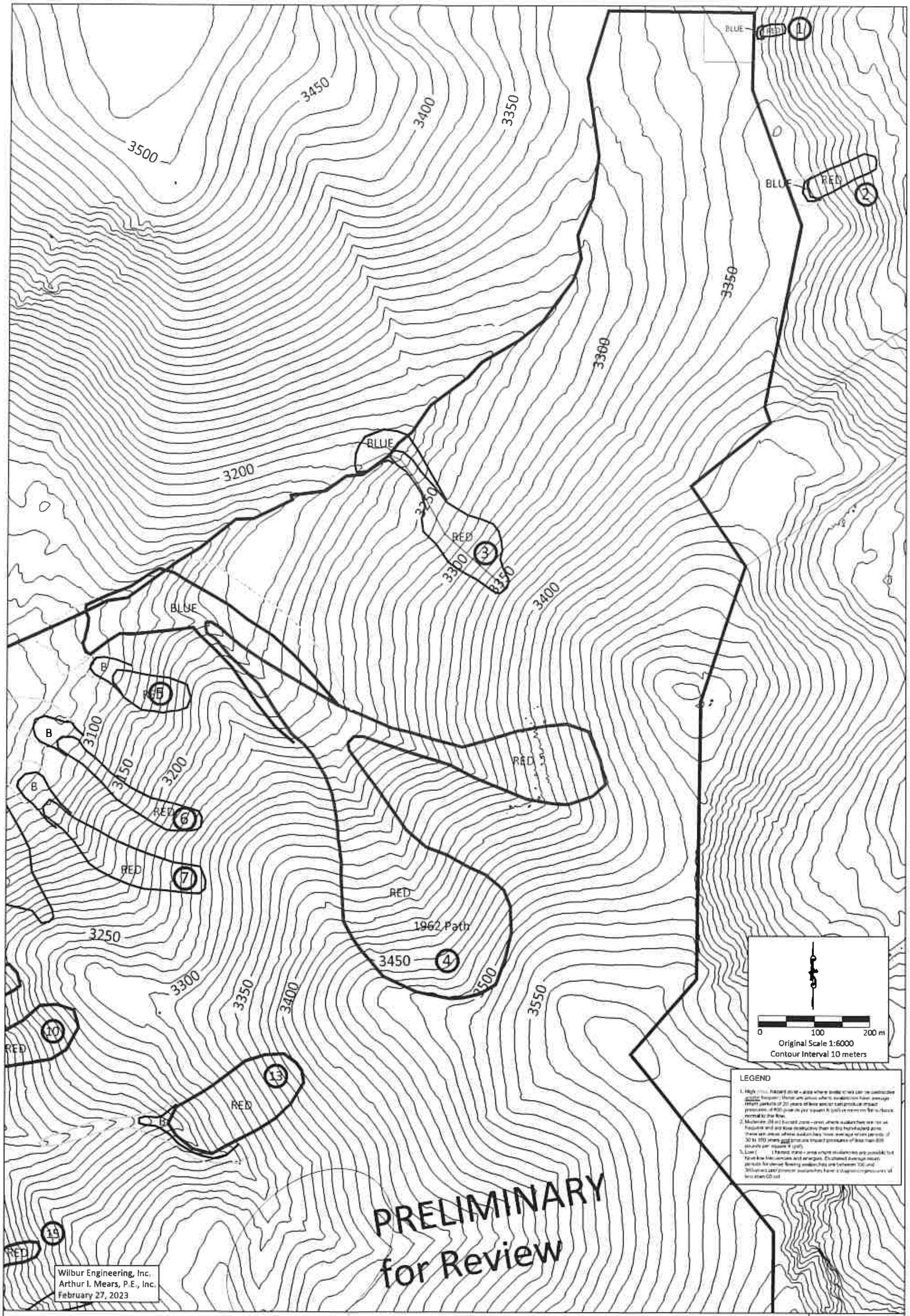
Avalanche Hazard Map

Village Center

Village of Taos Ski Valley, New Mexico, USA

Map

3



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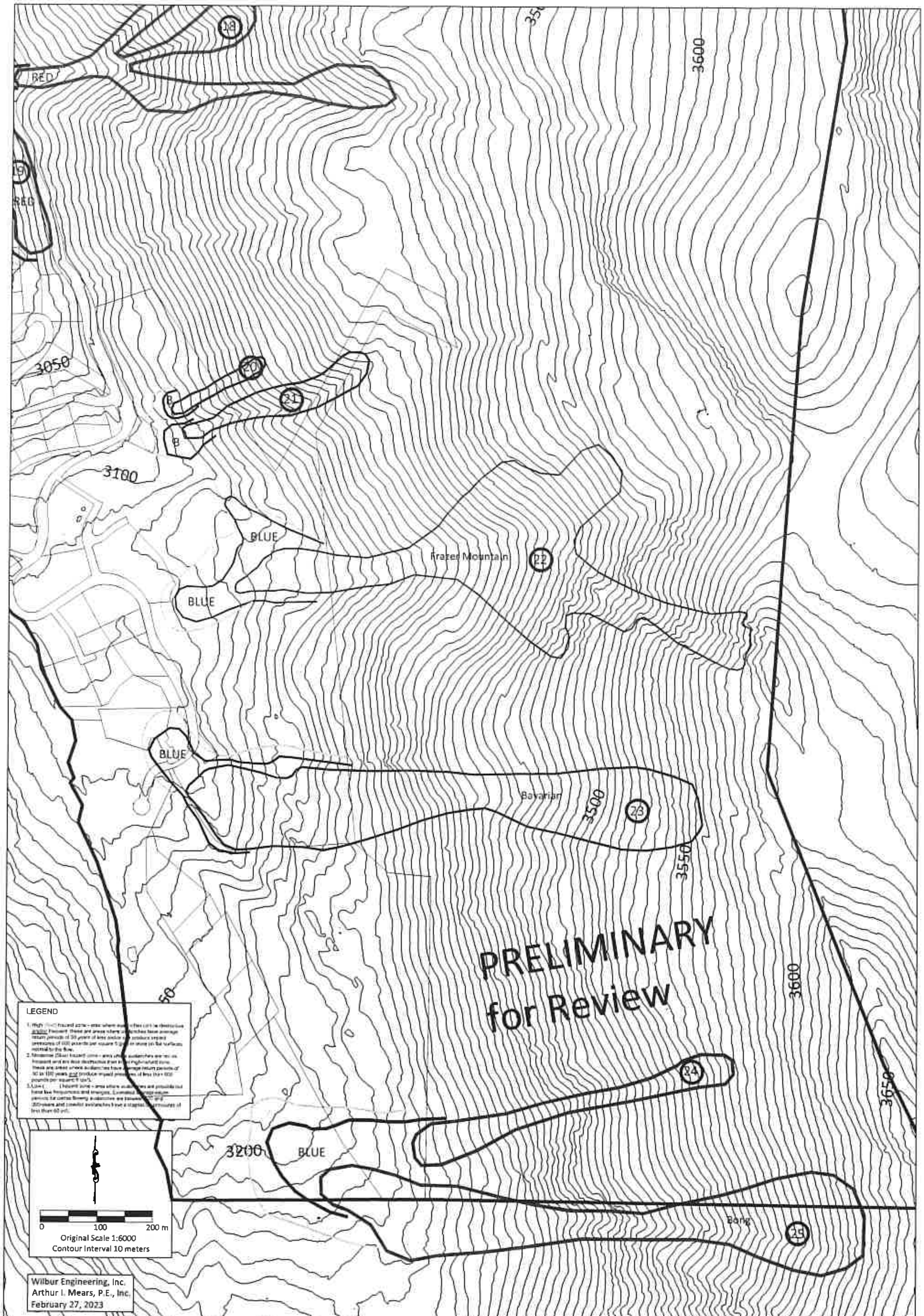
Avalanche Hazard Map

Northside

Village of Taos Ski Valley, New Mexico, USA

Map

4



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Avalanche Hazard Map

Lake Fork

Village of Taos Ski Valley, New Mexico, USA

Map

5

Appendix A
Climate Data

Poco Gusto Weather Station, el. 10,860'

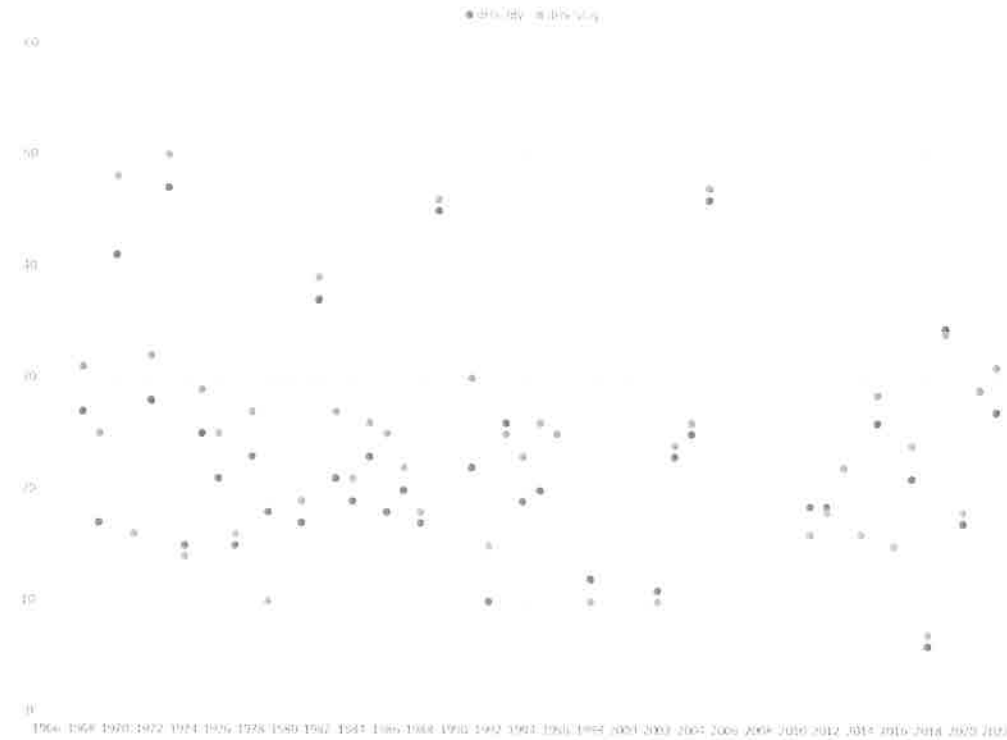
rank	3-day SWE			5-day SWE			delta-HS 3-day			delta-HS 5-day	
1	2019	5.35		2008	6.51		1973	47		1973	50
2	1989	4.85		2019	5.85		2005	46		1970	48
3	2008	4.64		1989	4.95		1989	45		2005	47
4	1978	3.50		2017	4.55		1970	41		1989	46
5	2017	3.35		1978	4.25		1982	37		1982	39
6	2021	3.20		2022	4.10		2019	35		2019	34
7	2022	3.10		1995	3.65		2021	29		1972	32
8	2004	2.92		2001	3.60		1972	28		2022	31
9	2001	2.80		1985	3.30		2022	27		1968	31
10	1985	2.79		2021	3.20		1968	27		1991	30

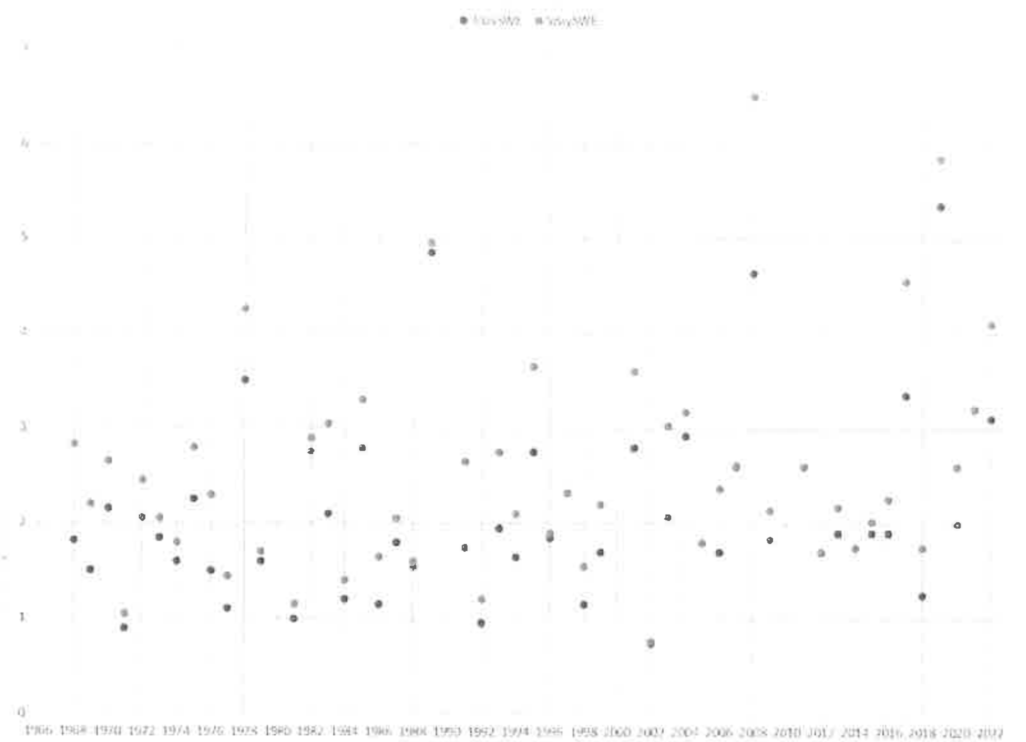
Notes:

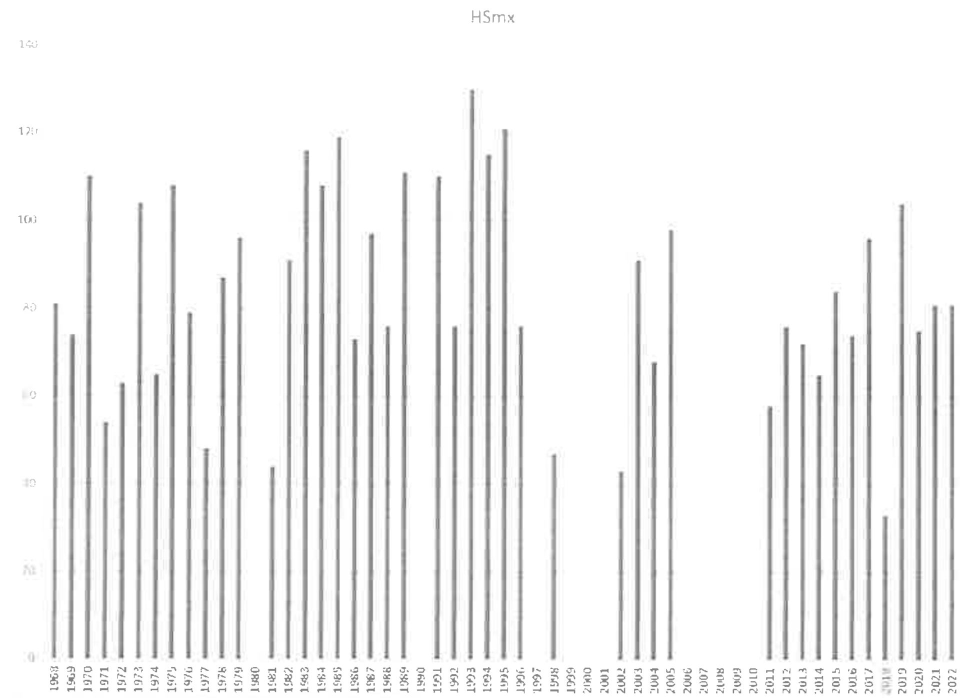
1. Data provided by TSV Ski Patrol in inches from Poco Gusto, el. 10,860 ft.
2. SWE period of record: 51/55 years
3. HS period of record 43/55 years
4. missing all data:1980, 1990, 2000, 2010
5. missing HS data: 1999-2001, 2006-2009

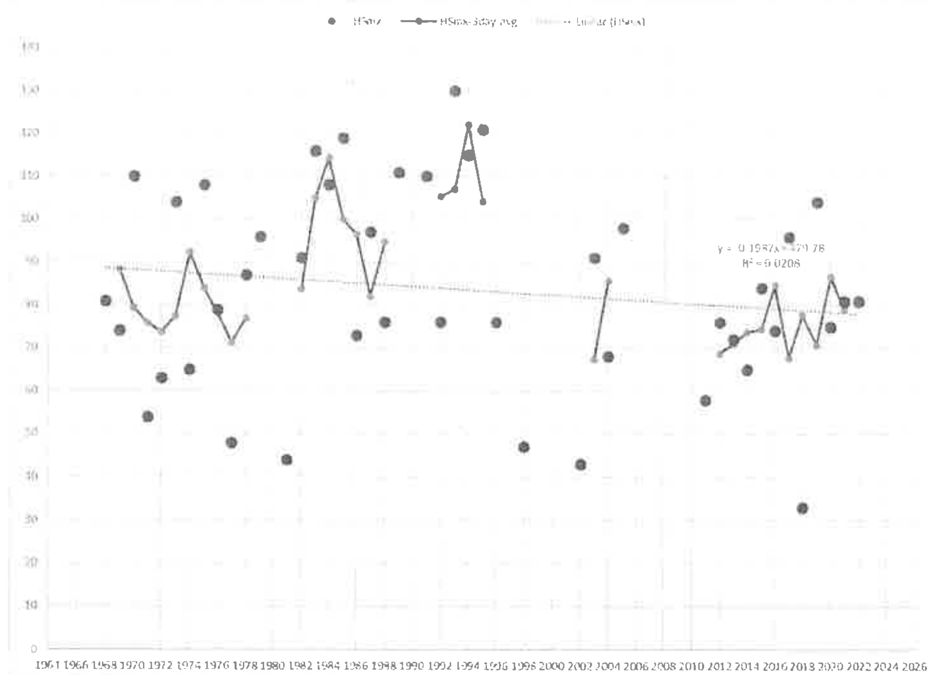
Chronological Storm Dates

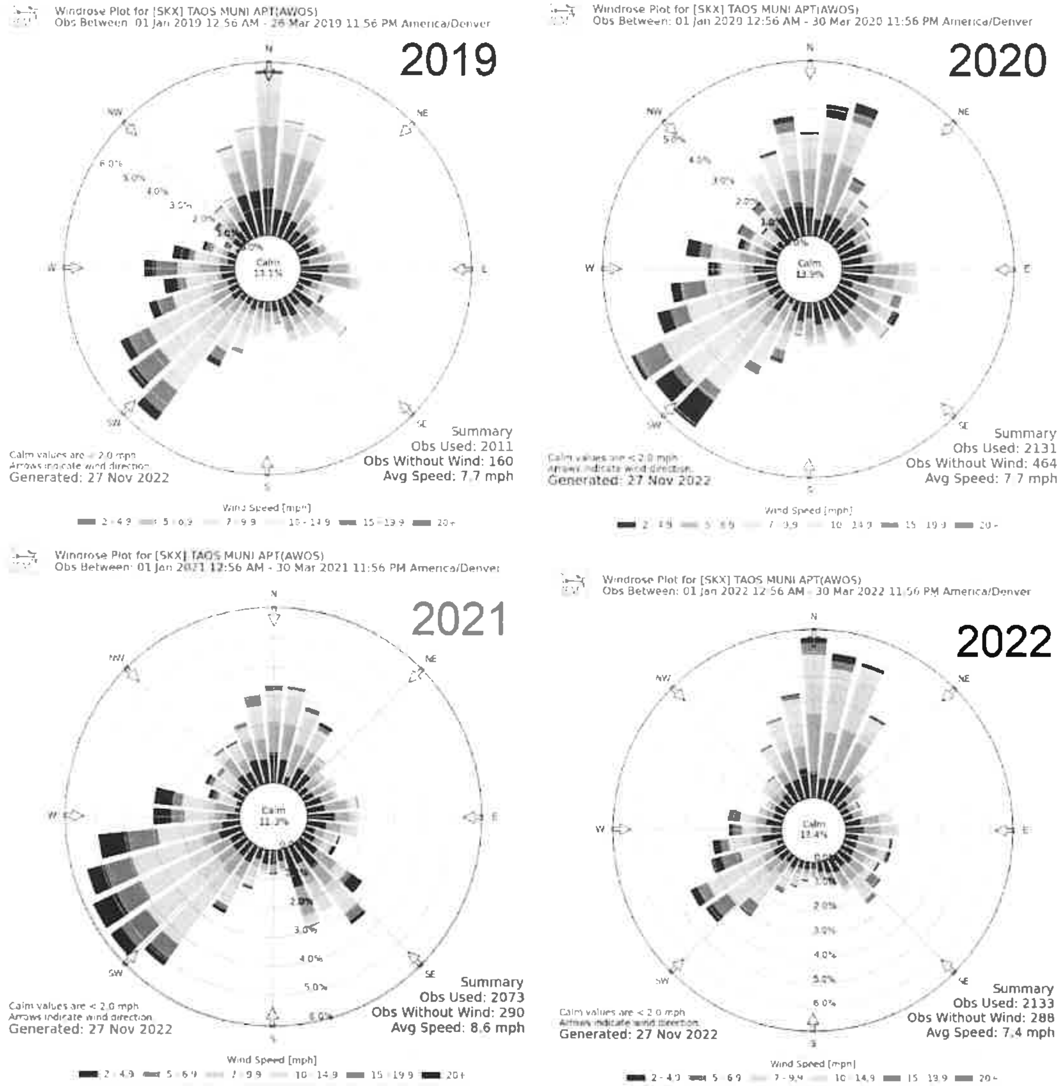
	HSmx	HSmx-3day-avg	HN-max	HW-max	dHS-3dy	dHS-5day	3daySWE	5day-SWE	mid-storm
1970	110	79	22	1.15	41	48	2.15	2.65	3/31/1970
1973	104	77	18	1.05	47	50	1.85	2.05	12/29/1972
1975	108	84	20.5	1.15	25	29	2.25	2.8	3/10/1975
1978	87	77	16	1.8	23	27	3.5	4.25	3/2/1978
1982	91	84	34	2.05	37	39	2.75	2.9	2/4/1982
1983	116	105	12	0.9	21	27	2.1	3.05	3/20/1983
1985	119	100	16	2	23	26	2.79	3.3	3/12/1985
1989	111		36	2.85	45	46	4.85	4.95	2/5/1989
1991	110		18	1.7	22	30	1.75	2.65	12/15/1990
1993	130	107	16	1.15	26	25	1.95	2.75	1/10/1993
1994	115	122	16	1.2	19	23	1.65	2.1	3/27/1994
1995	121	104	12	1.5	20	26	2.75	3.65	3/4/1995
2001							2.8	3.6	4/7/2001
2005	98		11	1.75	46	47	1.8	1.8	12/30/2004
2008			18	2.9			4.64	6.51	12/10/2007
2017	96	68	19	2.3	21	24	3.35	4.55	1/8/2017
2019	104	71	28	3	34.5	34	5.35	5.85	3/14/2019






HSmx





Taos Airport Wind Roses for Jan-Mar, 2019-2022

Taos Powderhorn SNOTEL
Site Number: 1168
Elevation: 11045 feet
Reporting since: 2010-08-09

Appendix B
Site Photos

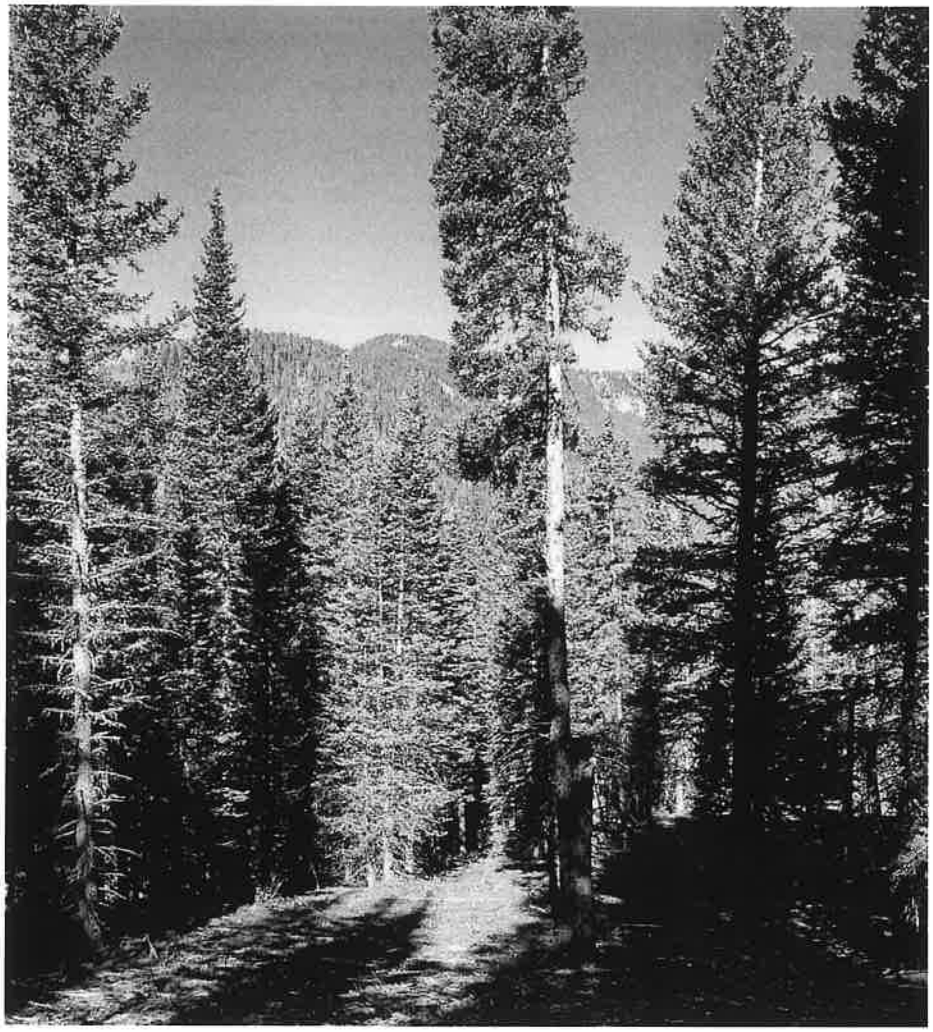


Photo 10
Location low in Jean's meadow; branches stripped on large tree to 16+ feet

Photo 5
Lop and pile area in 1962 avalanche path

Photo 6
Tree damage 3 to 6 feet above ground

Frazer, Bavarian, Bong, Peace paths
Jan. 11, 2008

Jan. 11, 2008 C. Wilbur photo

Mineslide Feb. 9, 2011

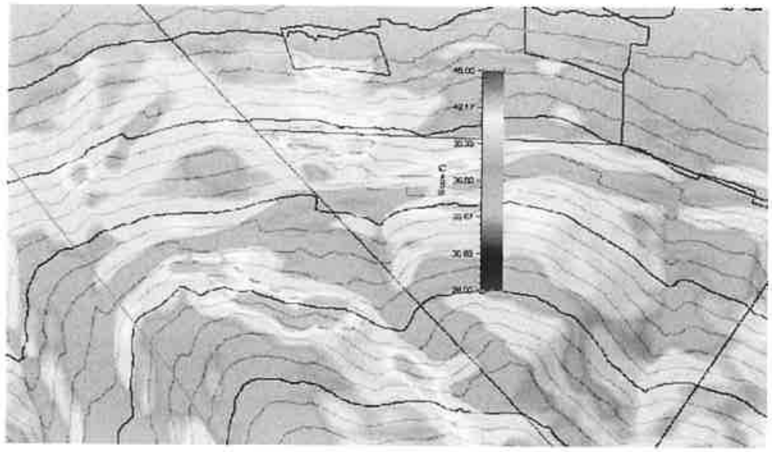
Appendix C
RAMMS Parameters & Results for Design Magnitude Avalanche

*** Important Note: ***

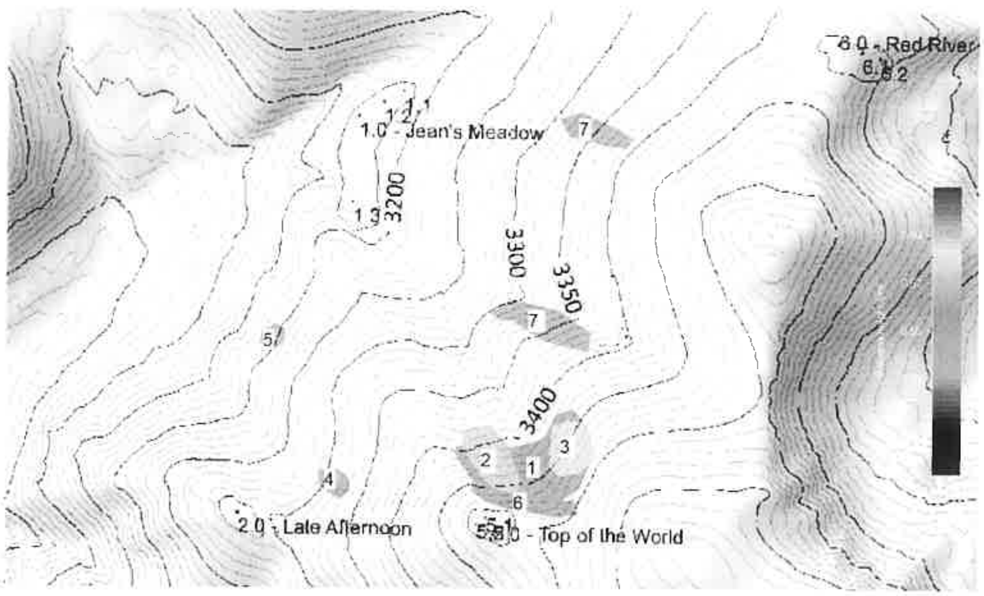
Interpretation of avalanche dynamics model results requires an understanding of the model assumptions, simplifications and limitations of the underlying equations of motion. The models do not accurately show wet avalanche runouts, flow heights or impact pressures, or the variations in avalanche properties with depth, including density and velocity.

Run No.	res.	Release name	ht. (m)	vol(m3)	Friction	cohesion (Pa)	Comments
Snowbear Condos							
run1	5	R1	0.8	6,200	S100	0	upper rel. Snowbear
run2	5	R1	0.8	6,200	S100-for	0	add forest friction
run3	5	R2	0.7	2,300	T100	0	lower rel Snowbear
run4	5	R1	0.7	2,300	T100-for	0	add forest friction
NTSV-front							
run6	3	R2	0.8	15,700	T100	100	7 tiny rel. front side
run7	3	R3	0.6-1.0	24,500	S100	0	8 rel. mid valley - runs too far
run8	3	R3	0.6-1.0	24,500	T100	0	8 rel. mid valley - still runs too far
run9	3	R3	0.6-1.0	24,500	T100	200	Add C
Amizet							
run10	3	R1	0.5	5,400	T100	100	5 tiny rel.
run11	3	R1	0.5	5,400	T100	200	incr C
HSB							
run8	2	R1	0.5		T30	0	30-yr
run9	2	R1	0.65		T100		same rel, diff hts
run5	2	R1	0.75	2000	T30	0	30-100-yr
run10	2	R1	0.85		T300		same rel, diff hts
run6	2	R1	0.9	2400	T100	0	100-yr
run7	2	R1	1.05	2800	T300	0	300-yr

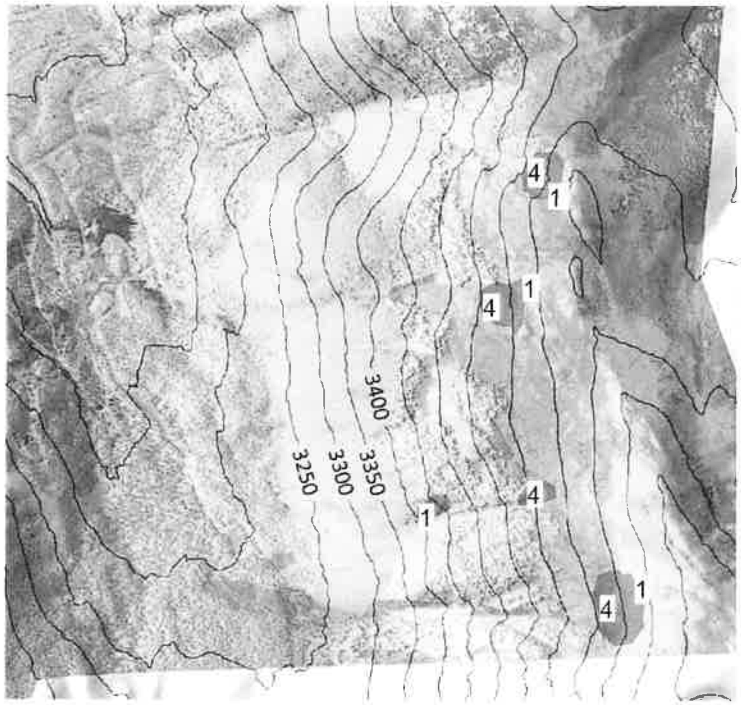
1962 path - Cabin 1.3							
run 1	5	R1	1.0	36,600	M100	0	Jeans mdw - hits cabin 1.3
run 2	5	R1	1.0	36,600	M300	0	300-yr friction
run 3	5	R1	1.0	36,600	M300	100	300-yr add C
run 4	5	R1	0.7	25,600	M100	0	smaller rel
run 5	5	R1	0.7	25,600	M100	100	add C
run 6	5	R1	0.7	25,600	M100	200	addl C
run 7	5	R2	1.0	11,300	S100	0	100yr Wind-loading rel
run 8	5	R3	1.0	9,300	S100	0	E rel. sparce forest
run 9	5	R3	1.2	11,100	S100	0	incr rel ht
run 10	5	R3	1.2	11,100	S300	0	300-yr friction
Late Afternoon paths							
run 11	5	R4	1.0	3,200	T100	0	W of L Afternoon
run 12	5	R5	1.0	5,500	T100	0	N of L Afternoon
run 13	5	R6	1.2	9,600	S100	0	cornice-drift rel 100-yr
run 14	5	R6	1.2	9,600	S100	150	Hi C
run 15		R6	1.2	9,600	S100	75	Low C
run 16	5	R7	0.8	14,800	T100	0	2 east rel.
run 17	5	R7	0.8	14,800	T100	150	1 east rel.
Mineslide, Dog leg							
run 18	3	R1	0.7	1,030	T100	0	
run 19	3	R2	0.7	1,850	T100	0	N release
run 20	3	R3	0.7	920	T100	0	S release
run 21	3	R4	0.7	800	T100	0	wider S rel.
run 22	3	R4	0.7	800	T100	0	10% cutoff vol; dep matches 2019
run 23	3	R4	0.8	915	T100	0	calibrated to 2019
run 24	3	R4	0.9	1,030	T100	0	100-yr design-magnitude
run 25	3	R2	0.5	1,320	T100	0	
run 26	3	R2	0.5	1,320	T100	0	10% cutoff vol
run 27	3	R5	0.8	4,840	T300	0	300-yr
run 28	3	R6	0.8	2,300	T100	0	ext rel N
run 29	3	R7	1.0	1,500	T100	0	adj rel per terrain
Frazer, Bavarian, Bong				N-vol(m3)	S-vol(m3)		
run 30	3	R1	1.2	14,500	11,700	M100	initial run
run 31	3	R2	1/0/1.2	12,000	11,700	M100	adj rel. ht for terrain
run 32	3	R3	1/0/1.2	17,800	13,700	M100	revise R2 to fit forest
run 33	3	R4	.75/85	8,100	13,100	S30	30-yr
run 34	3	R5	.9/1.1	9,700	16,900	M100	100-yr
run 35	3	R6	.8/1.1	8,700	16,900	M100	100-yr reduce N rel sli
run 36	3	R7	1.0/1.3	10,800	20,000	M300	300-yr
run 37	3	R6-for	.8/1.1	8,700	16,900	M100	add forest friction
run 38	3	R7-for	1.0/1.3	10,800	20,000	M300	300-yr-forest friction
run 39	3	R8	1.1	14,900	-	M300	incr. 300-yr vol.
run 40	3	R8	1.5	18,700	-	M300	incr rel ht. 300-yr vol.
run 41	3	R4	1.3-1.5	14,100	37,100	M300	300-yr Bav big
run 42	3	R1	1.2	27,000	S100	0	rel from RB
run 43	3	R1	1.2	28,300	S100	0	adj rel per aerial, esp Bong
run 44	3	R3	1.3	40,400	S300	0	300-yr



Release areas – above Snow Bear Lodge

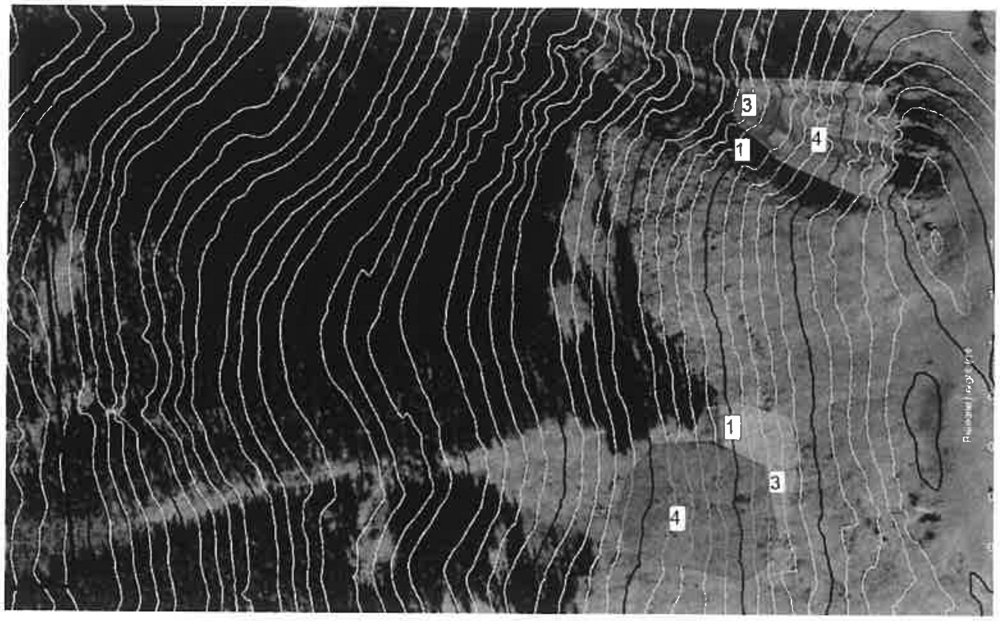


Release areas - Northside

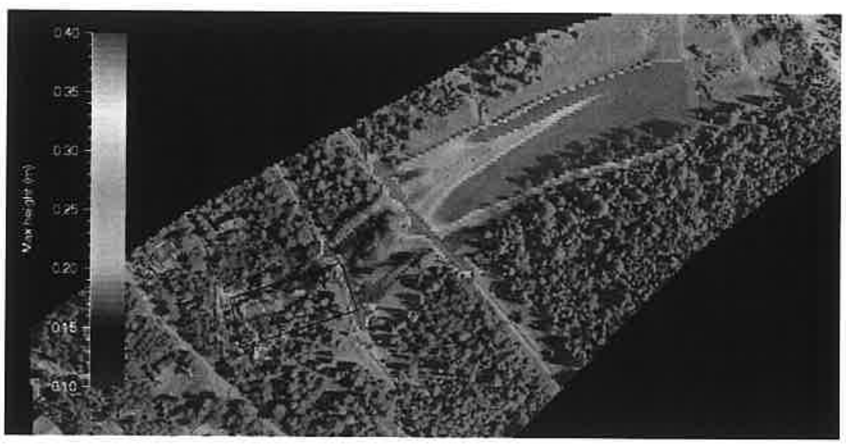


Release areas – Dog leg area

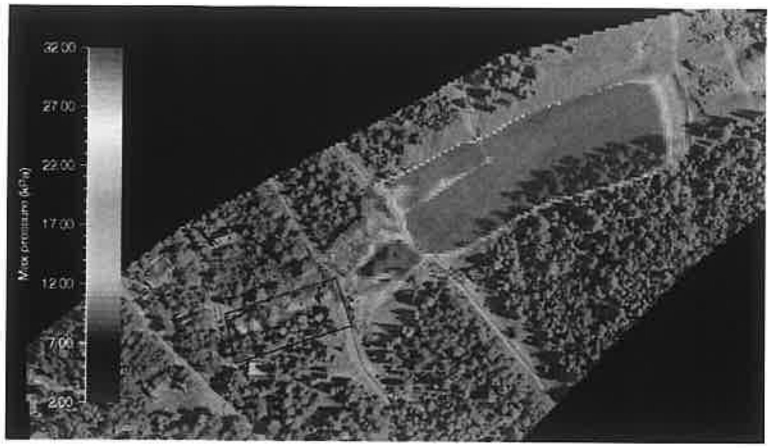
Release areas - Mineslide



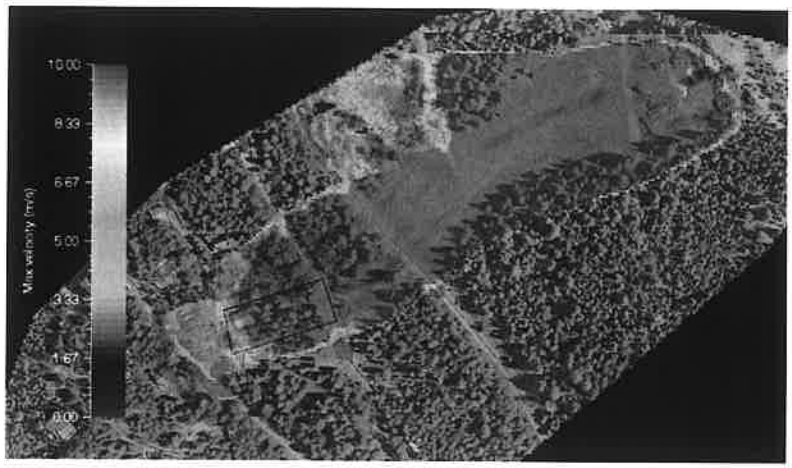
Release areas – Frazer, Bavarian



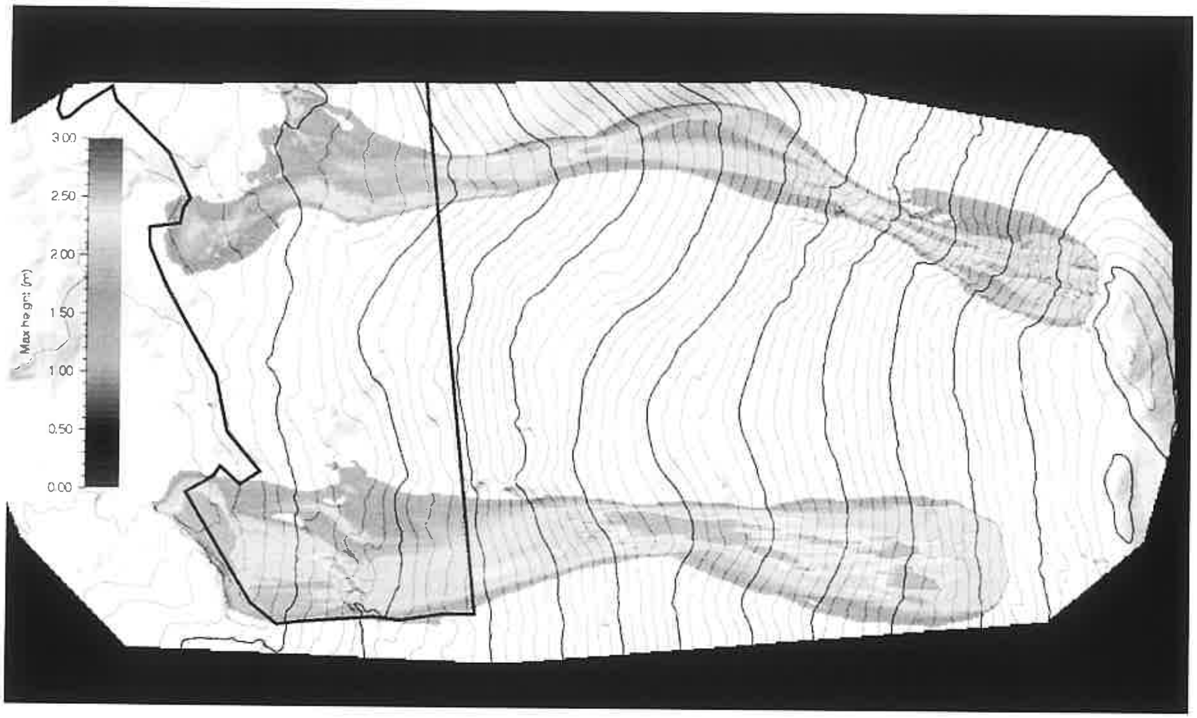
Mineslide Run 24 – height



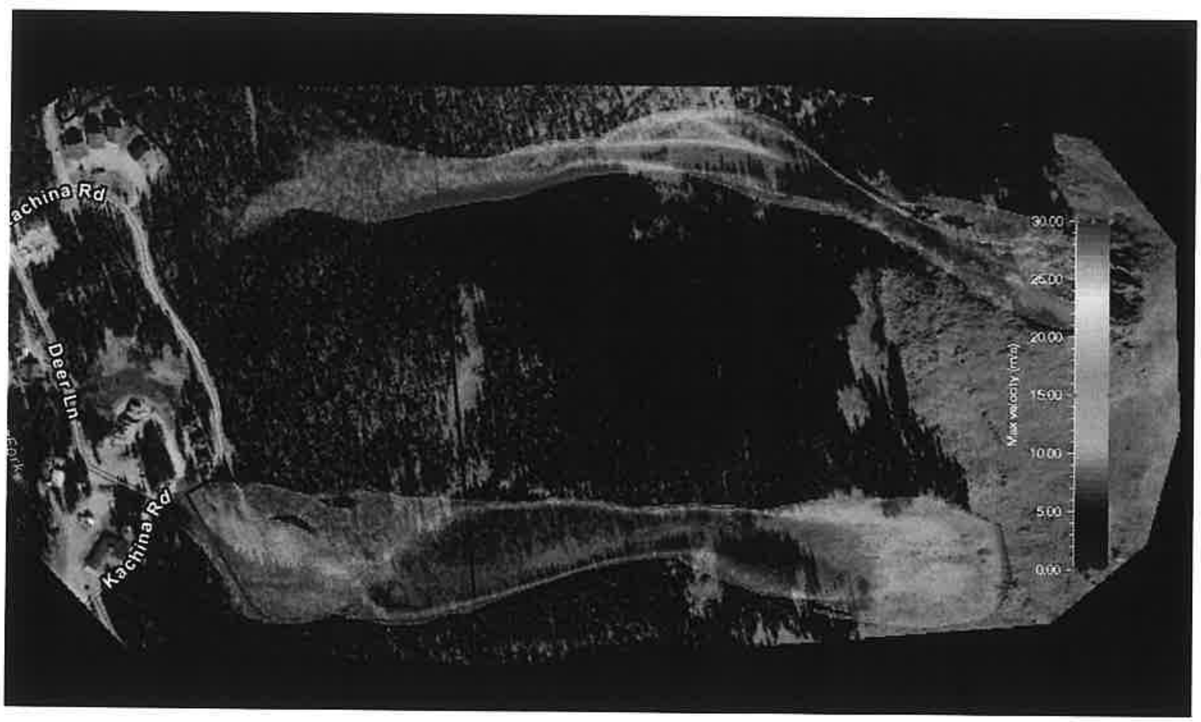
Mineslide Run 24 – pressure



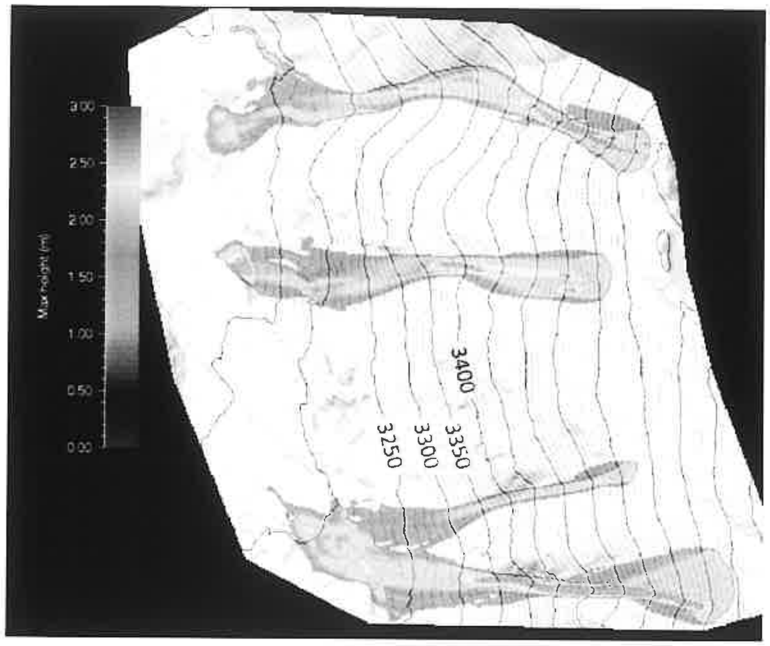
Mineslide Run 27 – velocity



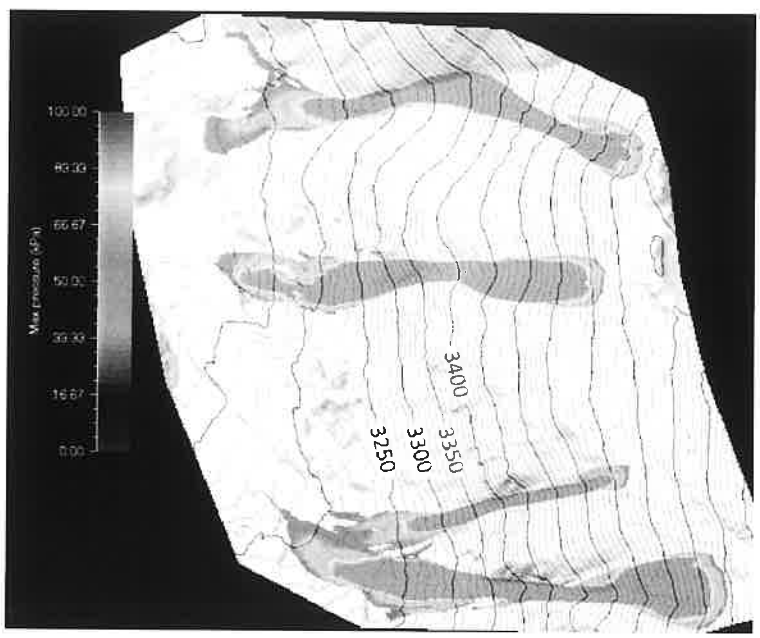
Run 36 – height



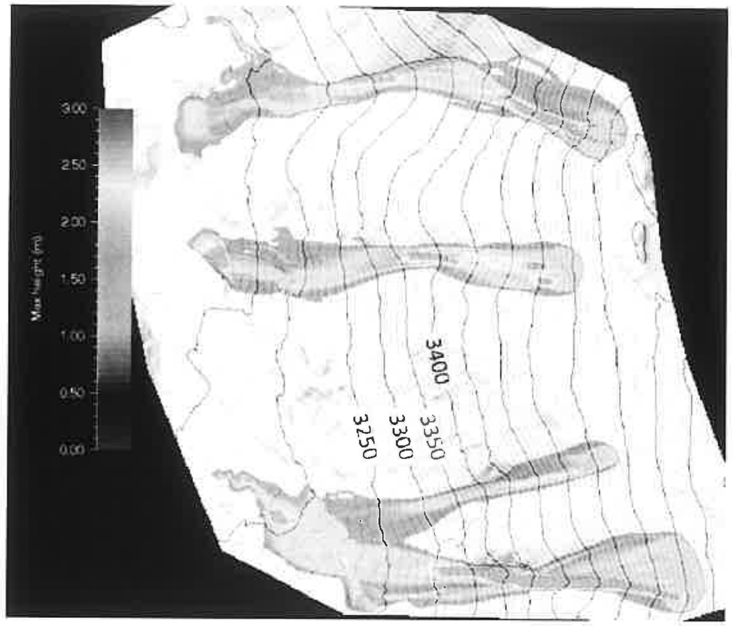
Run 36 – velocity



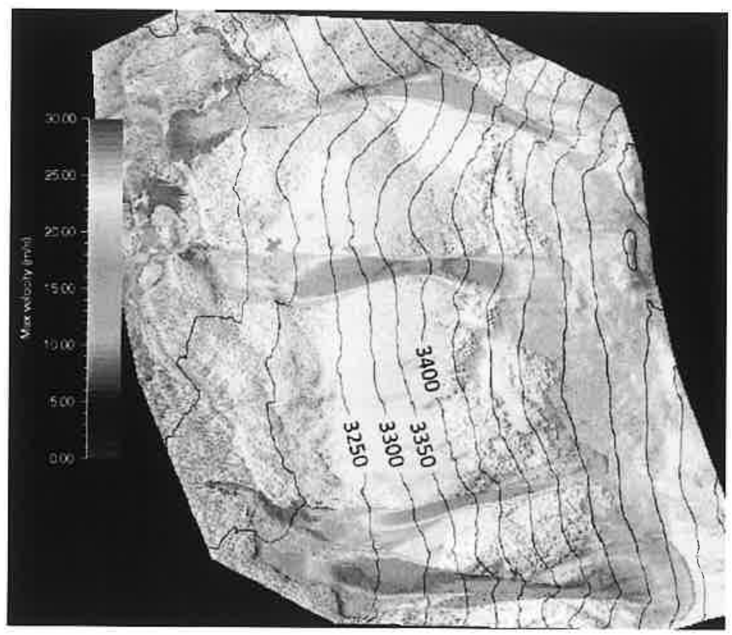
Run 43 – height



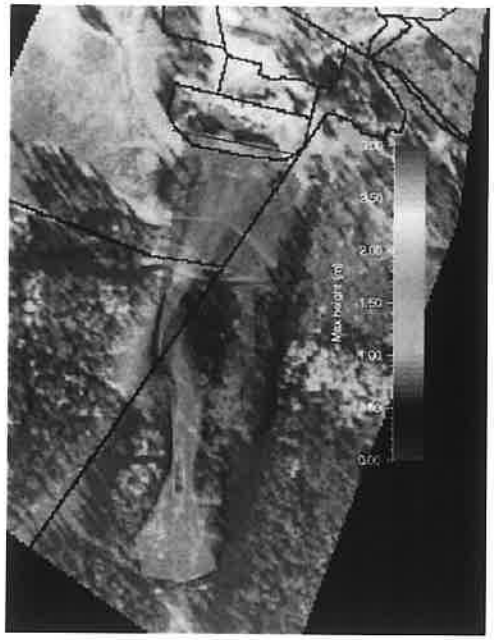
Run 43 – pressure



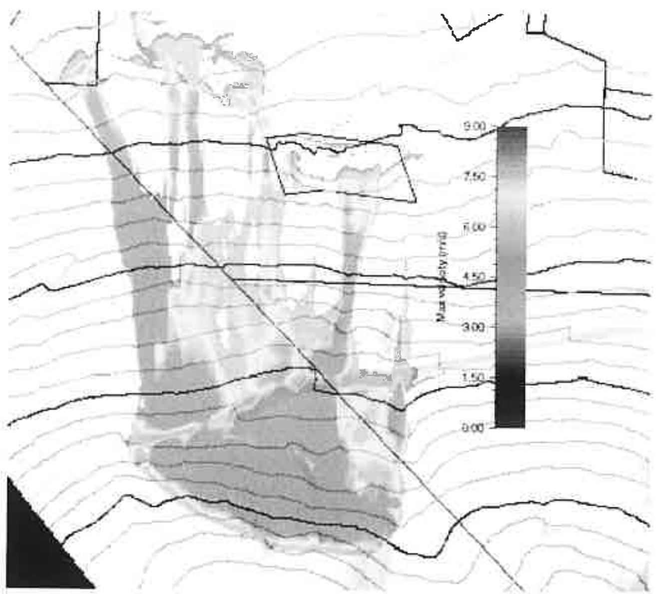
Run 44 – height



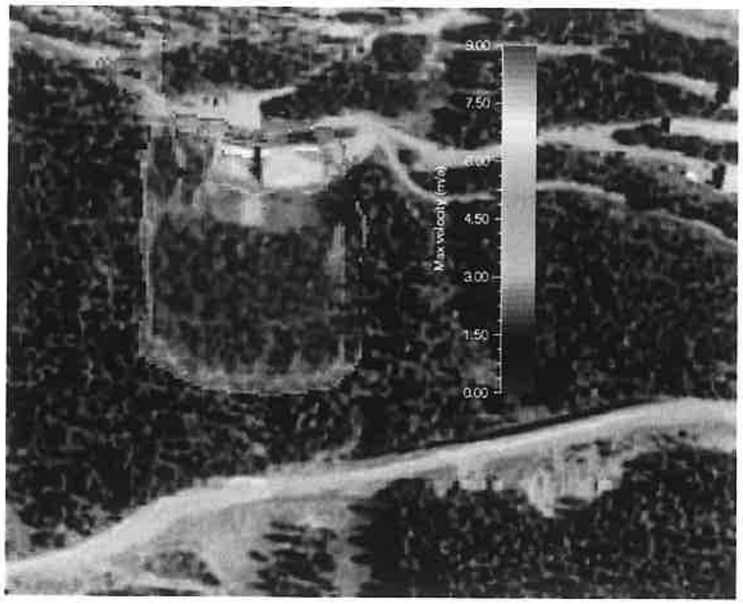
Run 44 – pressure



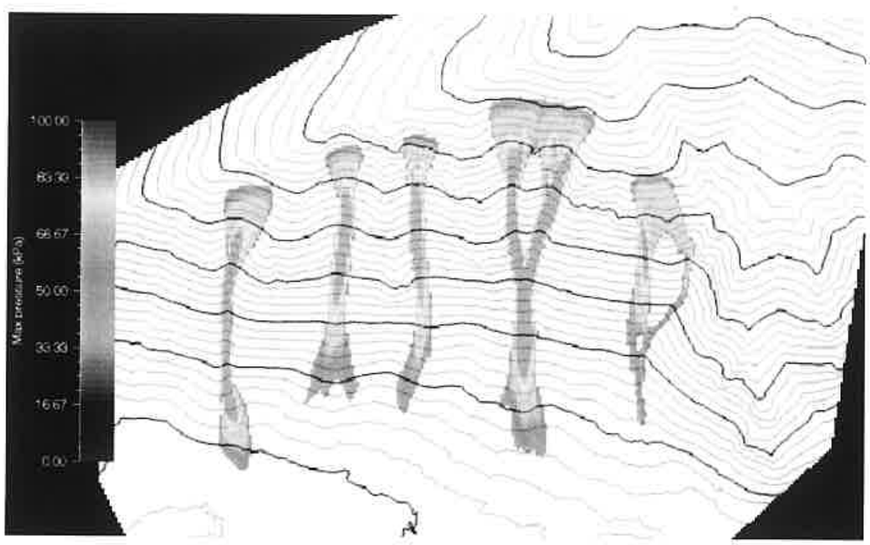
HSB Run 6 – height



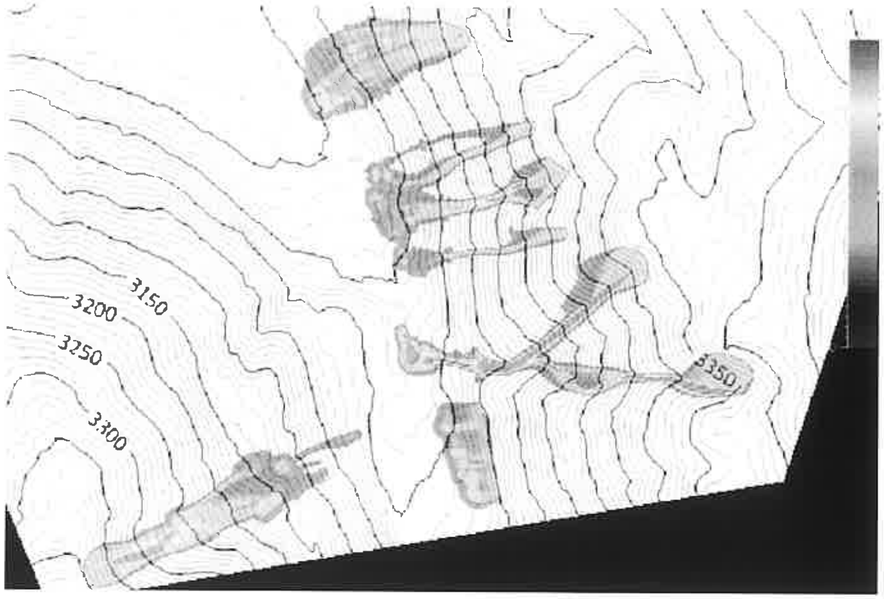
Snowbear Run 4 – height

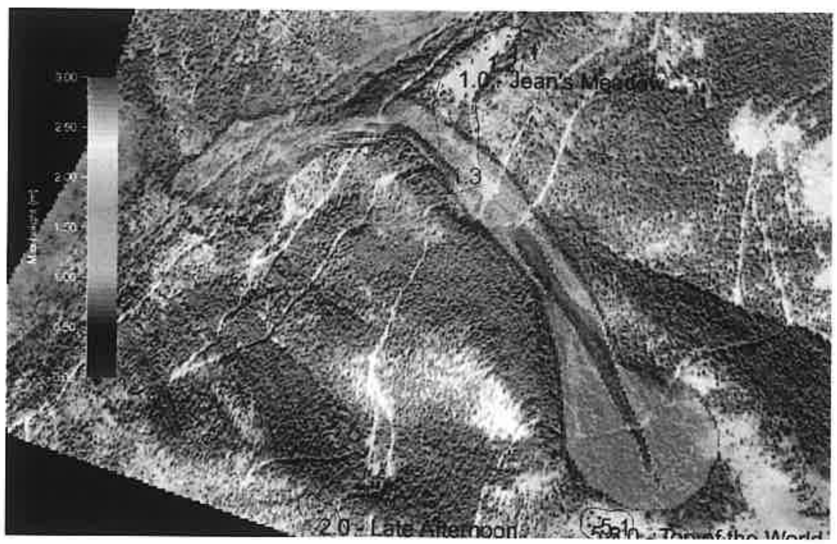


Snowbear Run 3 – height

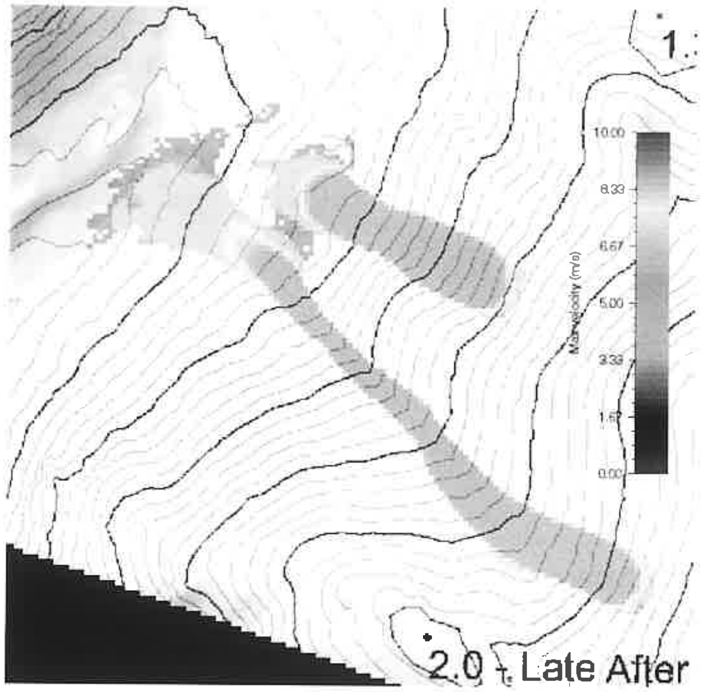


Amizette Run 11 – height





Northside Run 3 – height



Northside Run 12 – velocity