

ALPINE ENTERPRISES INC.

Surveying, Mapping, Civil Engineering, GPS, GIS, and Natural Hazards Consulting

DATE: June 23, 2023

TO: City of Ketchum Planning & Zoning Commission
City of Ketchum Planning & Building Department

Re: Snow Avalanche Hazard Evaluation
Warm Springs Valley Subdivision, Block 5, Lot 9
219 Hillside Drive

Dear P&Z Commission and City,

At the request of the City and the Landowner of 219 Hillside Drive we performed a Site-Specific Snow Avalanche Hazard Evaluation for the subject property. On Tuesday, June 13th, 2023, Alpine Enterprises Inc. presented the Site-Specific Snow Avalanche Hazard Evaluation before the City of Ketchum Planning and Zoning Commission. During the meeting numerous public comments and concerns were raised regarding the Avalanche Study. In the following memo we will further explain the findings and methods used. This memo should be viewed along with the full Site-Specific Snow Avalanche Hazard Evaluation that was submitted with the Design Review Application.

All of the Avalanche Studies performed by Alpine Enterprises Inc. use a 300-year design event, 0.33% annual chance. This is done in an attempt to account for the inherent variabilities associated with avalanches, snowfall, and snowpacks. Many other fields rely on the 100-year design event, but we have found that the more conservative 300-year event better represents the potential avalanche hazards in the region. In the past 5 years we have experienced numerous extreme and record-breaking snowfall events that suggests climate change is creating more sporadic and severe weather events.

Several design parameters are adjusted to differentiate between the 300-year and 100-year design events. The 300-year design event assumes a constant snow density of 300 kg/m³, whereas the 100-year event assumes a constant snow density of 150 kg/m³. The 300-year design event also assumes greater avalanche release volumes, release depths, and flow heights than would be used in a 100-year design event. We also make other assumptions when evaluating the 300-year design event which account for potential changes in the existing site conditions. We assume that the neighboring properties and forested areas will not provide any protection from an avalanche event. This approach has proven to be realistic as many homes have been torn down and large areas of forest have been lost to fires.

The subject property is located at Block 5, Lot 9, Warm Springs Valley Subdivision. This Lot was platted 50 years ago in 1963. While this Lot would not be permitted under the current Ketchum Municipal Code Subdivision Ordinances, Idaho is a pro-property rights state, and Landowners have a vested right to develop their property in a manner similar to what the adjoining properties have been permitted to do. The City of Ketchum Avalanche Zone District Code of Ordinances has undergone numerous changes since it was first adopted on April 19th, 1974. A requirement that has been consistent throughout this period is that an applicant shall submit a written acknowledgement or provide personal testimony of knowledge that a proposed development or improvement is located within the Avalanche Zone District prior to the issuance of a building permit in said zone. Further, each and every real estate agent, salesperson, or broker of every property for sale, rent, or lease within the Avalanche Zone District have been required to disclose that a property is within the district via written statement upon first inquiry since 1974.

Prior to KMC Ordinance No. 1135, July 6th, 2015, Landowners were permitted to build single-family residences within the Avalanche Zone District without structural engineering designed to withstand potential avalanche impact pressures. Currently, all new development within the Avalanche Zone District is required to be designed and certified by a Structural

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Engineer that the development will be able to withstand potential avalanche forces, the exception being remodels under 1,200 gross square feet for existing non-engineered single-family homes. The subject property, 219 Hillside Drive, is surrounded by single-family residences that have and have not been designed to resist potential avalanche forces. The two properties downslope of the proposed development, 213 and 215 Hillside Drive, were not constructed with such engineering, whereas the adjacent property to the east, 223 Hillside Drive, was constructed with large concrete avalanche protection walls incorporated into the foundation. Alpine Enterprises Inc. was consulted on the avalanche protection of this structure.

The subject property and the adjoining properties north of Hillside Drive have all been identified in both the 1977 and 1978 Avalanche Studies, conducted by Norman A. Wilson and Arthur I. Mears respectively, as being located within high, red-zone, avalanche hazard areas. These zoning areas can be seen on sheet 27 of the Site-Specific Snow Avalanche Hazard Evaluation of 219 Hillside Drive conducted by Alpine Enterprises Inc. The Mears avalanche hazard zones have also been included in Figure 9 of this memo. The Snow Avalanche Hazard Evaluation for 219 Hillside Drive is site-specific to the proposed building area and is not indicative of and does not comprise the total risk present to the immediately adjacent properties. When performing a site-specific avalanche hazard evaluation, we attempt to not evaluate adjacent properties to avoid the possibility of potentially imposing zoning restrictions upon Landowners that have not requested such a study. However, in this particular instance, the properties located directly downslope of the proposed development were required to be included in the avalanche study. Any property that is not directly in the modeled avalanche path is still assumed to be located within the high avalanche hazard areas depicted in the 1977 and 1978 Avalanche Studies, conducted by Norman A. Wilson and Arthur I. Mears respectively, unless superseded by a site-specific evaluation. Site-specific avalanche hazard evaluations are able to refine the existing studies that were conducted before most of the development occurred in the area with the use of Avalanche Dynamics Modeling Software and LiDAR topographic mapping that were not available until recently.

The primary concern raised at the June 13th, 2023 Planning and Zoning Commission meeting was in regard to avalanche deflection and an increased risk to surrounding properties. Ketchum Municipal Code 17.92.010.D.2 states that:

“Avalanche protective, deflective and preventative structures, devices or earthwork which threaten to deflect avalanches toward property of others or otherwise threaten to increase the danger to persons or property are prohibited. The construction of such structures, devices or earthwork shall be permitted only as a conditional use. Prior to granting of a conditional use permit, the applicant shall submit to the City plans signed by an engineer licensed in the state, certifying that the proposed construction will withstand the avalanche forces set forth in the avalanche studies on file with the City and that the proposed construction will not deflect avalanches toward the property of others. Other information and engineering studies may be requested in consideration of an application for a conditional use permit. As a further condition of any conditional use permit, appropriate landscaping may be required where such structures, devices or earthwork alter the natural slope or beauty of the land. This shall not apply to reforestation. Alteration or removal of any existing natural barriers is prohibited.”

All avalanches will deflect off of any man-made or natural object in its path, but when designed correctly, a structure can minimize such deflection, contain avalanche runout to the confines of the subject property, and not increase dangers to persons or property. The proposed development for 219 Hillside Drive presents difficulties when evaluating this criteria, as all the adjacent properties are currently subject to avalanche danger independent of the proposed development. A proposed development cannot be considered to deflect towards another property that was already directly in the avalanche path, and the proposed development cannot be required to be direct protection for a property that does not currently have engineered protection measures. In this situation the evaluation standard we have to rely on is does the proposed development increase the danger to the adjacent properties compared to the existing danger if the development were not constructed.

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In order to assess if the proposed development meets City design criteria, we evaluated three different avalanche situations for the area that would be directly impacted by the development. All three scenarios modeled the same 300-year avalanche design event with the same release volume and the same friction and turbulence parameters. The first situation is included in the Site-Specific Snow Avalanche Hazard Evaluation of 219 Hillside Drive conducted by Alpine Enterprises Inc. This situation follows the 300-year design event model and omits all existing structures in the area. This method is used to establish avalanche zoning areas and potential avalanche impact pressures. This method is indicative of the worst-case scenario and is used to develop design parameters.

The second method, Situation 2 in the included figures, evaluated the subject property with the adjacent structures to the south and east included in the terrain model. The existing structure located at 213 Hillside Drive was not included as this Lot is subject to a separate avalanche path than the one that affects the proposed development. The third method, Situation 3 in the included figures, evaluated the subject property with the proposed structure and the adjacent structures to the south and east included in the terrain model. The results of these studies should not be used for any future building designs and are only included to demonstrate that the proposed development does not increase dangers to adjacent properties.

Figures 1 and 2 depict the anticipated pre and post development maximum avalanche flow depths for the 300-year design event. The results show that some avalanche runout will be diverted around the proposed structure, but the majority of runout directly in the structures path will be captured behind and on top of the residence. The avalanche runout distance remains mostly unchanged adjacent to the structure, and the area directly down slope shows a significant decrease in in avalanche debris accumulation. Both scenarios show that adjacent properties will be affected by the design avalanche event, but there will not be an increase in avalanche hazard at these locations.

Figures 3 and 4 depict the anticipated pre and post development maximum avalanche flow velocities for the 300-year design event. The results show that there is a considerable decrease in avalanche flow velocity caused by impact with and friction across the roof of the proposed structure. The energy dissipated through the initial impact with the rear retaining wall and roof friction causes an estimated 50% to 60% reduction in avalanche velocities at the southern/downhill roof edge than would be experienced if the proposed structure was not present. The proposed structure does have the potential to project runout debris into the air and act as a “ski jump”, but in this situation the debris will not land on the roofs of neighboring properties and will land within the boundary of the subject property. The anticipated flow velocities off of the roof at this location range between 3 m/s and 6 m/s (6.7 mph and 13.4 mph). The “ski jump” concerns presented at the June 13th, 2023 Planning and Zoning Commission meeting would be valid for a significantly larger avalanche path with higher flow velocities, but in the location of the proposed development the existing site conditions and the structural design will limit the hazards associated with airborne runout debris exclusively to the subject property.

Figures 5 and 6 depict the anticipated pre and post development maximum avalanche flow pressures for the 300-year design event. Figures 7 and 8 depict the same anticipated pre and post development maximum avalanche flow pressures, but with the upper display limit set to 30 kpa to differentiate between red and blue avalanche hazard areas. The results show that there would be a clear reduction in anticipated avalanche impact pressures to the residence located downslope of the proposed development at 215 Hillside Drive. It is of our professional opinion that the proposed development would increase the avalanche safety for this property, particularly because this structure was built prior to the requirement that single-family residences be designed to withstand avalanche forces.

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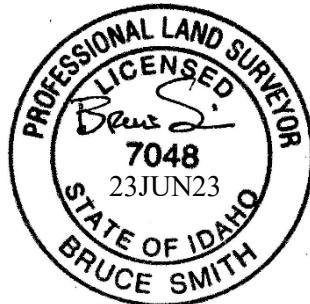
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The design team and applicant of the proposed development located at 219 Hillside Drive are sympathetic to the public comments and concerns associated with the proposal and have evaluated the concerns presented. Since the June 13th, 2023 Planning and Zoning Commission meeting design considerations have been assessed and implemented. In order to increase avalanche safety to the surrounding properties, the uphill grade north of the proposed foundation has been lowered in order to expose more of the vertical foundation wall. Other design considerations have been implemented, but only those associated with avalanche mitigation have been included in this memo.

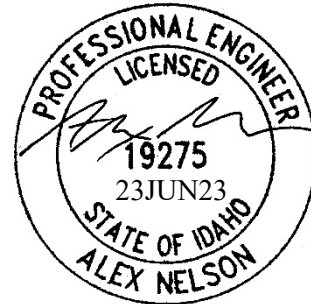
In conclusion, the subject property, located at 219 Hillside Drive, and the surrounding properties north of Hillside Drive are all located in high avalanche danger areas. Any person building or dwelling in the Avalanche Zone District is required by Ketchum Municipal Code to acknowledge the potential hazards to life, health, and property for residents, guests, and visitors. The avalanche event included in this study consists of only a small portion of the total hazard in the area. The likelihood of the design avalanche releasing at a 300-year magnitude solely in the path evaluated would be exceedingly rare. In this type of situation, the adjacent avalanche paths would have a high probability of sliding simultaneously. Extreme avalanche hazards already exist in this area, and it is not exclusive to the to the subject property. Development within high avalanche hazard areas is prohibited in virtually every other municipality that possesses a fundamental understanding of avalanche dangers. The City of Ketchum has worked to increase avalanche awareness and promote responsible development, but past recklessness has set a dangerous standard. Living and developing in avalanche paths is an inherited and assumed risk that should not be taken lightly.

Alpine Enterprises Inc. operates under Idaho State surveying and engineering codes, standards, and ethics. Our primary obligation is to protect the health, safety, and welfare of the public. We welcome anyone with questions or concerns regarding the avalanche study and safety of the proposed development to contact us.

Respectfully submitted,



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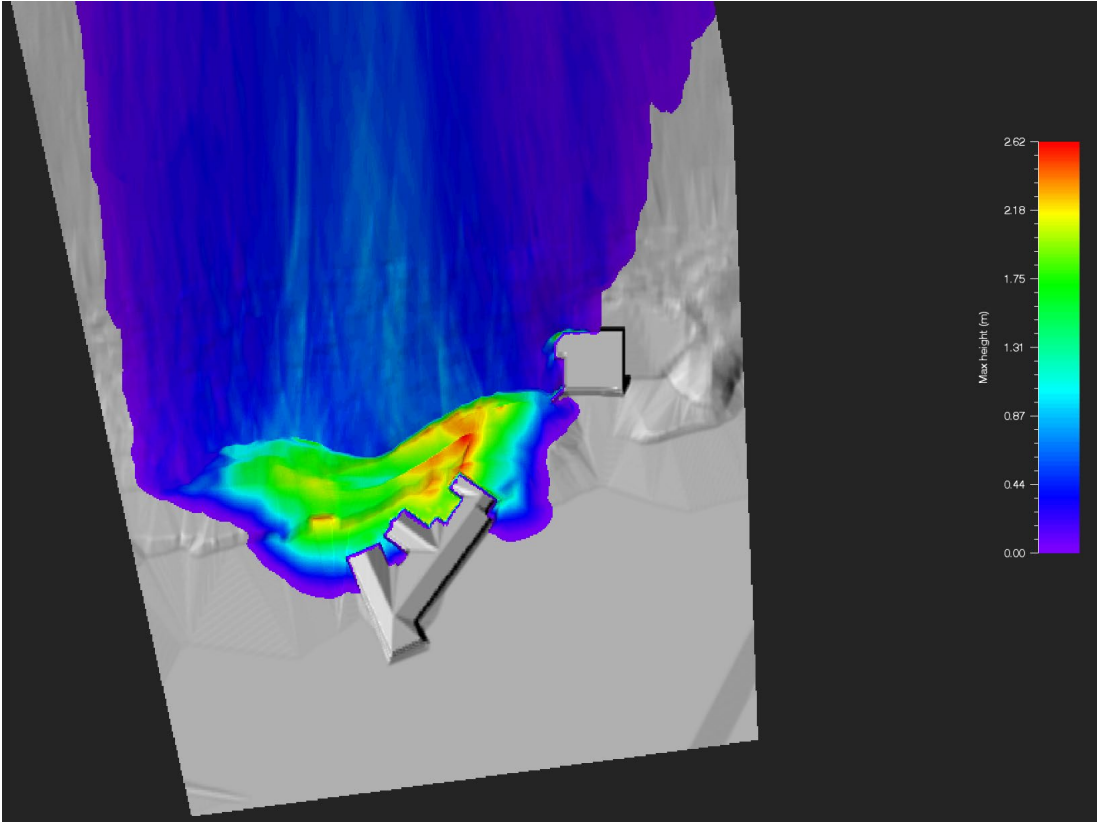


Figure 1 – Path_R5_S300 – Maximum Flow Height, Situation 2

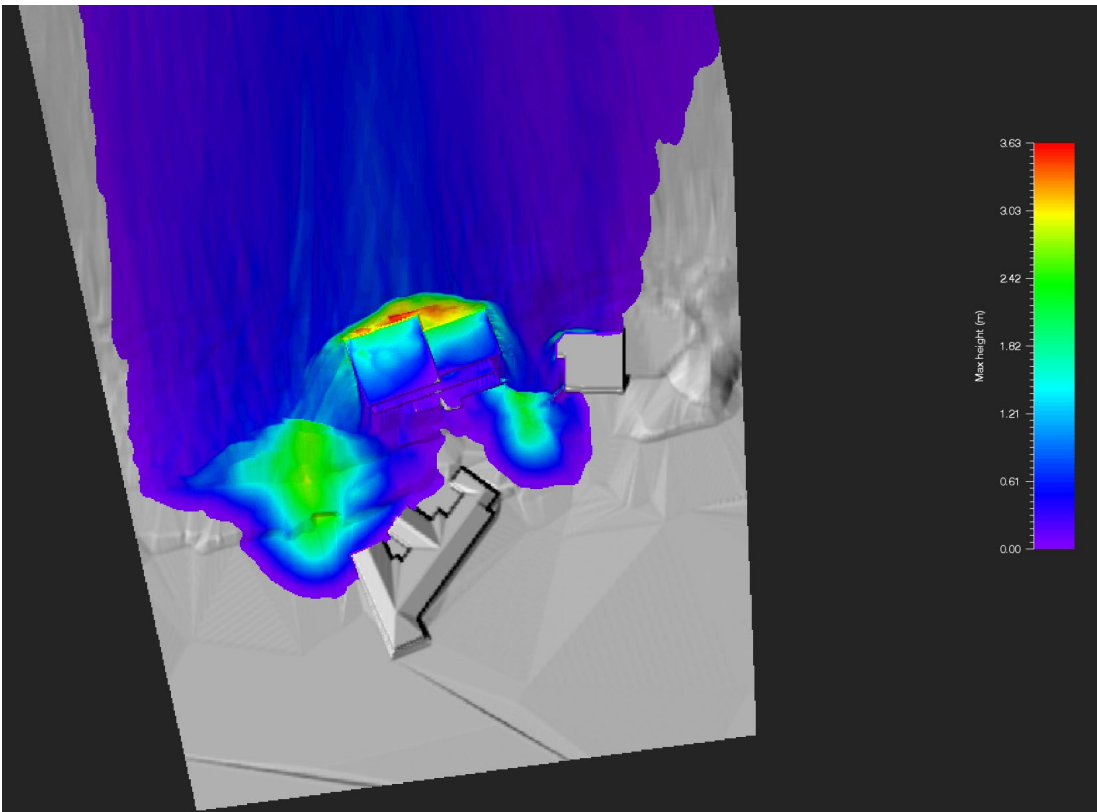


Figure 2 – Path_R5_S300 – Maximum Flow Height, Situation 3

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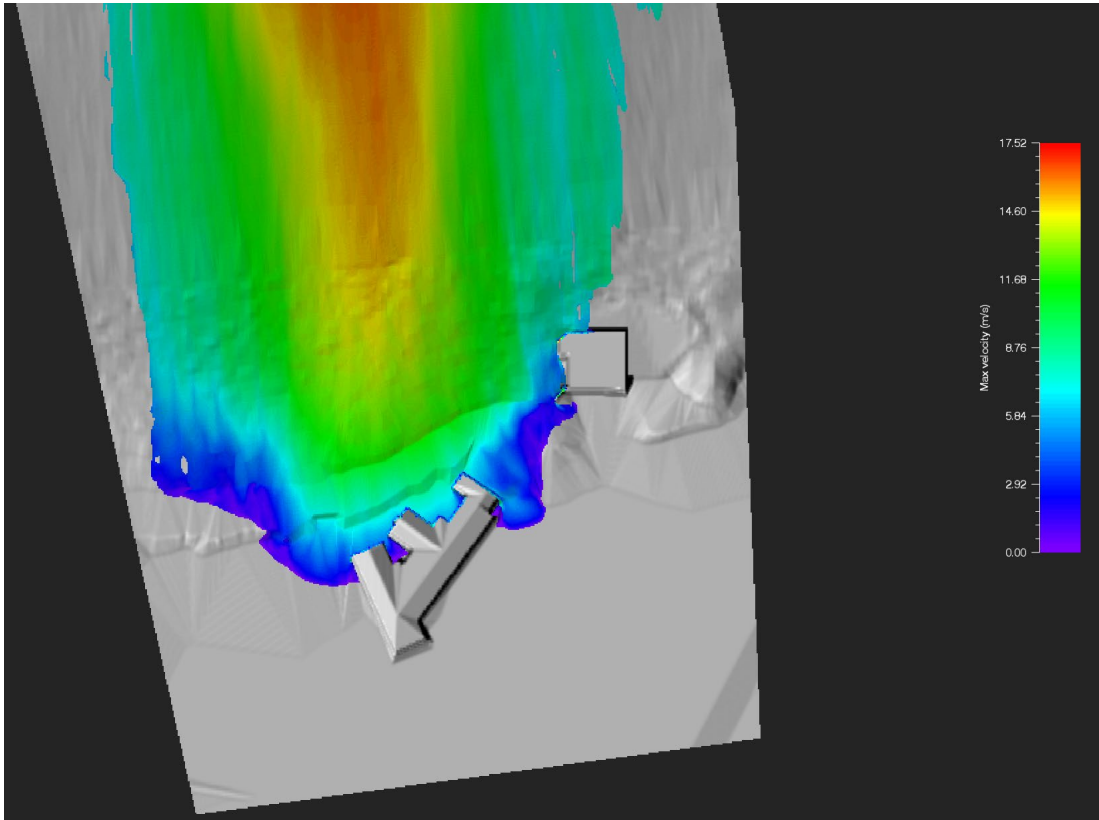


Figure 3 – Path_R5_S300 – Maximum Velocity, Situation 2

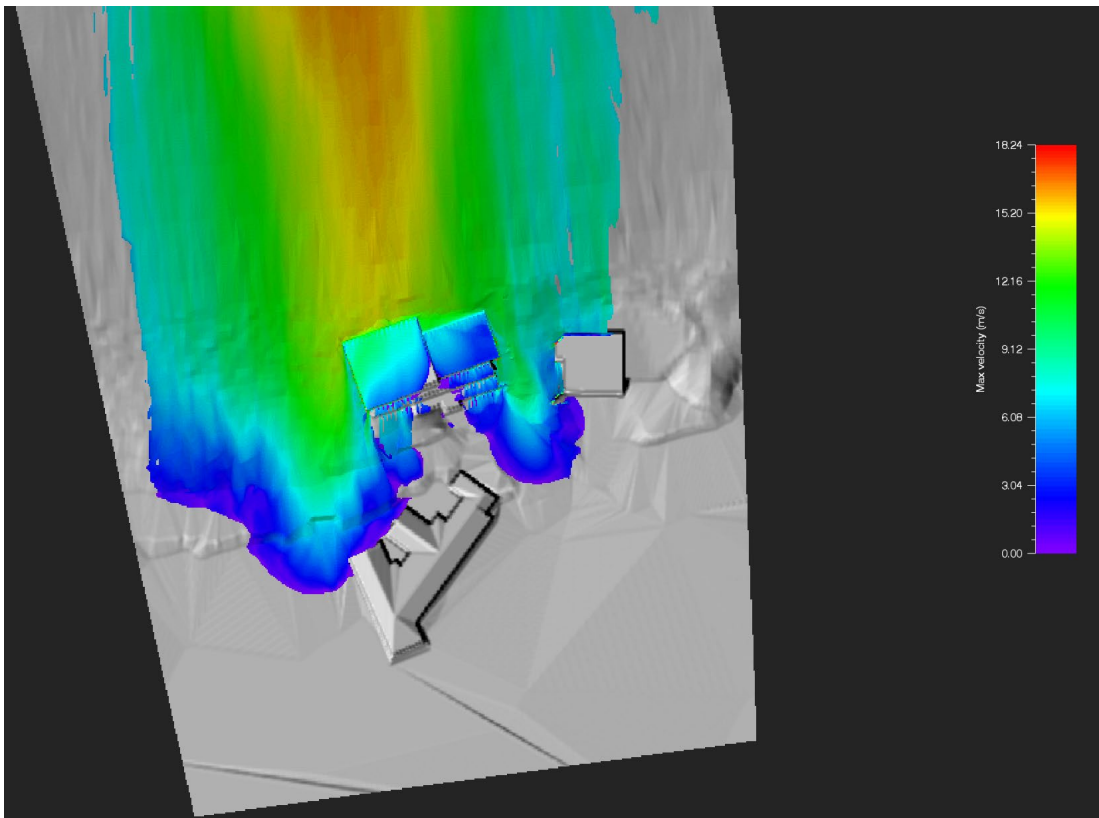


Figure 4 – Path_R5_S300 – Maximum Velocity, Situation 3

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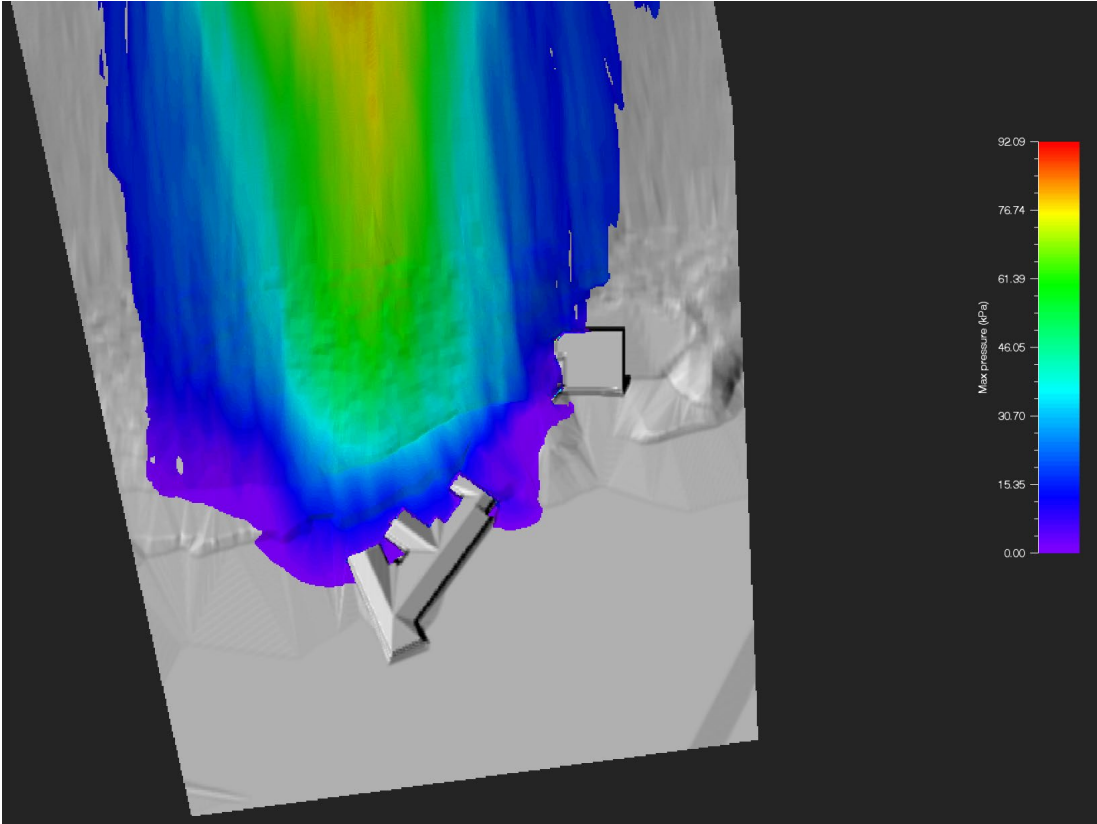


Figure 5 – Path_R5_S300 – Maximum Pressure, Situation 2

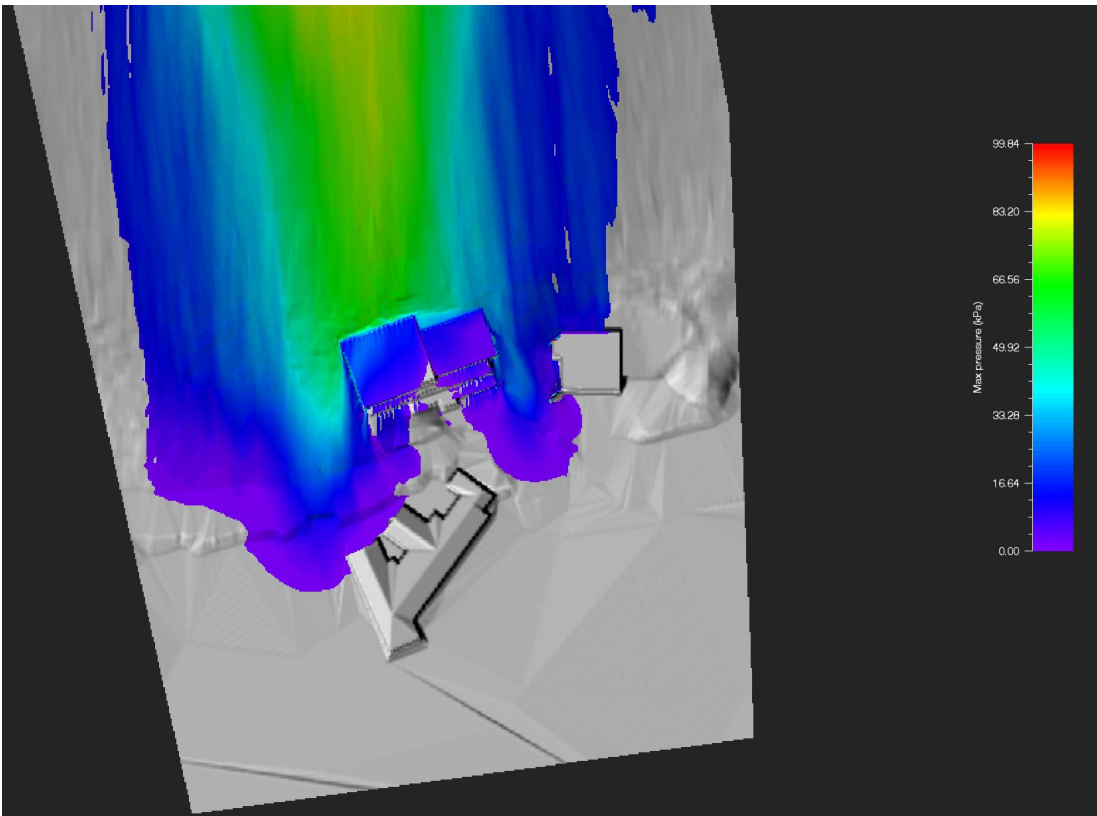


Figure 6 – Path_R5_S300 – Maximum Pressure, Situation 3

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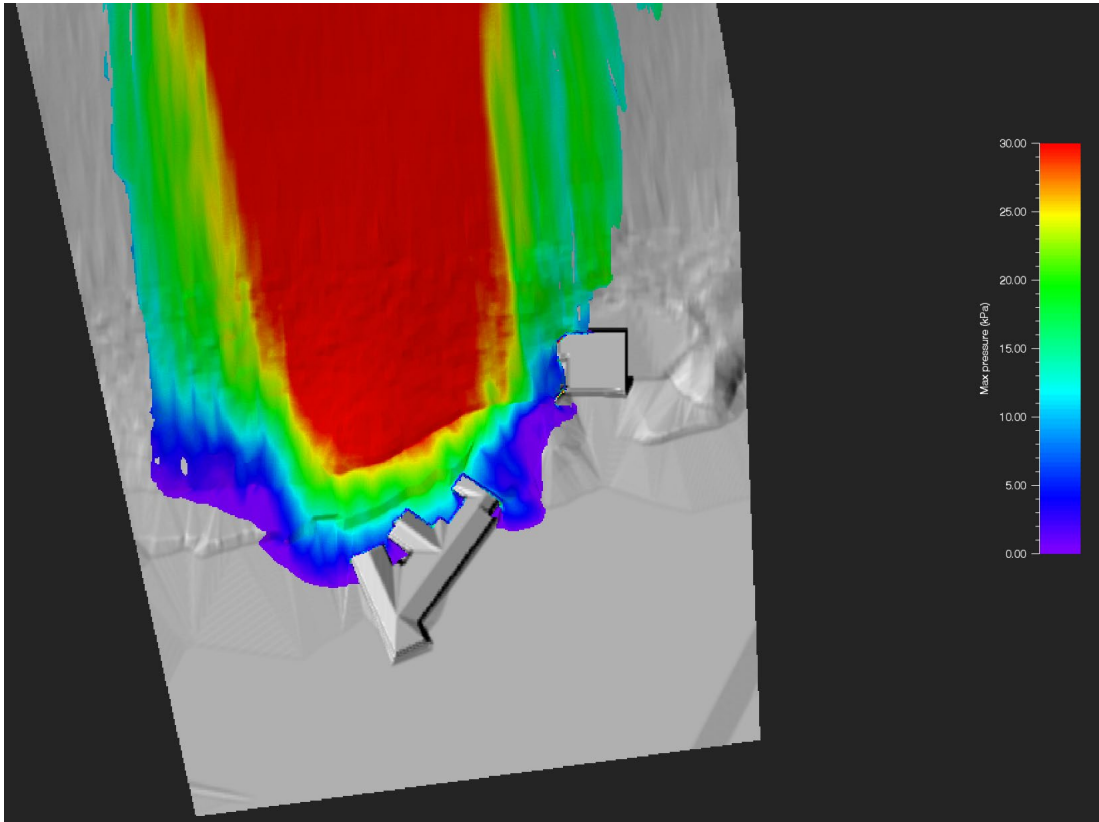


Figure 7 – Path_R5_S300 – Maximum Pressure, Red-Zone, Max. Pressure Set To 30 kpa, Situation 2

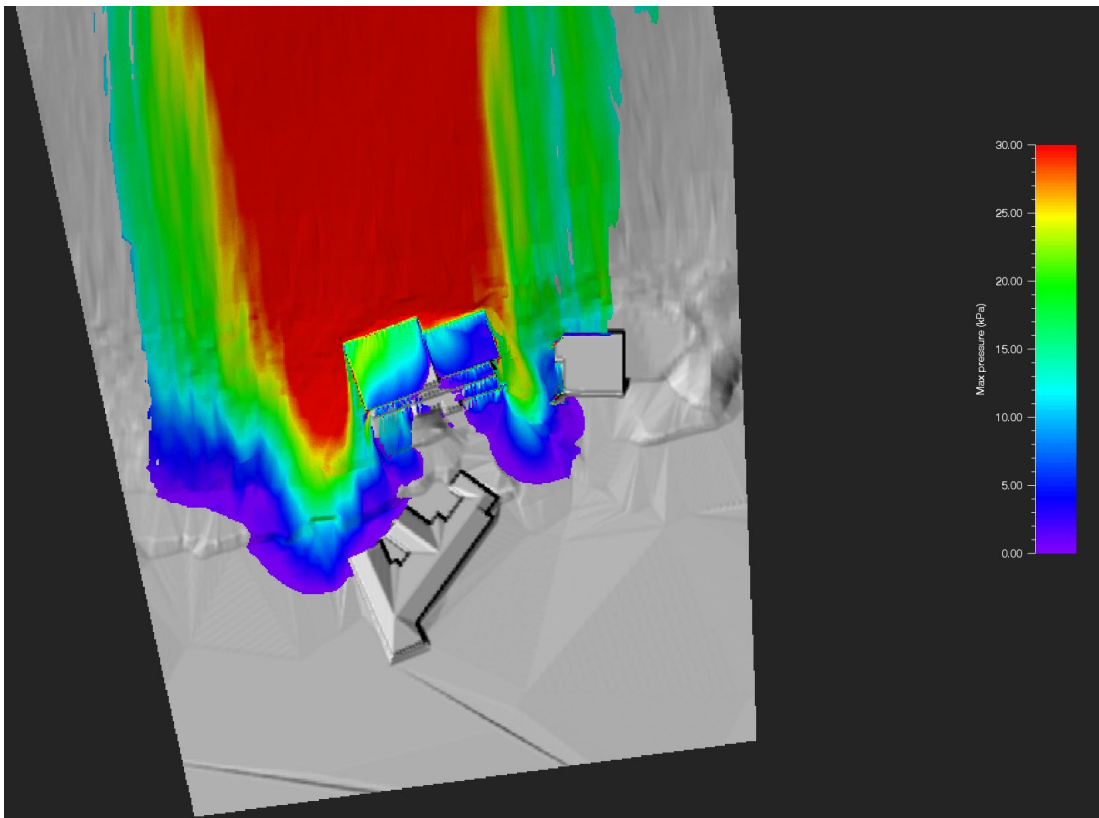


Figure 8 – Path_R5_S300 – Maximum Pressure, Red-Zone, Max. Pressure Set To 30 kpa, Situation 3

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Figure 9 – Vicinity Map Showing the Mears 1978 Red & Blue Avalanche Hazard Areas