Warren Anderson
(b) (5)

Mel Bolling, c/o Jay Pence
Teton Basin District Ranger
P.O. Box 777
Driggs, ID83401

COMMENTS ON THE GAND TARGHEE MASTER PLAN PROJECTS

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1.Water and Sewer
A. Geology

The resort is mostly on the Madison Limestone with the Darby Formation bellow that. The USGS Wyoming geology page describes the Madison Group as: Mission Canyon Limestone (blue-gray massive limestone and dolomite), underlain by Lodgepole Limestone (gray cherty limestone and dolomite).[1] The Geologic Map of the Rendezvous Peak Quad describes the Darby Formation as Upper part: nonresistant yellowish-brown, thin bedded dolomitic siltstone, commonly poorly exposed. Lower part: interbedded brownish-gray to dark-brown fine- to medium-grained dolomite and dark-gray to dark-brownish-gray dense very fine grained limestone; top is a ridge-forming dolomite about 60 feet thick. Total thickness is about 400-450 feet.[2] The Geologic map of the Granite Basin Quad describes it as: Brown fetid dolomite interbedded with yellow, gray, pink, and black shale and thin sandstone. Thickness about 350 feet.[3]

The rocks at Grand Targhee Resort are mostly carbonates. Carbonate rocks are soluble and when exposed to water, the water infiltrates cracks in the rocks and dissolves them, creating caves and open fissures. When this process progresses enough, the surface terrain is altered to the point where it becomes a karst terrain. A karst terrain is a terrain where the dominant geomorphological process affecting the surface topography is the solution of soluble bedrock, or alternately as a terrain characterized by caves and sinkholes and rapid groundwater movement through karst aquifers.

The Madison formation was not immediately covered by the Amsden formation.

For many years it was above sea level, exposed to rain and it developed a karst terrain much like the present day Yucatan Peninsula. When the Amsden formation was deposited above it the many caves and sinkholes in the Madison were loosely refilled with weak brecciated limestone. This created pre-existing conduits for rapidly-moving ground water. These features are called paloekarst. A description of paleokarst in the Madison Formation can be found in Sando, 1988[4] and a description of a re-excavated paleokarst in the Gros Ventre range can be found in:
Keefer, 1963[5].

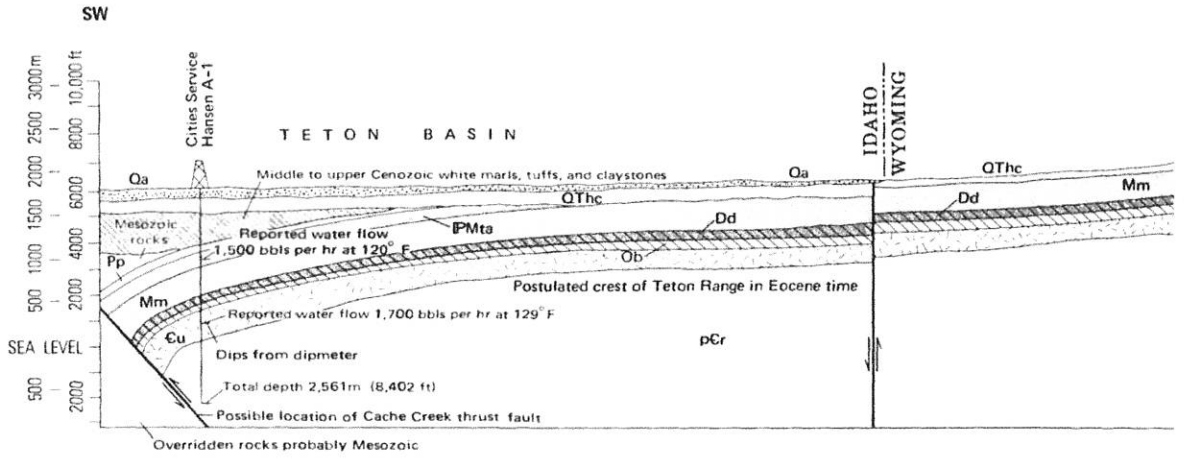
The geology at Grand Targhee is a problem for the proposed expansion of the ski area. The Madison limestone is particularly permeable. Meteoric water falling on the Madison descents vertically to shale at the top of the Darby Formation and then runs down-dip to the west where it resurges at the Madison/Darby contact. The impermeable shale at the top of the Darby formation prevents the permeable limestone member in the middle of the Darby Formation (source of well water at Targhee) from being recharged from above and importantly, the Darby Formation only extends for a short distance up-dip to the east before it outcrops in cliffs, so it has a very limited recharge area.

restaurants will be dry holes because the carbonate rocks that could be sources of water end in cliffs a short distance up-dip to the east of these locations and have no recharge zones. The scoping document also says that 57 acres of snow making would be built using new ground water wells. This means that at least four new wells would be drilled at the site.

The Forest acknowledged this problem in the last appendix of the final draft of the earlier EIS which states that adequate water resources for the planned expansion of the resort probably aren't available at the site and that additional water resources would have to be located. Nevertheless the current master plan includes a large number of housing units and hotel rooms for which it is unlikely that there is any water. Because water resources at the site are insufficient the Forest must:

1. Conduct a rigorous study of the water resources at the site including pump testing the existing wells during a dry season such as late fall to determine how much water is really available and do a realistic assessment of the demand for water at the resort when all of the improvements are completed.

2. Include the need to develop a source of water in the valley and pump the water to the resort as an alternative in the master plan. This was an alternative in the earlier EIS. It would probably be necessary to drill a major water well in the west side of the valley where the bed rock is deep as shown in this geological cross section from Love, Leopold, and Love [6]:



C. Sewage Disposal

Any effluent disposed of on the Mountain will not slowly percolate through the ground and be purified as it would be in a non-karst hydrological system. It will move very rapidly through the permeable Madison Limestone, first vertically to the top of the Darby Formation and then down-dip to the west until it encounters the contact between the two formations where it outcrops at the surface. An example of where sewage could be expected to resurge would be the spring in Sawmill Creek. No better example of this exists that the original sewage disposal system at the resort. Sewage was discharged into the east end of a sewage lagoon in the Madison Limestone. It was expected to break down in the pond and flow out at the west end. It never did because all of the effluent sank into the Madison limestone. It resurged as raw sewage at a spring northwest of the resort. The Wyoming DEQ and Teton County will probably require

effluent to be piped to the sewage treatment plant (which will have to upgraded) that was needed because of the problems of disposing effluent on a karst aquifer.

2. New Lifts

The justification for the new lifts states: "improve the recreational experience and address shortcomings in [our] terrain offerings and operations". At least two of these will have the opposite effect. These are the North Boundary and Crazy Horse lifts. The resort shouldn't build these because they would serve terrain that already has lift service. This would over-crowd these runs and provide the public with bad recreational experience.

3.Mountain Sheep

The public has told the Forest and the Wyoming Game and Fish that they very strongly support efforts to keep the Teton Range sheep from going extinct. The number one recommendation of the working group is to re-establish migration routes to lower elevation where wintering habit exists. One choice could be Teton Canyon. This choice will be eliminated after it's developed as a ski resort. Also the terrain at Mary's Nipple is potential sheep habitat.

4. Parking

At times the parking lots at the resort are full. The buildings in the master plan will increase the need for and reduce the amount of parking at the resort. If the resort expands as much as it wants, the need for more parking will increase greatly. The Scoping document must address the need for parking with a realistic study. If skiers have to take public transportation to the resort it will have to build a parking lot in Driggs like the Stilson lot in Wilson that the Jackson Hole Mountain Resort uses.

RERERENCES

1. https://mrdata.usgs.gov/geology/state/sgmc-unit.php?unit=WYMD%3B0

2. Geologic map of the Rendezvous Peak Quad, USGS GQ-980
https://ngmdb.usgs.gov/Prodesc/proddesc_2279.htm

3. Geologic map of the Granite Basin Quadrangle
Reed Jr., J.C., and Love, J.D.
Wyoming Geologic survey- map LMS-5 (2001)
http://sales.wsgs.wyo.gov/geologic-map-of-the-granite-basin-quadrangle-teton-county-wyoming-2001/

4. Sando, W.J., 1988, Madison Limestone (Mississippian) paleokarst: a geologic synthesis in James, N.P. and Choquette, P.W., eds., Paleokarst: New York, Springer-Verlag, p. 211–228.

5. Keefer, W. R., 1963, Karst topography in the Gros Ventre Mountains, Northwestern Wyoming: U. S. Geological Survey Professional Paper 475-B, pp. 129-130.

6. Eocene Rocks, Fossils, and Geologic History, Teton Range, Northwestern Wyoming
J. D. Love, Estrella B. Leopold, and D. W. Love
GEOLOGICAL SURVEY PROFESSIONAL PAPER 932 - B, 1978
https://pubs.usgs.gov/pp/0932b/report.pdf

NOTES

The standard reference on karst hydrology is:

Jennings J. N. Karst Hydrology
Publisher : B. Blackwell; Revised Edition (January 1, 1985)
ISBN-10 : 063114031X
ISBN-13 : 978-0631140313

An overview of the karst features of The Teton Range is:

SOLUTIONAL LANDFORMS ON CARBONATES OF THE SOUTHERN TETON RANGE, WYOMING
Douglas M. Medville
I I 762 Indian Ridge Road, Reston, Virginia 22090
John C. Hempel
EnvironmentalExploration, P. 0. Box 200, Barrackville, West Virginia 26559
Charles Plantz
2242 East Water Street, Tucson, Arizona 85719
Eberhard Werner
Department of Geology and Geography, West Virginia University, Morgantown, West Virginia 26506
NSS Bulletin 41: 70-79 (1979).
available online at: https://caves.org/pub/journal/NSS%20Bulletin/Vol%2041%20num%203.pdf

The layman's guide to the geology of the Teton Range is:
Creation of the Teton Landscape
Love, Reed, Pierce, 2016
Publisher : Grand Teton Association; 2nd Revised & Enlarged Edition
Paperback : 135 pages
ISBN-10 : 093189557X
ISBN-13 : 978-0931895579

some prefer the earlier edition:
Creation of the Teton Landscape: The Geologic Study of Grand Teton National Park
Love, Reed, 1971
Grand Teton Natural History Association
ASIN : B000HCY57A