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Comments: 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 below 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 creates pre-existing conduits for rapidly-moving ground water. These features are called paleokarst. A description of paleokarst in the Madison Formation can be found in Sando, 19884 and a description of a re-excavated paleokarst in the Gros Ventre range can be found in: Keefer, 19635.

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 descends 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.

See attachment 1

See attachment 2

Geologic and cross section of Fred's Mountain after J. D. Love, Estrella B. Leopold, and D. W. Love, 1978 6. This is the Hominy Peak Tuff.

B. Water resources

In the winter of 1991 Targhee ran out of water. First the resort pumped water over the surface from the two auxiliary wells to the primary well but this soon failed. Starting in January they trucked water to the resort. That Spring the resort replaced all of its water-using fixtures with low-consumption devices and built the 35,000 gallon storage tank below the Dream Catcher lift to act as a buffer for high water use periods in the day and lower demand at night when the tank could be refilled. What does this tell you about the availability of water resources at the site?

In the EIS for transferring the resort to private ownership the Forest accepted a back-of-the-envelope calculation by Jorgensen Engineering's consultant, Scott D. Meford, that stated that based on the water table in the wells there would be plenty of water for resort expansion but no actual tests of the capacity of the wells were done. When you build your house in Teton Valley your well driller conducts a pumping test to see how many gallons per minute your well can produce. This was not done as part of the EIS for the Grand Targhee privatization.

One would expect that since the top of the Darby formation is impermeable that the wells would have no water. The reason that they do is that the valley south of Fred's mountain has been eroded down until the unusual, highly permeable brecciated limestone bed that is the source of the well water at Grand Targhee is exposed. It's recharged during the spring when snow melt soaks into it. This allows the resort to produce a limited amount of water at the resort but the rapid movement of water in the diffuse karst flow of this limited aquifer with a small recharge area probably allows it to be depleted when it isn't being recharged. Wells drilled at the locations of the proposed 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:

See attachment 3

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 than 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 be 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

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https://ngmdb.usgs.gov/Prodesc/proddesc_2279.htm
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NOTES

The standard reference on karst hydrology is:

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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

11762 Indian Ridge Road, Reston, Virginia 22090

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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