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November 19, 2022

To: Protect Our Water Jackson Hole, Wilson, WY

From: Brian Remlinger, *Professional Wetland Scientist*, Alder Environmental LLC

Re: **WY State Land (Teton Village) Site 9 - Aquatic Resources and Water Quality Impact Assessment**

Alder Environmental LLC has been retained by Protect Our Water Jackson Hole to assess the aquatic resources within the vicinity of Site 9 of the Teton Village State Land Parcel and to evaluate potential impacts to surface and groundwater quality from current Teton Village Resort (Resort) development on Site 9. This assessment and opinion are based off a review of historical aerial imagery, best available hydrologic feature data, a site visit on November 16, 2022, previous site visits to the parcel, and 23 years of professional experience and knowledge of wetlands and water resources in the area.

LOCATION

Site 9 of the "Teton Village" State Land Parcel is in the NE¼ SE¼ of Section 36, Township 42 North, Range 117 West of the 6th P.M., Teton County, Wyoming (Figure 1). The Teton Village Parcel is located centrally within the Fish Creek Watershed, a tributary of the Snake River. The watershed is underlain by the vast Snake River alluvial aquifer containing course gravels and significant groundwater reservoirs. There is a slight downward tilt in the valley to the west towards Wilson and Fish Creek where surface and groundwaters flow to.

Fish Creek and its tributaries, including wetlands, irrigation ditches, and return flows are designated as Class 1 Surface Waters by the State of Wyoming. Class 1 Surface Waters are defined by Wyoming's Chapter 1 Surface Water Quality Standards as:

> *(a)Class 1, Outstanding Waters. Class 1 waters are those surface waters in which no further water quality degradation by point source discharges other than from dams will be allowed. Non-point sources of pollution shall be controlled through implementation of appropriate best management practices. Pursuant to Section 7 of these regulations, the water quality and physical and biological integrity which existed on the water at the time of designation will be maintained and protected. In designating Class 1 waters, the Environmental Quality Council (council) shall consider water quality, aesthetic, scenic, recreational, ecological, agricultural, botanical, zoological, municipal, industrial, historical, geological, cultural, archaeological, fish and wildlife, the presence of significant quantities of developable water and other values of present and future benefit to the people.*

In addition, dredge and fill activities within Class 1 Surface Waters trigger specific Clean Water Act Sections 401 and 404 notifications to the State and US Army Corps of Engineers.

HYDROLOGIC CONDITIONS

The Fish Creek watershed gains surface water flows from Teton Mountain Range snowmelt runoff to the west and north, irrigation diversions from the Snake River to the east, and many springs seeping from the ground (Figure 1). Interactions between surface and groundwater are well documented in studies conducted by the US Geological Survey and others (Eddy-Miller 2009). Valley snowmelt and rainfall runoff contribute to surface flows

and groundwater recharge at the Teton Village State Parcel. Groundwater flows within the gravel based alluvial aquifer at the Parcel respond quickly to seasonal conditions and surface water inputs or recharge. The seasonal rise in groundwater can result in the water table rising at or above the surface in certain locations.

The area within the vicinity of Site 9 Teton Village State Parcel contains surface waters that flow from northeast to southwest. These include irrigation supply ditches, remnant spring and river flood channels, and irrigation laterals (Figure 2). The ponds at the Site were historically excavated in course gravels and the water surface in the ponds fluctuate with the groundwater water table. The outlets of these ponds eventually surface flow into the Grosh and Palmer Ditches that return flows to Lake Creek, a tributary of Fish Creek. These ponds also recharge or interact with the groundwater in the vicinity. The groundwater within the vicinity of Site 9 has significant hydrologic connectivity with surface water and stormwater and snowmelt runoff due to being seasonally near the ground surface, having high infiltration rates, and as a result of high transmissivity or the porous nature of the gravel based alluvial aquifer.

AQUATIC RESOURCES

Aquatic resources include wetlands and surface waters that are regulated by the federal Clean Water Act. The area in the vicinity of Site 9 was observed to contain ponds, flowing channels, emergent and scrub-shrub wetlands, and groundwater inundating the ground surface. Figure 2 depicts the wetlands and surface waters identified and mapped using knowledge of the area, historical infrared and true color aerial imagery, site observations, and existing topographic contour data. Connectivity of these wetlands and surface water is continuous throughout the Study Area from Site 9 to the Grosh and Palmer ditches.

The US Army Corps of Engineers and WY Department of Environmental Quality (DEQ) determine federal and state jurisdiction over aquatic resources. Depending on their jurisdictional determination, any dredge or fill activities and other non-point source pollution resulting from construction and operation of Site 9 may require notification and/or permits from federal and state regulatory agencies.

WATER QUALITY

The surface and groundwater in the upper Snake River watershed in Jackson Hole is generally of excellent quality, however, has been affected by anthropogenic disturbances and uses in the Fish Creek watershed (Eddy-Miller 2013). Twenty-one different wastewater chemicals were detected in the Fish Creek and groundwater during the US Geological Survey studies from 2007-11 (Eddy-Miller 2013).

In the summer of 2021, Kelsey Ruehling, a University of Wyoming graduate student, collected and analyzed microbes in water, fecal, and wastewater samples to identify and quantify sources of fecal pollution in Fish Creek. Ms. Ruehling's research indicates that increasing land development in the Fish Creek watershed has a negative effect on microbial diversity and that human wastewater is the dominant fecal source contributor to the creek (Ruehling 2022). The high number of residential wastewater treatment leachfields in the Fish Creek watershed (~1,000) are assumed to be the primary contributor to this wastewater fecal contamination load.

A recent 2-year study of raised mound wastewater treatment leachfields and septic systems in the Fish Creek watershed indicates that nitrate contamination of groundwater due to these systems is highest during winter months when the effectiveness of these systems is limited by cold conditions (Nelson and Alder 2022). There was an increase in nitrate concentrations observed in the groundwater downgradient of the leachfields, most notably in the winter months. The study makes recommendations to improve winter treatment of wastewater in leachfields and septic systems through heat retention designs.

POTENTIAL & OBSERVED DEVELOPMENT IMPACTS

The proposed development plans at Site 9 (Teton Village Resort Construction Plans, 11/9/22) depicts a leachfield and mound near and likely within potential wetlands and surface waters. The existing contours on the plan set, a review of aerial imagery, and site observations indicate the mound from the leachfield extends into the wetland/pond complex. The leachfield infiltrators are less than 50 feet from estimated wetlands and possibly surface waters.

The potential fill in wetlands and surface waters resulting from development at Site 9 appears relatively minor and would likely comply with a federal Clean Water Act Section 401 and 404 Nationwide Permit Conditions, however the fact that the fill is associated with a leachfield system might negate that compliance. The US Army Corps of Engineers and WY DEQ are the regulatory authorities that would make determinations on this development fill and situation.

Negative water quality impacts to groundwater as a result of the wastewater from the proposed Site 9 Resort facilities would likely be highest during the winter unless the wastewater treatment system was designed to be insulated for heat retention, as recommended in the 2022 Nelson and Alder report. Regardless, there will likely be some level of wastewater pollutant contribution to groundwater from the Resort as indicated by the 2022 study. The level of wastewater pollution leaching into the groundwater at Site 9 will likely be low concentration, however, water quality impacts will be chronic and long term and will ultimately be determined by occupancy rates and flow rates to the system.

REFERENCES

Eddy-Miller, C.A., Wheeler, J.D., and Essaid, H.I., 2009, Characterization of interactions between surface water and near-stream groundwater along Fish Creek, Teton County, Wyoming, by using heat as a tracer: U.S. Geological Survey Scientific Investigations Report 2009–5160, 53 p.

Eddy-Miller, C.A., Peterson, D.A., Wheeler, J.D., Edmiston, C.S., Taylor, M.L., and Leemon, D.J., 2013, Characterization of water quality and biological communities, Fish Creek, Teton County, Wyoming, 2007–2011: U.S. Geological Survey Scientific Investigations Report 2013–5117, 76 p.

Nelson Engineering and Alder Environmental LLC. 2022. Teton County Septic System Effluent Monitoring Report. Jackson, WY. August 2022.

Ruehling, K. 2022. Microbial Source Tracking Presentation. May 26, 2022. Jackson, WY, https://www.youtube.com/watch?v=Yco-OoO8zMM&t=1535s

Enc. Figure 1 – Watershed and Location
Figure 2 – Aquatic Resources Connectivity in Vicinity of Site 9
Photo Log (Corresponds to Photo Points on Figure 2)

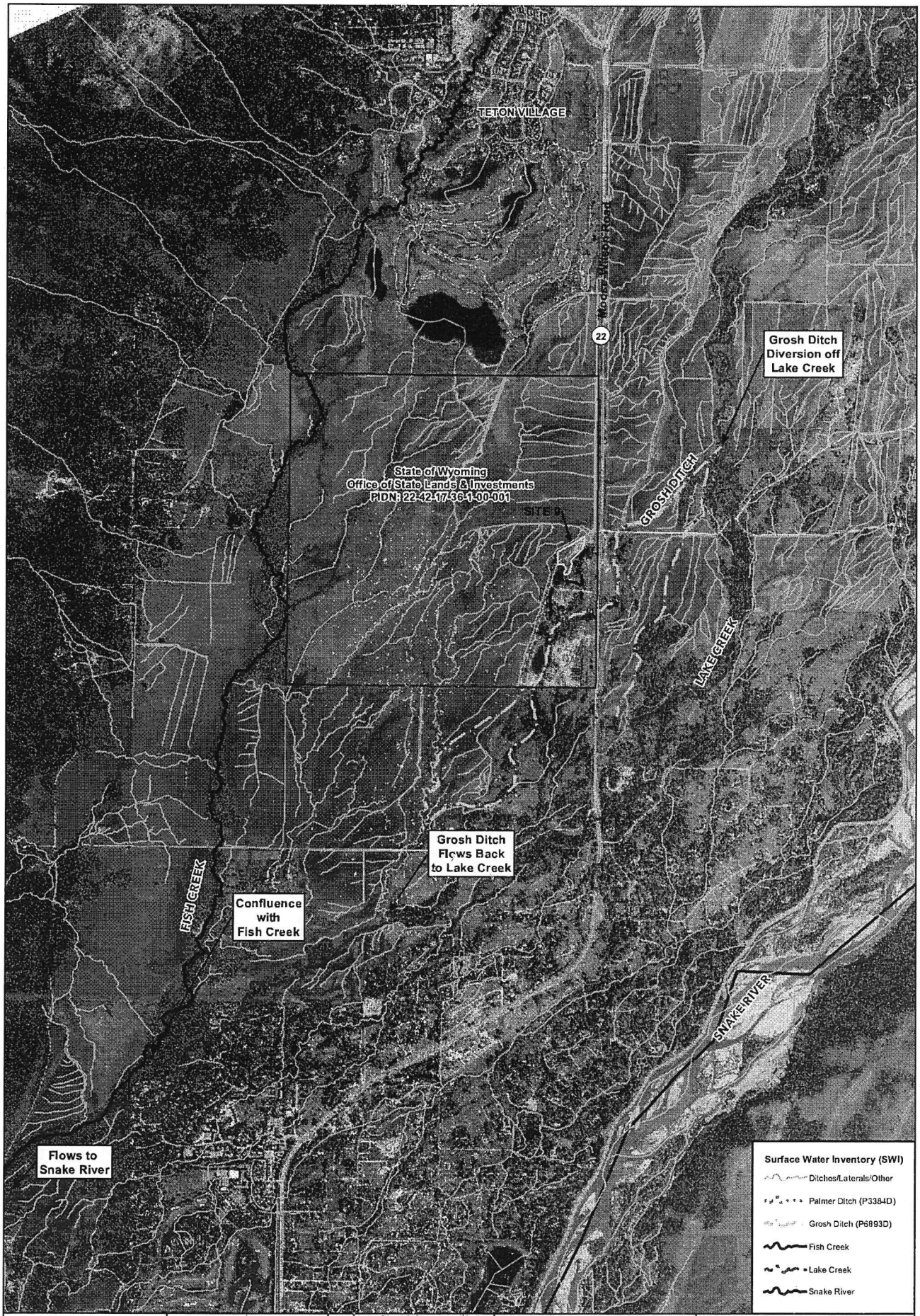

FIGURE 1

Watershed & Location

November 19, 2022

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Site 9 State Land Parcel

Teton County, WY

Legend

- State Land Parcel
- Site 9 (approx.)
- Flowline (approx.)

Sources

Teton County
- Ownership Boundaries
- Aerial Imagery, 2019

Teton Conservation District (TCD)
- Surface Water Inventory (SWI)

WY State Engineer's Office
- Water Rights

Alder Environmental LLC
- Aquatic Resources (approximate)

1 inch = 1,500 feet

0 500 1,000 1,500 Feet

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Attachment H

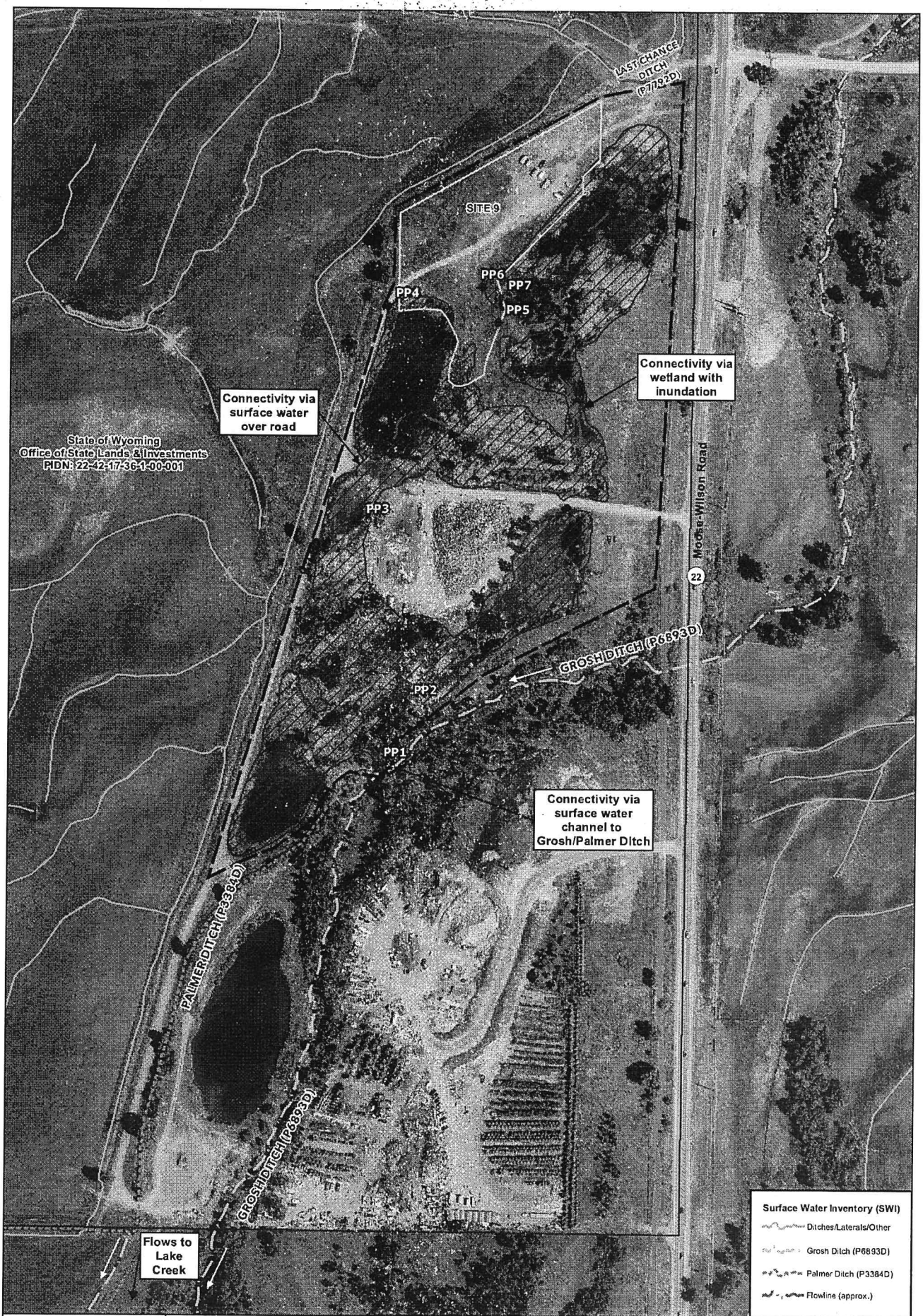

FIGURE 2

Aquatic Resources Connectivity in Vicinity of Site 9

November 19, 2022

Protect Our Waters Jackson Hole

Site 9 State Land Parcel

Teton County, WY

Legend

- State Land Parcel
- Study Area
- Site 9 (approx.)
- Wetland/Surface Water Complex (approx.)
- Flowline (approx.)
- Photo Point (11/15/22)

Sources

- Teton County
  - Ownership Boundaries
  - Aerial Imagery, 2019
- Teton Conservation District (TCD)
  - Surface Water Inventory (SWI)
- WY State Engineer's Office
  - Water Rights
- Alder Environmental LLC
  - Aquatic Resources (approximate)

1 inch = 200 feet

0 50 100 150 200 Feet

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Attachment H

Photo 1 – Photo Point 1. View south of Grosh Ditch/Palmer Ditch Diversion and the channel connecting from the Site 9 vicinity ponds (November 16, 2022).

Photo 2 – Photo Point 1. View northwest of surface water channel and wetland connectivity to Grosh/Palmer Ditch (November 16, 2022).

Photo 3 – Photo Point 2. View northwest of wetland and surface water complex that connects to Grosh/Palmer Ditch to Site 9 Vicinity (November 16, 2022).

Photo 4 – Photo Point 3. View northwest of surface water and wetland complex, with surface water connectivity over road to Site 9 Ponds (November 16, 2022).

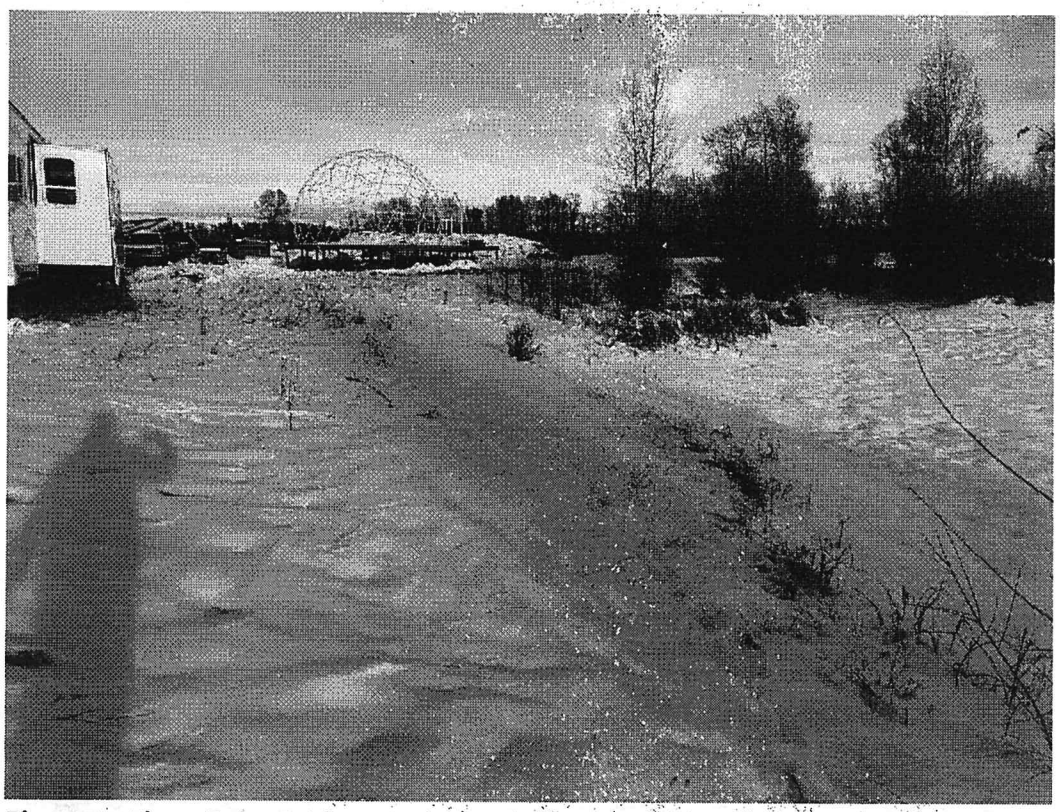

Photo 5 – Photo Point 4. View northeast along surface water/wetland complex at Site 9 development (November 16, 2022).

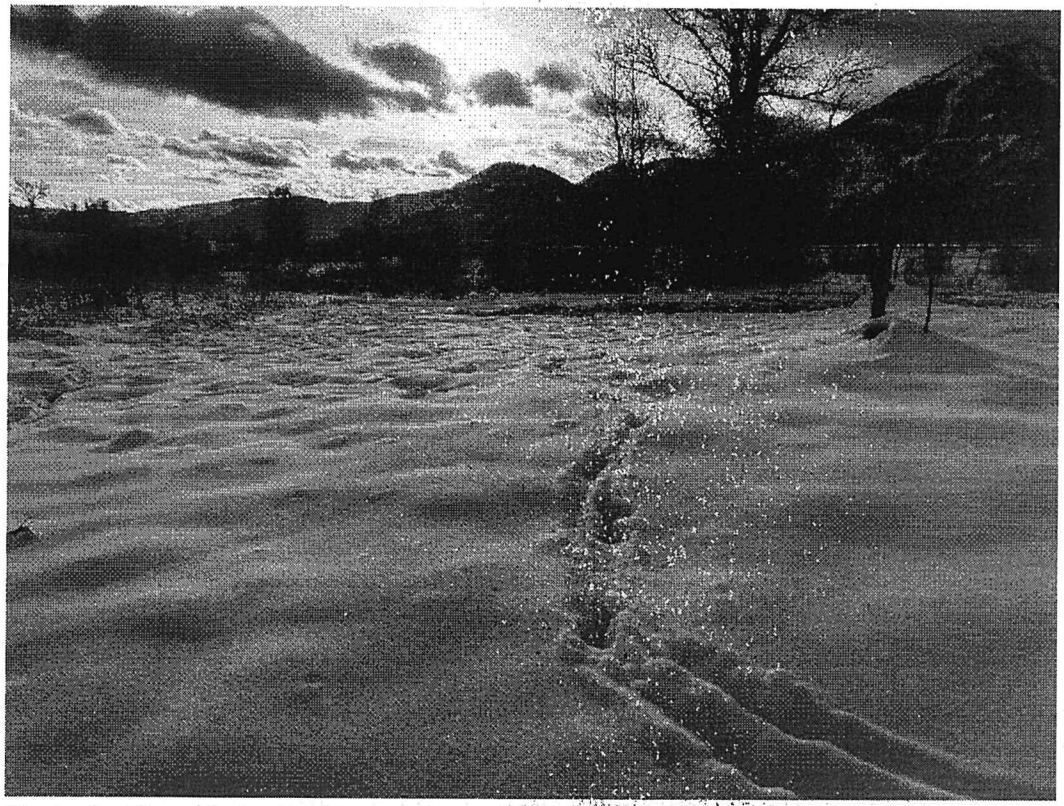

Photo 6 – Photo Point 5. View southwest of location of future Geodome facilities, sewer line pipe risers on right (November 16, 2022).

Photo 7 – Photo Point 6. View northeast of leachfield mound fill adjacent to and likely into surface water/wetland complex (November 16, 2022).

Photo 8 – Photo Point 7. View north of surface water/wetland complex adjacent to Site 9 (November 16, 2022).