December 13, 2021~~May 8, 2013~~

Mr. Robert Jennings
Santanka Heights, LLC
1712 Carey Avenue, Suite 100
Cheyenne, WY 82001

RE: LARAMIE, WY SITE SPECIFIC INVESTIGATION
Santanka Heights Development
LEGAL LOCATION: A tract of land located in the NE¼ of the NE¼ of Section 2 T15N R73W of the 6th P.M.

Dear Robert:

This Site Specific Investigation Report (SSI) was prepared for Mr. Robert Jennings (Owner). The report encompasses 14.43 acres of vacant land (GEO PIN 05-1573-02-1-00-028.00) located in the NE¼ of the NE ¼ of Section 2 T15N R73W that is being evaluated for future development located within the Casper Aquifer Protection Zone (CAPZ) 82070 (subject property).

Subject Property:

1. A literature search to determine the presence of mapped faults, folds, fractures and other evidence of conduit flow on the subject property.

A literature search of readily available geologic and hydrogeologic reports to determine the presence of mapped faults, folds, fractures, and other evidence of conduit flow on the subject property was conducted by InterTech Environmental & Engineering, LLC (InterTech). The documents reviewed include:

- City of Laramie/Albany County Environmental Advisory Committee (EAC), 2002. Casper Aquifer Protection Program.
- Huntoon, P.W., and Lundy, D.A. (Huntoon & Lundy), 1979. Fracture-controlled ground-water circulation and well siting in the vicinity of Laramie, Wyoming. Ground Water, v.17, pp.463-469.
- Lundy, Don A., 1978. Hydrology and geochemistry of the Casper aquifer in the vicinity of Laramie, Albany County, Wyoming. University of Wyoming Master of Science Thesis, 76pp.
- TriHydro Corporation (THC), 2010. SSI Report Gem City Bone & Joint Expansion, Gem City Properties, Laramie, Wyoming SSI and SSI Review 17pp.
- Ver Ploeg, A.J., 2009. Revised Geologic map of the Laramie Quadrangle, Albany County, Wyoming: Wyoming State Geological Survey Map Series MS 50, scale 1:24,000 (color).
- Western Water Consultants, Inc. (WWC), 1993. Wellhead Protection Area Delineation for Turner Well Field, Pope Well Field Soldier Spring, and Simpson Springs. Consultant's report prepared for the City of Laramie, 60pp.

- Western Water Consultants, Inc. (WWC), 1994. Turner Tract Assessment, Laramie, Wyoming. Consultant's report prepared for the City of Laramie, 43pp.
- Western Water Consultants, Inc. (WWC), 1997. Hydrogeologic Investigation of the LaPrele Park Prospect. Consultant's report prepared for the City of Laramie, 52pp.
- Wyoming Groundwater, LLC (WGLLC) 2010. Technical Review of: SSI Report Gem City Bone and Joint Expansion, Gem City Properties, Laramie, Wyoming. May 24, 2010, by Trihydro Corporation, 9pp.

The results of the literature search and discussions with Alan Ver Ploeg and Karl Taboga at the Wyoming State Geological Survey (WSGS) identified that vulnerable features are present on the subject property including exposed aquifer bedrock, faults and fracture zones. These results are further discussed in Section 5.

2. A site narrative that includes historical information on previous land use, contaminant releases, abandoned wells, underground storage tanks, and septic systems as well as any other information relevant to the site.

Figure 1 shows the Public Land Survey System location and aerial image of the current land use of the subject property. A review of historic aerial photos of the subject property dated June 30, 1957 and August 24, 1966 revealed that the site was quarried prior to the 1957.

A search of the Albany County Assessor's records revealed no record of any structures being assessed on the subject property. A site inspection revealed two (2) abandoned quarry sites (Figure 1) and remnants of boom foundations and steel cables commonly utilized in historic quarry operations are still present at various locations on the subject property.

On-line databases from the Wyoming Department of Environmental Quality/Solid and Hazardous Waste Division (WDEQ/SHWD) website, were accessed on March 15, 2013. A review of the data indicated there were no reported contaminant releases or spills on the subject property and that no current or historic underground storage tanks are or have been on the subject property. The Wyoming State Engineers Office (SEO) records indicate no abandoned wells on the subject property. Visual evidence of underground storage tanks, or septic systems was not apparent in the aerial photography review or observed during a site inspection of the subject property

3. A site plan showing the proposed use and zoning of the property including existing and proposed ground contours accurate to a two-foot interval as referenced to the USGS contour map for the area or other specified elevation standard as required by the City, and for a distance of at least 500 feet beyond any proposed development activity, existing and proposed structures, parking areas, driveways, landscaping areas, setbacks, surface and subsurface drainage facilities, potential contaminant storage locations, and methods of storage, above ground storage tanks, best management practices, utilities, roads, storm water management, and a vicinity map. Where necessary, specific construction details shall be provided to assure adequacy to accepted design standards.
Figure 1 shows the vicinity surrounding the subject property and includes projections of the two (2) foot contour interval data north of the subject property from the City of

Laramie's 2011 aerial survey data. Figure 2 shows an aerial photo-based location map of the subject property and surrounding area with an outline of the area where the conceptual development would be located (proposed development area).

The Owner's proposed use for the subject property is either as a hotel/restaurant (conceptual development). This development type typically requires approximately five (5) acres of contiguous surface to accommodate structures and associated parking. A conceptual site plan is not included at this time because the Owner requires a variance offsets from vulnerable feature offsets required by enrolled Ordinance No. 1527 in the Laramie Municipal Code in order to proceed with site design.

The conceptual development site will be designed to conform to the design standards of the City of Laramie. The water and sewer infrastructure for the conceptual development will be connected to City of Laramie sanitary sewer and water facilities so no septic systems or water supply wells will be located on the subject property. All maintenance service for the conceptual development will be provided by off-site contractors; therefore, no storage facilities for potential contaminants are anticipated at any location on the subject property.

Commented [rfg1]: Rob & Dave: I recommend enlarging the development area to include some of the fractured Casper Formation bedrock to the north of the current proposed development area. This would be in line with what you would need for a hotel/restaurant plan. The foundation of a building structure could be poured over benched sections of the Casper limestone and that would fill any fractures and mitigate that are being a vulnerable feature.

4. Identification of potential contaminants and amounts stored, generated or handled on the subject property.

The planned land use for the subject property is either as a hotel/restaurant in the proposed development area shown on Figure 2. No potential contaminants are anticipated to be utilized within the development, with the exception of typical substances, such as small quantities of pesticides applied within buildings for insect control, biodegradable cleaning materials to maintain sanitary conditions, cooking oil, etc. Infrastructure maintenance involving potential contaminants such as paint, sealers etc. would be conducted with spill prevention protection in place and such materials will not be stored onsite.

5. A field inspection shall be conducted to verify the presence or absence of vulnerable features as defined in Section 7.82.070.A. A summary of the field inspection shall include a written report, maps identifying vulnerable features, and the distance and direction of the nearest well and vulnerable feature. Where subsurface water disposal is proposed, the investigator shall conduct deep pit soil analysis to a depth at least five feet below the proposed bottom of the leaching system to establish that there are no obstructions such as bedrock, water table or other forms of refusal that could interfere with the proper functioning of the wastewater disposal system.

A site-specific geologic and hydrogeologic investigation of the subject property was conducted by InterTech. A site Inspection was completed on March 16, 2013 by a licensed Professional Geologist (PG) to gather information and verify reported data for this and other sections of the report. Figure 2 shows that the subject property is located within the City of Laramie in Albany County, Wyoming and within the Aquifer Protection Overlay (APO) Zone established by City of Laramie Ordinance number 1527, Section 8, 17.82.080: Site-specific Investigations for All Proposed Developments. As stated in the ordinance, a site-specific investigation is required to be conducted by a licensed

Professional Engineer (PE) or PG. to identify the impacts, if any, that the proposed development may have on the Casper Aquifer.

The subject property is located on the western flank of the north-south trending Laramie Range. Sedimentary beds uniformly dip from three (3) to eight (8) degrees to the west except where the presence of local faults and folds, such as those that exist in certain areas on the subject property, locally deform the west dipping monoclinal flank of the Laramie Range. An aerial photograph review and an on-site inspection of the subject property by an InterTech geologist confirmed surface evidence of faulting or fracturing within the boundaries of the subject property as shown on Figure 3 and mapped by Ver Ploeg, 2009 and Lundy, 1978.

The following site specific conditions document the presence of geologic vulnerable features on the subject property. Mapped geologic structures on the subject property are shown in Figure 3 and include:

1. Exposed east-west trending Quarry fault.
2. Inferred east-west trending fault trace south of the Quarry fault.
3. North-northeast trending faults between the faults identified above in 1 and 2.
4. Fractured bedrock exposed between faults identified above in 1 and 2.

A fault exposed at the ground surface is considered to be a vulnerable feature because it could act as a conduit to the underlying Casper aquifer. The southern portion of the Quarry fault, while not discernible at the surface on the subject property, is an inferred fault trace on the Ver Ploeg (2009) map. The fault, should it be present in the subsurface, would be overlain by relatively low permeability mixed alluvium and colluvium material discussed below.

The proposed development area shown on Figure 3 overlies the inferred fault. Lundy (1978) mapped approximately 60 feet of vertical offset for this inferred fault's offset where it is exposed at the surface approximately 400 feet to the east of the east boundary of the subject property. This eastern fault offset combined with the observation that the projection of this fault trace fault is observed as a shear zone with virtually no offset in the west wall of quarried area 2 (Figure 3), approximately 50 feet west of the west boundary of the subject property, indicates the Satanka Shale could be no greater than 25 to 30 feet thick in the southern portion of the proposed development area.

Geologic mapping by Ver Ploeg (2009) shown on Figure 3 indicates the subject property contains outcrops of the Satanka and Casper Formations as well as mixed alluvium and colluvium (Qac). The Qac deposits unconformably overlie the Permian Satanka Shale geologic formation, and quite possibly, the Casper Formation with in the subject property area. The Satanka Shale is comprised of interbedded red siltstone and shale, soft sandstone, thin limestone beds and local gypsum beds (Ver Ploeg, 2009) and is a regional confining layer that unconformably overlies the Casper Aquifer (Lundy, 1978; Huntoon & Lundy, 1979; WWC 1993, 1994; WEI, 1995). The Fractured Casper formation limestone is exposed at the ground surface in portions of the the northern 1/3rd of the area. This fractured bedrock is a potentially vulnerable feature if there are open fractures present to act as permeable pathways through which surface water recharges the Casper aquifer. Portions of the Casper formation outcrops on the subject property are noted as faulted and fractured (Figure 3).

The Laramie/Albany County EAC determined that 75 feet of Satanka Shale is sufficient to confine the underlying Casper Aquifer (EAC, 2002). Based on the geology above and the well records discussed below the thickness of the Satanka Shale is estimated to range from approximately 25 feet to 35 feet respectively at the western and eastern subject property boundaries.

The nearest well of record located south of the subject property is the now abandoned Bone and Joint #1, SEO Permit W39294P shown on Figure 3. The SEO records show this well was drilled to a depth of 130 feet in 1977 and had a static water level of 60 feet below ground surface (bgs). The SEO records also showed drilling fluid circulation was lost from 36 feet to 140 feet which indicates that cavities or fractures were encountered, which are often present in structurally deformed portions of the Casper Formation limestone and brittle sandstone beds in this region. The thickness of the Satanka Shale in this well was estimated to be 62 feet (WGLLC, 2010).

The nearest well of record located to the west of the subject property is the Turner #2 (aka 41T2) City of Laramie municipal supply well, SEO Permit WP157CP shown on Figure 3. SEO records show the well was drilled in 1941, a depth of 557 feet, and a static water level of 29.5 feet bgs. In a personal communication with Karl Taboga, WSGS, 2013, regarding the 41T2 well, he relayed that: the Satanka Shale has an overlying thickness of approximately 25 feet; and, pump tests involving this well have shown it is interconnected to fractured permeability in the Casper Aquifer.

No subsurface water disposal is proposed on the surface property.

6. A map showing the area and types of exposed bedrock, marshes, perennial drainages, intermittent drainages, ephemeral drainages, creeks, and other bodies of water on the subject property.

Figure 3 provides the locations of the features required in Section 6. Exposed bedrock within the subject property proposed development area consists of the Casper and Satanka Shale formations and Qac.

An ephemeral drainage traverses the subject property from east to west, and conveys runoff during large precipitation events. There were no marshes, creeks, perennial or intermittent drainages, or other bodies of water present on the subject property.

The ephemeral drainage that passes through the proposed development area is considered a vulnerable feature. To mitigate this features vulnerability in the proposed development area of the subject property, the Owner plans to: design the site pad to preclude hydraulic contact with ephemeral drainage; and, install an adequately-sized culvert infrastructure beneath the road to both bridge and handle potential storm flow in the ephemeral drainage. A grading plan will be designed to route undeveloped surface drainage water around the proposed development area of subject property. Storm water runoff from the proposed developed area ground surfaces will be confined in retention/detention basins, where waste effluent will be removed via a hydrodynamic separator and the remaining runoff will be discharged to the ephemeral drainage. The retained waste effluent will be removed from the site and disposed of appropriately.

7. Where the 100-year floodplain mapping is unavailable, the professional geologist and/or engineer will calculate the 100-year flood plain for the drainage. The flood plain mapping will be provided on the site map with a scale not to exceed 1 inch equals 200 feet.

Figure 4 shows the subject property is not located in a FEMA-delineated flood plain but it is located within the FIRM Flood Insurance Rate Map Community No/Panel/suffix 560002/1770/E, revised June 16, 2011.

8. An evaluation of the water supply and sewage system that includes the potential risks of systems to the Casper Aquifer and its recharge area and the adequacy and safety of the systems. Items such as floor drains and plumbing schematics and the locations of potential contaminants, waste storage, and liquid transfer locations shall be provided.

The water supply and sewage system for the subject property development will be connected to existing City of Laramie services located in the right-of-way on the subject property that parallels the north side of I-80 Business-US 30 transportation corridor. The water supply and sewage system in the proposed development area will be designed and installed in compliance with the City of Laramie Standard Details, the Wyoming Public Works Standard Specifications (WPWSS), and the Wyoming Department of Environmental Quality/Water Quality Division (WDEQ/WQD) Rules and Regulations to preclude any risk to the Casper Aquifer from the water and sewer system. The foundations of building structures will be constructed to seal off and prevent direct contact of plumbing and internal drainage systems from contact with bedrock.

No potential contaminants are anticipated to be stored on the subject property, with the exception of typical substances, biodegradable cleaning materials to maintain sanitary conditions, etc. Potential contaminants such as pesticides, paint, sealers etc. used for infrastructure maintenance would be not be stored on site and proper spill prevention protection will be in place when these materials were being used. The storage and handling of waste effluent separated from ground surface runoff from the proposed development area is discussed in Section 6.

9. A map(s) depicting the potentiometric surface of the Casper Aquifer at the subject property using data from historical water level measurements and published potentiometric surface maps. No new wells shall be drilled for the purpose of determining the potentiometric surface.

Figure 2 shows the potentiometric surface of the Casper aquifer in the vicinity of the subject property. The map is adapted from mapping performed by Trihydro, 2010. The direction of groundwater travel in the Casper Aquifer beneath the site is approximately east to west with a slight northerly component.

10. A surface water risk assessment and mitigation plan for any impacts caused by storm water runoff, retention, and/or detention basins on the City water supply and the Casper Aquifer.

The topographic surface shown in Figure 1 shows that if surface runoff from the proposed developed area were to enter the ephemeral drainage within the subject

property, it would travel downgradient toward the 41T2 City water supply well (Figure 3). It is possible that infiltration from the ephemeral drainage stream bed could act as recharge to the Casper Aquifer in the reach between the 41T2 and the proposed development area of the subject property. See Sections 6 & 8 above for further discussion of surface water runoff risk mitigation utilizing infrastructure design.

A storm water mitigation plan based on a storm water management system, which may include runoff drainage infrastructure, a hydrodynamic separator and retention/detention basins, will be fully developed after a preliminary plat review is completed by the City of Laramie planning and engineering departments. The mitigation plan will contain the as-built storm water management system design, and monitoring criteria necessary to ensure all fluids entering the system are contained until waste effluent is separated from the runoff. Non-waste runoff from the system will be discharged to the ephemeral drainage and any waste effluent will be removed from the subject property and disposed of properly.

See Sections 6 & 8 above for further discussion of risk mitigation utilizing infrastructure design.

11. A maintenance plan and agreement for any retention and/or detention basins and associated improvements will be required. Such plan and agreements shall be recorded in the Albany County Clerk's Office.

The proposed development area of the subject property shown in Figure 2 will be the location area for discussion purposes to produce a preliminary plat for review by the City of Laramie planning and engineering departments. Upon approval of the preliminary plat and the subsequent approval of the final plat, construction will begin on retention and detention ponds as deemed appropriate by the project's engineering consultants and the City of Laramie Engineering Department. After the construction of the storm water management system, a maintenance plan and agreement will be developed in cooperation with the City of Laramie Engineering Department and filed in the Albany County Clerk's Office.

12. A groundwater risk assessment and mitigation plan to respond to any evidence of contamination or vulnerability which is the result of the development. Such plan shall not limit the liability of any Person for impacts to the Casper Aquifer.

The potentiometric surface discussed in Section 9 indicates that if contamination entered the Casper Aquifer within the subject property, it would likely travel to vicinity of the downgradient 41T2 City water supply well (Figure 3).

Based on the groundwater risk assessment above and in information in Section 5, InterTech recognizes that there are several geologic vulnerable features present on the subject property. However, the potential risk for impacting Casper Aquifer would be minimized for activities normally associated with the planned use at the subject property by: proper design, installation, and maintenance of infrastructure, combined with a site specific Spill Prevention, Control and Countermeasure (SPCC) plan to prevent any potential contaminant introduction or mitigate a contaminant spill on or adjacent to the proposed development area of the subject property.

The SPCC plan would incorporate a process to be advised of and respond to any identified contamination in the 41T2 well. The response to such notice would be:

- Review of the monitoring logs and inspection to ensure proper function of the:
  - building infrastructure sanitary drainage system, and
  - the storm water management system.
- Review of all building and grounds maintenance records to determine if any of those activities could have been a source for the identified contaminant.

Should an upset condition in any of the above be identified, the control and countermeasure conditions of the plan would be engaged to mitigate the contamination source. It is understood that a mitigation plan would not limit the liability of "any person" for impacts to the Casper Aquifer.

13. Demonstration of compliance with all applicable City Standards.

The subject property will comply with all City of Laramie Standards and meet the intent of the Casper Aquifer Protection Plan and the Casper Aquifer Overlay Zone Ordinance. All engineering measures or construction requirements will conform to Standards of the WDEQ/WQD and WPWSS Standards already in place. Construction permit applications will be prepared and submitted to the City of Laramie for review of compliance with all standards prior to construction.

REFERENCES CITED

City of Laramie/Albany County Environmental Advisory Committee (EAC), 2002. Casper Aquifer Protection Program.

City of Laramie Municipal Code, Ordinance Number 1527, Section 8, 17.82.080-Site Specific Investigation for all Proposed Developments.

Huntoon, P.W., and Lundy D.A., 1979. Fracture-controlled ground-water circulation and well siting in the vicinity of Laramie, WY. Ground Water, v.17, pp.463-469.

Lundy, Don A., 1978. Hydrology and geochemistry of the Casper aquifer in the vicinity of Laramie, Albany County, Wyoming. University of Wyoming Master of Science Thesis, 76pp.

TriHydro Corporation (THC), 2010. SSI Report Gem City Bone & Joint Expansion, Gem City Properties, Laramie, Wyoming SSI and SSI Review, 17pp.

Ver Ploeg, A.J., 2009. Revised Geologic map of the Laramie Quadrangle, Albany County, Wyoming: Wyoming State Geological Survey Map Series MS 50, scale 1:24,000 (color).

Western Water Consultants, Inc. (WWC), 1993. Wellhead Protection Area Delineation for Turner Well Field, Pope Well Field Soldier Spring, and Simpson Springs. Consultant's report prepared for the City of Laramie, 60pp.

Western Water Consultants, Inc. (WWC), 1994. Turner Tract Assessment, Laramie, Wyoming. Consultant's report prepared for the City of Laramie, 43pp.

Weston Engineering, Inc. (WEI), 1995. Revised Report on Results of Honken Veterinary Clinic Well Drilling Program. Consultant's report prepared for Coffey and Associates, L.L.C., 6pp.

Wyoming Groundwater, LLC (WGLLC) 2010. Technical Review of: SSI Report Gem City Bone and Joint Expansion, Gem City Properties, Laramie, Wyoming. May 24, 2010, by Trihydro Corporation, 9pp.

If you have any questions, or need additional information, please feel free to call me at 307-755-3510 or via email at rgarland@cbmainc.com. Thank you.

Sincerely,

Rob Garland, PG

RG:sb
Enclosures
Cc: File