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City of Laramie  
City Manager's Office  
P.O. Box C  
Laramie, Wyoming 82073

Attn.: Mr. Darren Parkin  
Water Resources Manager

Re: Site Specific Investigation  
Turner Tract Block 2 Lot 4  
Technical Review

Dear Mr. Parkin:

This letter serves to present the findings of our technical review of the site specific investigation prepared by Trihydro Corporation (Trihydro) for the City of Laramie for the City owned Turner Tract Block 2 Lot 4 parcel of land located within the Casper Aquifer Protection Area. Our review comments will be presented to address the adequacy of this site specific investigation in fulfilling the requirements of the City of Laramie's Unified Development Code, subsection 15.08.040.A.8.

***15.08.040.A.8(d)(i) A literature search to determine the presence of mapped faults, folds, fractures, and other evidence of conduit flow on the subject property.***

Trihydro's literature search to address the presence of mapped faults, folds, fractures, and other evidence of conduit flow on the site of the subject property satisfies the requirements of this section. Trihydro identified two mapped vulnerable features; the Sherman Hills fault and an unnamed ephemeral drainage which is located approximately 150 feet south and parallel to the southern border of the property. Both of these features are outside of the required vulnerable feature setback distance of 100 feet (City of Laramie Unified Development Code, subsection 15.08.040.A.7(b)). The mapped location of the Sherman Hills fault is located over 400 feet south of the southern lot boundary of Turner Tract Block 2 Lot 4.

As mentioned, the literature search performed by Trihydro appears to be adequate to identify the mapped features in the project location; however, it is recommended that previous SSI reports in the study area be reviewed both for thoroughness and consistency. A review of previous SSI reports will benefit the City of Laramie in developing their overall understanding of the hydrogeologic conditions within the Casper Aquifer Protection Overlay Zone. If inconsistencies are found with other data reported in previous SSI reports, these inconsistencies should be identified with a justification for the discrepancy. Previous SSI reports that have been submitted to the City of Laramie that are within the general area of this SSI report include the following:

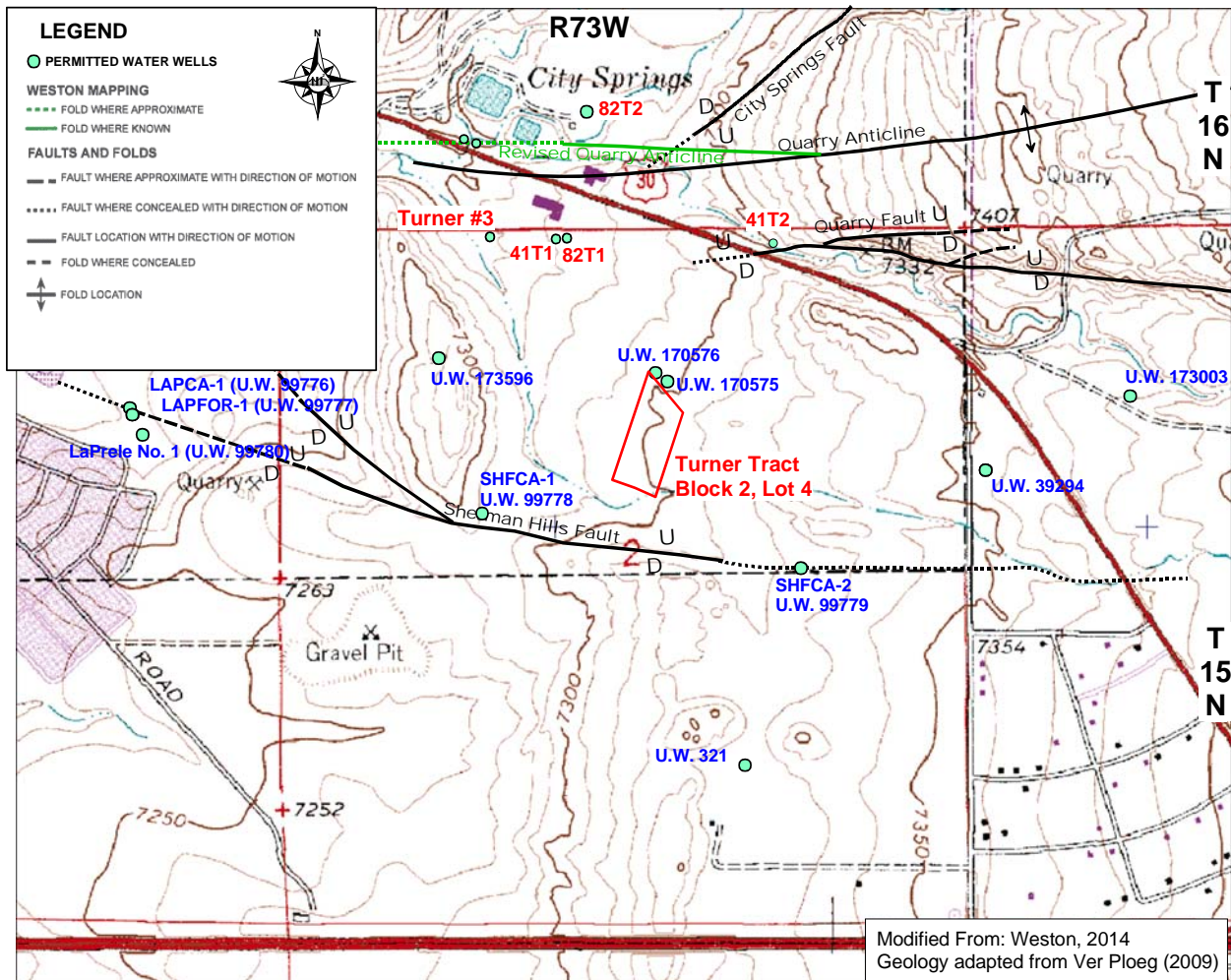
- Final Site-Specific Investigation Report, Laramie Ford Expansion, Revision No. 3, Prepared by Trihydro Corporation for Grothouse Construction, November 12, 2012.
- Technical Review of: SSI Report Laramie Ford Expansion, Grothouse Construction, Laramie, Wyoming. Revised June 7, 2011 by Trihydro Corporation. Technical review prepared and submitted by Wyoming Groundwater, LLC, June 10, 2011.

- Technical Review of: SSI Report Laramie Ford Expansion, Groathouse Construction, Laramie, Wyoming. Revised June 7, 2011 by Trihydro Corporation. Technical review prepared and submitted by Wyoming Groundwater, LLC, November 23, 2012.
- Addendum to Site-Specific Investigation for White's University Motors for Commercial Building Services Inc. Prepared by Trihydro Corporation, May 2, 2014.
- Technical Review of: Addendum to Site-Specific Investigation for White's University Motors for Commercial Building Services Inc. May 2, 2014, by Trihydro Corporation. Technical review prepared and submitted by Wyoming Groundwater, LLC, June 10, 2014.
- Site-Specific Geologic and Hydrogeologic Investigation Report Wyoming State Bank Addition. Prepared by Weston Engineering for Snowy Range Investments, LLC, March 2012.
- Technical Review of the Site-Specific Geologic and Hydrogeologic Investigation Report Wyoming State Bank Building Addition Provided by Weston Engineering to the City of Laramie. Technical review prepared and submitted by InterTech Environmental & Engineering, LLC, March 22, 2012.
- Site-Specific Investigation Report for City of Laramie, City Springs Chlorination Application Site Improvements. Prepared by WWC Engineering for the City of Laramie, June 10, 2010.
- Technical Review of: SSI Report for City Springs Chlorination Application Site Improvements. June 10, 2010, by WWC Engineering. Technical review prepared and submitted by Wyoming Groundwater, LLC, July 1, 2010.
- Site-Specific Geologic and Hydrogeologic Investigation Report, American National Bank Exterior Improvements Project. Prepared by Weston Engineering for Realty Management Group, September 15, 2014.

Some, or all of these documents may have been reviewed by Trihydro as part of their efforts in preparing the SSI report (several of these documents were generated by Trihydro), but it is unknown if they were reviewed since they were not listed in this section of the SSI report or in the reference section. If other documents were reviewed, they should be noted as such so that the City of Laramie and the SSI technical reviewer can judge the full depth of review that has taken place in the preparation of the SSI document.

One item that was researched and discussed in later sections of Trihydro's SSI, but not listed in this section of their report, were the State Engineer's Office completion records for the wells in the subject property area. A review of the statement of completion records for the wells in the area indicated that none of the wells in the near vicinity of the Turner Tract Block 2, Lot 4 property were identified as encountering fractures. Five wells in the general vicinity of the subject property referenced either encountering fractures or losing circulation of the drilling fluid during the drilling phase. These wells are the two Wyoming State Highway Department wells (Spring Creek Well Nos. 1 and 2) located approximately ½ mile north of the Turner Tract parcel,

the Bone and Joint #1 Well (U.W. 39294) located approximately ½ mile east of the subject property, the LaPrele No. 1 Well (U.W. 99780) and the LAPFOR-1 Well (U.W. 99777), both located approximately ¾ of a mile west of the Turner Tract parcel. The driller of the Spring Creek wells documented encountering “fractured zones” at depths below approximately 20 feet. The driller of the Bone and Joint well indicated that circulation was lost during drilling from 36 feet below ground level to the well’s total depth at 140 feet and the driller’s log for the LAPFOR-1 and LaPrele No. 1 Wells indicated that fractures were encountered in the Forelle Limestone. The driller’s report for the SHFCA-1 well did not reference any fracturing in this well even though it is very close to Sherman Hills Fault. Although fracturing has been documented in the general area, the lack of fractures in the SHFCA-1 Well and the two Laramie County Community College wells (U.W. 170575 and 170576) indicates that fracturing may not be present at the Turner Tract Block 2 Lot 4 location. The locations of the area wells are shown in the figure below.



**15.08.040.A.8(d)(ii) 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.**

Our review of the WDEQ Solid and Hazardous Waste Division's website and EPA's Enviromapper databases verifies Trihydro's findings that there have been no recorded contaminant releases and we concur that there is no evidence of any contaminant releases on the project site.

Our review of the Wyoming State Engineer's Office (SEO) E-Permit website indicates that there have been no wells permitted with the SEO in Section 2 of Township 15 North, Range 73 West since Trihydro prepared the SSI. Therefore, based on the data presented in the SSI report and as discussed in the site investigation narrative, Trihydro has confirmed that there are no wells on the project site.

With the data presented, and from their narrative with respect to their contaminant release and well research, Trihydro has met the requirements of this section.

**15.08.040.A.8(d)(iii) 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 five hundred 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, stormwater management, and a vicinity map. Where necessary, specific construction details shall be provided to assure adequacy to accepted design standards.**

The SSI prepared by Trihydro does not address this section. A preliminary site plan was not presented by Trihydro as they state "A preliminary site plan for development is not presented as there are no plans to develop this property at this time." The SSI report did present a surface geology map that has the Laramie USGS 7.5 Minute topographic map as a background (Figure 1). However, the scale of this map did not accurately reflect the topography (scale of map was too large to show adequate number of contours and the contour labeling). The SSI report also incorporates an aerial photograph as a background (Figure 2) which shows the existing land use in the area. The figure on the preceding page of this review letter report shows the topographic conditions for the Turner Tract Block 2 Lot 4. The contour interval for this figure is 10 feet.

In general we agree with the concept presented in the SSI report that this section cannot be fully addressed at this time due to the status of the development plans for this parcel of land. When development is being considered for this property, this SSI should be amended and all of the requirements of this section addressed at that time.

**15.08.040.A.8(d)(iv) Identification of potential contaminants and amounts stored, generated or handled on the subject property.**

We agree with Trihydro's assessment of potential contaminants from the anticipated types of development that could take place on this property. Based on the setback distances to the vulnerable features identified in Section 15.08.040.A.8(d)(i), the thickness of the Satanka Shale

in the area (greater than 125 feet) and no indication of fractures in the immediate vicinity of the property, the potential impacts to the aquifer from the anticipated commercial development options appears to be minimal. However, as stated by Trihydro, we agree that this SSI amended and this section should be modified to address the specific type of chemicals (if any) that will be stored and/or handled on the property.

**15.08.040.A.8(d)(v) A field inspection shall be conducted to verify the presence or absence of vulnerable features as defined in subsection 15.08.040.A.7.a A summary of the field inspection shall include a written report, maps identifying the vulnerable features, and the distance and direction of the nearest well and vulnerable feature. Where subsurface wastewater 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.**

The requirements of this section were met by the Trihydro SSI. A field inspection was conducted on October 23, 2014 and the wells near the property were identified in the text and in Figure 1 of the report. This figure provides the requested distance and direction information of the wells. As discussed under the 15.08.040.A.8(d)(i) section, two vulnerable features, Sherman Hills fault and an unnamed ephemeral drainage, were identified near the Turner Tract Block 2 Lot 4 area. Distances from these two vulnerable features from the subject property exceed the 100 foot setback distance.

Since City of Laramie sewer facilities are accessible from this lot, onsite wastewater systems are not proposed for future development of the property. Therefore, a deep pit soil analysis for this SSI was not required and was not conducted.

**15.08.040.A.8(d)(vi) 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.**

The report maps and report narrative meet the requirements of this section. Labeling of the drainage on the figure is recommended. The shading of the outcropping formations appears to be washed out a little and the colors do not correlate well with the legend color blocks. It would be helpful to label the formations in the map as well as call them out in the legend. Some formation labels exist on the map but some appear to be mislabeled. For example, the Quaternary Terrace Deposit label (Qt) is positioned over the Quaternary Mixed Alluvium and Colluvium outcrop per the legend coloring.

**15.08.040.A.8(d)(vii) Where the 100-year flood plain 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 a site map with a scale not to exceed 1 inch equals 200 feet.**

Wester-Wetstein reviewed Federal Emergency Management Administration (FEMA) Flood Insurance Rate Map (FIRM) Panel NO 56001C1770E for Albany County, Wyoming with an effective date of June 16, 2011 available online at the FEMA Map Service Center website. A review of this map confirms the findings of Trihydro's SSI. It should be noted that the Federal Emergency Management Administration (FEMA) Flood Insurance Rate Map as quoted in the

SSI has been updated. The effective date of Panel NO 56001C1770E is June 16, 2011 and not October 16, 1996. The update of this panel, however, does not impact the findings in Trihydro's SSI report.

***15.08.040.A.8(d)(viii) An evaluation of the water supply and sewage system that includes the potential effects or risks of the 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 area locations shall be provided.***

As mentioned by Trihydro, water and wastewater services for future development of the property would be served by the City of Laramie sanitary and water utility systems and would be required to meet WDEQ standards and all other applicable building codes and therefore would pose a minimal risk to the Casper Aquifer. The recommendations presented in the SSI to construct double wall piping systems for the water and sewer services, is in our opinion, a little excessive for this lot. First, the water service would not need to be double walled since the water conveyed in this system is potable and presents no threat to the quality of the Casper Aquifer. Secondly, as presented in Trihydro's SSI, it is anticipated that the sewer service connection would be to a sanitary sewer pipeline in Boulder Drive. We feel double wall containment of the sewer service would not be necessary for the following reasons:

1. The majority of the lot facing Boulder Drive is located outside of the APO Zone.
2. The thickness of the Satanka Shale in the Block 2, Lot 4 area is 125 feet or greater.
3. The slope of the Satanka Shale is to the southwest away from the Casper APO Zone (See SSI Figure 1).
4. There is no evidence of fracturing in the Satanka Shale at this location that would provide a means of conduit flow into the Casper Aquifer.
5. Providing double wall piping with leak detection on a single sanitary service connection that may be made outside of the Casper APO Zone that flows into a sanitary sewer pipeline that is only a single walled system which flows across the Casper APO Zone will do very little if anything to protect the quality of the Casper Aquifer.

***15.08.040.A.8(d)(ix) 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.***

Trihydro's SSI satisfied this requirement. The potentiometric contours for the Casper Aquifer were superimposed upon the surface geologic map and were based upon data from the Laramie Water Management Study, Level II (2006). The potentiometric contours indicate that groundwater in the Casper Aquifer beneath the Turner Tract property is moving in a westerly to northwesterly direction. The statement in the SSI with respect to the depth to groundwater is a little misleading. Trihydro states "*Based on the thickness of Satanka Shale reported above, the depth to groundwater at the site is at least 150 feet.*" Groundwater was encountered in the LCCC wells (U.W. 170575 and 170576) and the SHFCA-1 well at depths of approximately 100

feet. It is our belief that the intent of Trihydro's statement was that depth to water in the Casper Aquifer would be at depths of approximately 150 feet. Also, based on the static water levels reported in the LCCC wells, the static water level in a Casper Well located on the subject property is estimated to be between 18 and 30 feet rather than the 40 feet mentioned by Trihydro.

***15.08.040.A.8(d)(x) 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.***

Wester-Wetstein agrees with Trihydro's evaluation of the potential risk to the Casper Aquifer from storm water runoff and their recommended approach to control and convey the collected stormwater.

***15.08.040.A.8(d)(xi) 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.***

Trihydro's response to this section was as follows: "Depending on the type and size of the development, a detention basin may or may not be required for stormwater management. The need for and maintenance of such facilities should be addressed during the development planning process." We are in agreement with the recommendation to further address any retention/detention facility during the development planning process; however, we feel that some guidelines can be put in place for this potential facility at this time. Based on a review of the APO Zone boundary, the natural slope of the surface topography and the strike and dip of the outcropping formations in the area, the recommended location for any proposed retention/detention facility would be in the southwest corner of the property. In this location the basin would be located outside of the APO Zone boundary. Additionally, the thickness of the Satanka Shale in this area would mitigate the potential for vertical seepage of the collected stormwater in the basin from infiltrating the Casper Aquifer and the dip of the formation will direct the seepage flow from the basin to the southwest away from the APO Zone.

***15.08.040.A.8(d)(xii) 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.***

Wester-Wetstein agrees with the conclusion provided by Trihydro that the risk of contamination to the Casper Aquifer from potential development of the Turner Tract Block 2 Lot 4 parcel is low based on the hydrogeologic conditions stated. However, as we stated in Section 15.08.040.A.8(d)(viii), we feel that the requirement that the water and sanitary sewer services be designed and constructed with a double-wall, leak detection system is unnecessary. As stated early, it is unnecessary to protect the aquifer from a potable water supply source. For convenience we have repeated our reasoning for not requiring a double-wall system on the sanitary sewer service below.

1. The majority of the lot facing Boulder Drive is located outside of the APO Zone.
2. The thickness of the Satanka Shale in the Block 2, Lot 4 area is 125 feet or greater.

3. The slope of the Satanka Shale is to the southwest away from the Casper APO Zone (See SSI Figure 1).
4. There is no evidence of fracturing in the Satanka Shale at this location that would provide a means of conduit flow into the Casper Aquifer.
5. Providing double wall piping with leak detection on a single sanitary service connection that may be made outside of the Casper APO Zone that flows into a sanitary sewer pipeline that is only a single walled system which flows across the Casper APO Zone will do very little if anything to protect the quality of the Casper Aquifer.

**15.08.040.A.8(d)(xiii) Demonstration of compliance with all applicable city standards.**

The SSI has adequately addressed and identified the requirements as mandated by this section of the City of Laramie's Unified Development Code.

If you have any questions, please do not hesitate to call.

Respectfully submitted,  
**Wester-Wetstein & Associates, Inc.**



John Wetstein

