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City of Laramie
City Manager's Office
P.O. Box C
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Attn.: Mr. Darren Parkin
Water Resources Manager

Re: Site Specific Investigation
Mountain West Estates Subdivision
Technical Review

Dear Mr. Parkin:

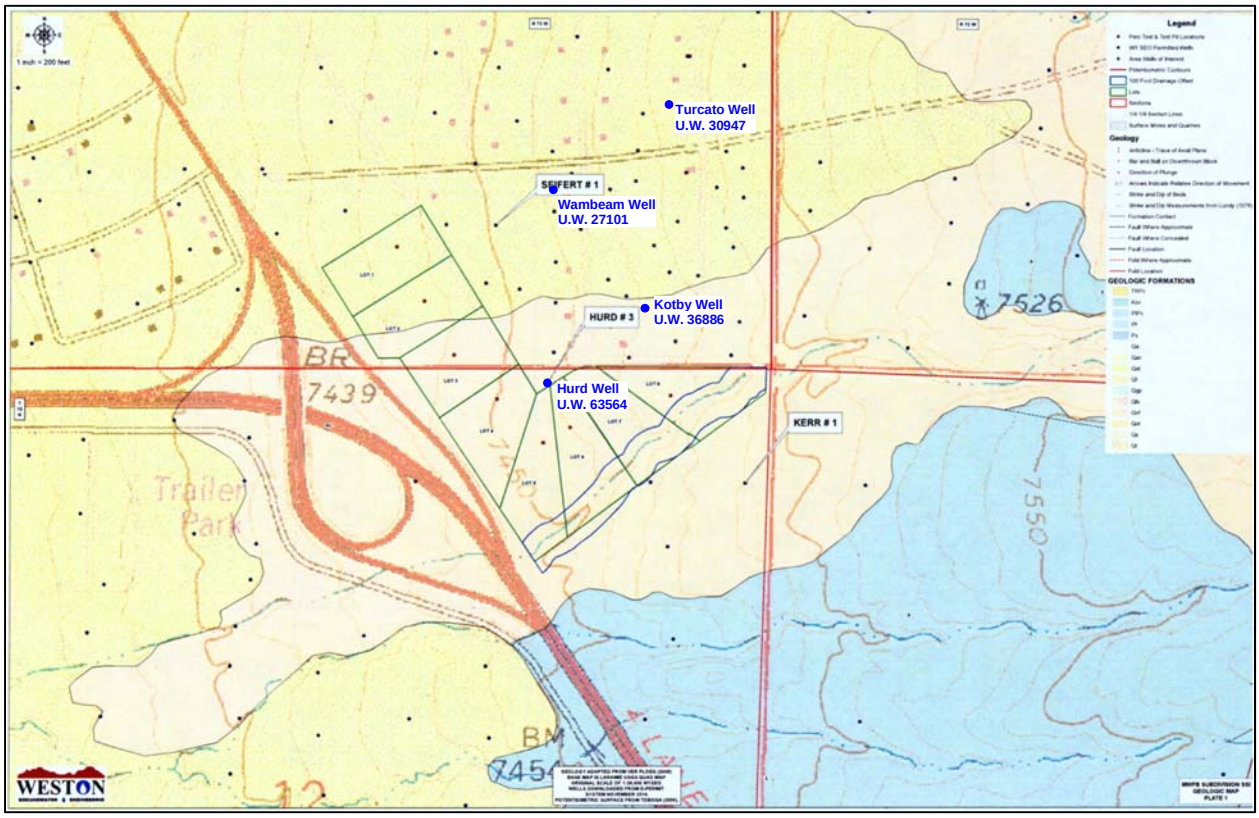
This letter serves to present the findings of our technical review of the site specific investigation prepared by Weston Engineering, Inc. (Weston) and presented to Albany County for the proposed Mountain West Estates Subdivision located within the Casper Aquifer Protection Area. Our review comments 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, subsection15.08.040.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.

Weston's literature search to address the presence of mapped faults, folds, fractures, and other evidence of conduit flow on the site of the proposed subdivision is adequate. Weston identified three mapped faults that are well outside of the required vulnerable feature setback distance of 100 feet (City of Laramie Unified Development Code, subsection15.08.040.A.7(b)). The closest of these is an unnamed fault located 1,320 feet east of the proposed development.

One vulnerable feature was identified within the setback distance of the development area. This is an ephemeral drainage located along the eastern boundary of the proposed subdivision. Mitigation of the potential impacts of this vulnerable feature to the Casper Aquifer has been addressed by identifying and incorporating a "build restriction" area 100 feet on each side of the drainage centerline. This building restriction zone, along with the ephemeral drainage's location along the eastern boundary, will limit the subdivision improvements to be constructed down gradient from this drainage. Access to the proposed development across this ephemeral drainage will take place along established roads and, therefore, the only increased risk of contamination to the Casper Aquifer via this ephemeral drainage will be the slight traffic increase imposed by the addition of these eight residential lots.

One item that was researched and discussed in later sections of Weston's SSI, but not listed in this section of their report, were the State Engineer's Office completion records for the wells in the proposed subdivision area. A very limited review of the statement of completion records for a few of the wells in the area that are close to the proposed development reveals that "broken limestone" or lost circulation conditions were encountered in some of these wells. The wells with the reported lost circulation and/or "broken" limestone zones are shown in the figure on the following page (blue dots and text) (modified from Weston's SSI Report).



The occurrence of lost circulation during drilling the Casper Formation is typically due to the presence of fractures or voids within the formation. The reference to lost circulation in the nearby wells, especially the Hurd #3 well, is evidence that conduit flow could be present in the area of the proposed development. The lost circulation was documented at depths of greater than 100 feet below the ground surface.

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.

A review of the WDEQ Solid and Hazardous Waste Division's website and EPA's Enviromapper databases shows that there have been minor changes to the list of data presented by Weston in Attachment B. These changes do not impact this project 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 Sections 1 and 12 of Township 15 North, Range 73 West and Sections 6 and 7 of Township 15 North, Range 72 West since Weston prepared the SSI. Therefore, based on the data presented in Attachment C to the SSI report and as discussed in the site investigation narrative, Weston has confirmed that there are no wells on the project site.

With the data presented, and from their narrative with respect to their well research and septic system investigation, Weston 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 Weston presents a surface geology map that has the Laramie USGS 7.5 Minute topographic map as a background. This provides the requisite information with respect to the ground contours, albeit at a 10 foot contour interval. This map does, however, show the area for the requested distance of greater than 500 feet away from the proposed subdivision boundaries. Additionally, a project site plan, prepared by Coffey Engineering and Surveying, was presented in Attachment A to Weston's SSI report. This site plan has surface contours accurate to the requisite two-foot interval; however, this site plan does not extend 500 feet beyond the proposed subdivision boundaries in all directions. The site plan incorporates an aerial photograph as a background which shows the land use in the area and a conceptual layout of the improvements for the proposed subdivision. This site plan, therefore, addresses the requirements for showing the structures, parking areas, driveways, landscaping areas, setbacks, surface drainage facilities and roads in the existing developed area and for the proposed development.

There was no discussion with respect to potential contaminant storage locations and methods of storage or the location of existing or proposed above ground storage tanks. The county requires that the site plan extend 150 feet away from the development area and that it identify all improvements. There were no utilities or other improvements identified in the project area with the exception of roads, driveways, homes, water wells and on-lot septic systems.

Although all of the requirements of this section have not been met, we feel that the material presented by Weston, and with the knowledge that the proposed subdivision is located in the County (limited utilities) that there is sufficient detail provided to satisfy the requirements of this section. Based on the material presented and general knowledge of the area, there is no evidence of any special conditions on this site that would require that specific construction details be provided.

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

Development of the proposed Mountain Wests Estates Subdivision will, or may, include the following prohibited activities as listed by Table 15.08.040.A – Prohibited Activities:

1. Application of pesticides and herbicides which do not become non-hazardous within 48 hours of application or which are not applied according to the manufacturer's instructions.

2. Application of fertilizer at greater than the agronomic uptake rate of the vegetation fertilized.

3. Installation and use of on-site wastewater treatment systems or septic-systems.

Of these three prohibited activities only the on-site wastewater facilities were addressed in the Weston SSI.

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.

As discussed under the 15.08.040.A.8(d)(i) section, only one vulnerable feature, the ephemeral drainage located on the east side of the proposed subdivision, was identified that falls within the 100 foot setback distance. The SSI prepared by Weston lists and shows the location of the wells on record with the SEO within a one mile radial distance of the proposed subdivision.

Onsite wastewater systems are proposed for the development. Therefore, the SSI prepared by Weston did address the potential impacts to the Casper Aquifer from these wastewater facilities. Two test pits were excavated in each lot (total of 16 test pits) to a depth of approximately 10 feet below ground level. Neither groundwater nor an impermeable bed of any nature was encountered in any of these test pits. Based on a description of the excavated soils (primarily medium to coarse grain sands and gravels) and the fast percolation rates, less than 3.5 minutes per inch, refusal of the wastewater will not be a concern. However, the fast percolation rates and the lack of biomat development typically associated with rapid percolating soils could hinder the proper functioning of the wastewater systems. The Chapter 23 Report required by WDEQ for new subdivision development was still being drafted at the time the SSI was presented by Weston Engineering. This Chapter 23 study should address the design requirements for the proposed onsite wastewater facilities with respect to the fast percolation rates.

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. The ephemeral drainage located on the east side of the proposed development is the only drainage and/or body of water located in the development area.

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 Adminstration (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 that the project area is classified as “Zone X Other Areas” which is

defined as “Areas determined to be outside the 0.2% (100 year flood) annual chance floodplain.”

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.

Both individual water supply wells and on-lot wastewater systems are proposed for this subdivision. Both of these types of facilities represent a potential threat to the Casper Aquifer. The Casper Aquifer subcrops beneath a layer of windblown sands and/or alluvial fan deposits comprised of clay, silt and gravel. The alluvial cover is reported to be from 0 to 25 feet thick. The target aquifer for the subdivision will, therefore, be the Casper Aquifer. Potential threats to the aquifer exist during the construction of the well (oil leak or spill during drilling) and a poorly constructed water well (inadequate surface seal) could provide a conduit for surface contamination to infiltrate the aquifer. The recent amendments to the SEO Minimum Well Construction Standards and the requirement that all wells be drilled and constructed by a well driller licensed in the State of Wyoming has greatly minimized the potential for contamination to an aquifer from the drilling and/or construction of a well.

The use of on-lot wastewater systems represents a potential risk to the Casper Aquifer. Weston in their SSI has indicated that these systems represent a low potential risk of contamination to the Casper Aquifer due to the depth to groundwater (greater than 70 feet) and their determination that the limestone unit (exposed at the bottom of the ephemeral drainage on the east side of the proposed subdivision) is an impermeable feature. Weston’s classification of the limestone as an impermeable layer was based on the ponding of surface snow melt witnessed during a site visit they conducted.

Classifying the on-lot wastewater systems as a “low potential risk” based solely on the mapped and field verified surface features in the area of the proposed subdivision appears valid. There are no mapped faults or other fracture inducing structural features present in, or near the subdivision. The only exposed bedrock in the subdivision area is the limestone that outcrops in the bottom of the ephemeral drainage. From Weston’s site visit, it was documented that there were no fractures seen and the ponding of the snowmelt water seemed to verify this. However, the documentation of lost circulation and/or “broken” limestone sections in several of the wells in the near vicinity of the proposed Mountain West Estates Subdivision (see figure page 2 of this letter) raises some concern that fractures could exist in the Casper Aquifer in the immediate area of the subdivision. If the limestone unit subcropping beneath the alluvial deposits is fractured, vertical travel times from the base of the leach fields to groundwater would be significantly decreased.

Studies have shown that both viruses and bacteria are effectively removed within the first 2 to 3 feet of soil beneath the leach field. With a mature biomat at the infiltrative surface of coarser soils, most bacteria are removed within the first 1 foot vertically or horizontally from the trench-soil interface (A list of references discussing the removal of viruses and bacteria by on-lot wastewater systems have been provided at the conclusion of this letter). Because of the coarse native material (fast percolation rates) and the indication that fracturing could be present within the Casper Aquifer in the area, the installation of on-lot wastewater systems could represent slightly more than a “low potential risk” to the Casper Aquifer. If infiltration rates are less than or equal to one minute per inch, a biomat will not properly form and inadequate treatment of the

wastewater will occur. Both Albany County and Wyoming Department of Environmental Quality require that a licensed professional engineer design the wastewater system in the event that percolation rates of less than one minute per inch are encountered in the desired leach field location(s). The use of a professional engineer to design the wastewater system in these vulnerable areas should greatly reduce the risk to 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.

Weston's SSI report narrative indicates that the depth to water is greater than 70 feet. It was indicated that potentiometric contours for the Casper Aquifer were superimposed upon the surface geologic map. A review of this map shows that the potentiometric lines were called out in the map legend but no potentiometric contour lines were visible on the copy of the SSI report presented to Wester-Wetstein for review. A review of a potentiometric map of the Casper Aquifer prepared by Wester-Wetstein for another project in the area of the Mountain West Estates Subdivision verifies the verbal description of the depth to groundwater as presented by Weston Engineering.

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 Weston Engineering's evaluation that the risk of impacts to the Casper Aquifer from storm water runoff is, in all likelihood, minimal based on: 1) the projected depth to groundwater of greater than 70 feet, 2) the lack of storm water runoff due to the minimal exposure of man-made impermeable surfaces, and 3) there are no proposed storm water impoundment facilities in the subdivision. Because all of the proposed development will be down gradient from the ephemeral drainage, storm water runoff generated within the proposed subdivision boundaries should flow away from this drainage.

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.

There are no retention or detention basins associated with this project. A maintenance plan and agreement are not needed.

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 feels that the proposed Mountain West Estates Subdivision presents a little more than a "low" risk to the Casper Aquifer. As mentioned in section 15.08.040.A.8(d)(iv), there is at least one and possibly three prohibited activities associated with the development of the Mountain West Estates Subdivision within the Casper Aquifer Protection Overlay Zone. Due to the depth of water, if the proper applications and types of pesticides, herbicides and fertilizer are used, these activities should present little additional risk to the aquifer. It would be our recommendation that potential lot owners be made aware of the sensitivity of the area with respect to the Casper Aquifer and that they be instructed to use only those pesticides and

herbicides which become non-hazardous within 48 hours of application and that application of fertilizer should not be greater than the agronomic uptake rate of the vegetation fertilized.

The use of on-lot wastewater systems, in our opinion, represents a slightly higher risk to the aquifer. The rapid percolation rates associated with the soils in the subdivision area present two critical risks to the aquifer. The first is the development of the biomat that is necessary to properly treat the wastewater and the second is the coarse nature of the soils in the area. If this biomat fails to properly develop, then the leachate will be able to migrate rapidly down through the soils and possibly intercept a fracture in the Casper Aquifer. As mentioned, the presence of the fractures in the Casper Aquifer beneath the subdivision has not been verified and is based only on the reported lost circulation during drilling of several of the wells in the area. The reported lost circulation occurred at depths greater than 100 feet below ground level and there is no indication that these fractures propagate to the shallower depths of the formation.

Studies have shown that with the proper development of a biomat film, very little soil depth is required for the removal of viruses and bacteria from the wastewater effluent. Even though the risk is low, because there is potential for the failure to develop a proper biomat (i.e. rapid percolating soils), the installation of the on-lot wastewater systems does present a risk to the aquifer. At a minimum, it is our recommendation that all of the systems be designed by a licensed engineer, including his/her overseeing the collection of the data from the percolation tests. These tests are the most critical component in the proper design of the wastewater system. A more conservative approach would be to require that an enhanced treatment system be utilized in the design of the wastewater systems for the Mountain West Estates Subdivision. One passive (non-mechanical) enhanced treatment system that is WDEQ approved is the Presby Environmental system. These systems are installed with layers that will quickly and effectively develop biomat layer and an aggressive venting system for the aerobic treatment required for successful treatment of the wastewater stream. It would be our recommendation that enhanced treatment wastewater systems be installed in the proposed subdivision.

15.08.040.A.8(d)(xiii) Demonstration of compliance with all applicable city standards.
The proposed development does not reside within the Laramie city limits, therefore, compliance with city standards is not applicable. The proposed wells will be required to be constructed to meet the minimum construction standards as imposed by the Wyoming State Engineer's Office and the proposed wastewater systems will need to be installed to meet the requirements of Albany County. As mentioned above, it would be our recommendation to require that, at a minimum, the wastewater systems design and installation be overseen by a licensed professional engineer due to the rapid percolation rates witnessed and the potential for fractures to be present beneath the subdivision area.

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

Respectfully submitted,
Wester-Wetstein & Associates, Inc.

John Wetstein

Wastewater Virus/Bacterial Treatment References

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