Preliminary North Ada County Ground Water Monitoring Plan (*for discussion purposes only*)

One task of the North Ada County Hydrogeologic Investigation is to develop a ground water monitoring network across the study area. The existing ground water level monitoring network covers only a limited area. Therefore, additional wells are being incorporated to observe water levels in multiple aquifers across the entire study area.

General Goals:

General goals of the monitoring network are as follows:

- Develop a long term ground water monitoring network to provide ground water level data in the North Ada County area for the next 20 years. This data can provide insight to resource managers with respect to general trends experienced in each aquifer system. In many cases, historic water level data illustrates trends, or changes in trends, that are key indicators in terms of available water for appropriation. The existence of a detail monitoring network will support future water resource allocation decisions.
- Provide a monitoring network to identify any potential ground water impacts as proposed development entities acquire water rights. The study area has multiple large scale developments under construction or being proposed. Detailed monitoring of water levels in the area will detect any potential impacts (i.e. water level declines) associated with the pumping centers for the proposed developments. This data will provide useful information to resource managers as future water right applications are sought within the study area.
- Monitor seasonal fluctuations in each of the aquifer systems. Quantifying recharge and discharge rates from the aquifer are major components of developing a water budget for the aquifer systems. Inspection of water level fluctuations that occur seasonally will provide some insight as to the amount of water each aquifer receives on an annual basis, while addressing the response to seasonal withdrawals.
- Determine any interactions that the various aquifer systems across the study area have on one another through the analysis of water level trends. Currently, the extent of each aquifer system is unknown. By comparing detailed water level records from well to well, time dependent trends in water levels will provide insight of each aquifer response (water level change) to recharge and discharge events. Similar or different trends observed in each aquifer system will help determine hydraulic communication between the various aquifers.
- Identify wells in which water quality samples will be collected to delineate separate aquifers based on general geochemical analysis and to provide estimates of recharge rates and timing. A monitoring plan associated with the water quality sampling will be presented at a later time.

Study Area Boundaries:

- Currently, the study area is divided into 3 sub-areas. The selection of the sub-areas was based on the geographic location with respect to the proposed developments (Figure 1). Aquifer systems may overlap from one sub-area to

another, as the lateral and vertical extents of each of the aquifer systems are currently unknown.

- Multiple aquifers exist in throughout the study area (i.e. shallow/deep, geothermal), and will each be monitored through this network.

Specific Questions:

- Eastern Area:
    - Do withdrawals from the deeper aquifer have impacts (induced recharge) on the shallow aquifer system? Existing wells in this area are withdrawing water from shallow, intermediate, and deep aquifer systems in the Dry Creek area. A majority of the domestic wells are completed in the shallow or intermediate flow system, and it is anticipated that the production wells associated with the proposed development will withdraw water from the deep aquifer in the area. Monitoring water levels in the shallow aquifer will allow the evaluation of whether the pumping in the deep aquifer will create any drawdown from the shallow aquifer system.
    - Do withdrawals from the deeper aquifer have impacts on the geothermal aquifer in the area (both pressure and temperature)? Geothermal wells exist throughout this portion of the study area. Monitoring water levels (or pressure) of these wells will provide information as to the relationship between the deep aquifer and the geothermal system in the area.
    - What interaction do the wells along the valley margins have with wells completed down in the deeper valley aquifer systems? A large number of domestic wells exist along the valley margins, above the valley floor. Most of these are low yielding wells completed in decomposed bedrock or isolated sedimentary units. Monitoring water levels in these wells will indicate any interaction or impacts associated with the pumping of the deep aquifer system on the valley margin wells.
    - What type of seasonal trends can be identified in the valley margin wells? Monitoring water levels in the valley margin wells will provide information regarding seasonal trends in these wells. Comparison of the seasonal trends from these wells to the trends observed in the deep valley aquifer system will allow the evaluation of the hydraulic communication between these two aquifer systems.
    - What influence do the surface water features (Dry Creek, Spring Valley Creek) have on the water levels in the shallow and deep aquifers? A comparison of water level trends in the ground water wells in the Dry Creek valley with hydrographs of Dry Creek will provide insight as to how much influence water from Dry Creek has on overall aquifer levels.
- Central Area:
    - What response does the shallow system have to withdrawals out of the deep and intermediate aquifers? A significant number of the existing wells in this area are completed into the shallow aquifer. Impacts to the shallow aquifer from pumping in the deeper aquifers are currently unknown. Monitoring water levels in shallow wells in this area as new

pumping centers are developed in the deeper system will indicate any potential connection between the shallow and deep systems.
    - What is the vertical hydraulic connection between the shallow, intermediate, and deep aquifers? The recent aquifer test conducted in Eagle highlighted the lack of certainty when determining the hydraulic communication between the various aquifers in this area. Analysis of water level trends in each of the aquifer zones will provide some insight to the hydraulic communication between one another.
    - What influence do the canal systems have on the aquifers in this area? Monitoring water level data throughout the irrigation and non-irrigation season will help identify any significant water level response to the irrigation canal systems in the area. Monitoring canal flows and stream flows are separate tasks associated with this project.
- Western/Northwestern Area:
    - What interaction does the Willow Creek aquifer have with the Pierce Gulch Aquifer? It appears these two aquifers have overlapping or adjacent boundaries. Monitoring water level changes in wells completed into both aquifers will provide insight into the relationship of these aquifers.
    - What impacts will the pumping centers for the proposed developments have on the various aquifers? Recent aquifer test results indicate the drawdown associated with pumping on the M3 property is minimal at any given distance outside the property boundary. Detailed monitoring of wells near the project site and completed in the same producing zone will confirm or dispute the recent aquifer test results.
    - What influence do the surface water features (Willow Creek) have on the various aquifers of the area? Inspection of water level trends in wells located near Willow Creek in conjunction with observed hydrographs from Willow Creek will provide information regarding the significance of Willow Creek discharges.

<u>Monitoring Method:</u>

- Based on the input from the Technical Working Group members, approximately 20 wells will be selected for monitoring with data loggers. Frequency of the data collection interval is open for discussion, but an interval of one measurement every six hours is the current recommendation.
- Additional wells will be included as data are collected and information gaps are identified.
- All other wells inventoried and not selected to be equipped with data loggers will be measured by hand, with an electric tape or steel tape to the nearest 0.01 feet. The frequency of these hand measurements will be quarterly.

<u>Budget requirements</u>:

- The monitoring discussed above was included in the budget for the project that includes the equipment, tools, and labor associated with the measurements, installation of the data loggers, maintenance and management of the data for the

duration of the project and 10 years following the conclusion of the project. Funding for additional monitoring beyond this time frame will need to be secured through additional sources.

Potential Data Logger Well Selections:

- Eastern Area (8 wells) see Figure 2:

    - DePartee: Domestic well completed into the intermediate/deep cold water aquifer in the Dry Creek area. The well is located near the Hidden Springs Community, up-gradient from Dry Creek Ranch location. There is minimal usage at the residence, and owner is willing to participate. Information collected from this well will provide insight to:
        - Overall water level trends in intermediate/deep Dry Creek system.
        - Impacts from pumping centers completed in same production zone.

    - Rush: Deep geothermal well located up-gradient from Dry Creek Ranch. Owner is willing to participate. Information collected from this well will help understand:
        - Overall water level and temperature trends in the geothermal system in the Dry Creek area.
        - Interconnection between geothermal wells in the area with the surround aquifers.

    - Bell: Deep geothermal well adjacent to the Dry Creek development site. Owner is willing to participate; in fact she had a drill company install an access port to collect water level data. Information collected from this well will be used to:
        - Determine interconnection between geothermal wells in the area with the surrounding aquifers.
        - Overall water level and temperature trends in the geothermal system in the Dry Creek area.

    - Mueleman: Intermediate/Deep cold water well located within the Dry Creek valley. Owner is willing to participate. Information collected from this well will provide:
        - Overall water level trends in intermediate/deep Dry Creek system.
        - Impacts from pumping centers completed in same production zone.

    - Bike Park: Well completed in the intermediate aquifer on the southeastern portion of the study area. This well has a historic USGS record associated with it. The well is currently unused, without a pump, and has been left open for a monitoring site. Information collected from this well will help:
        - Understand the interaction between the intermediate aquifer and the surrounding aquifers in the area through comparison of detailed water levels.

        - Monitor potential impacts from new pumping centers in the Dry Creek and greater Eagle area.
        - Help extrapolate aquifer boundaries to the southeastern portion of the study area.

    - Buchanan: Valley margin well located along Highway 55 across from the Shadow Valley golf course. Well is currently not being used and does not have a pump installed. Good well to:
        - Monitor seasonal trends in the valley margin aquifer system
        - Monitor potential impacts from withdrawals associated with the Avimor development.
        - Provide data to understand the hydraulic connection to surrounding aquifers.
        - Provide information to investigate the influence of Spring Valley creek on the valley margin aquifers.

    - Pence: Shallow/intermediate well located near the northern edge of the Dry Creek valley floor, adjacent to the proposed Dry Creek development project. Owners are willing to participate. Information collected from this well will:
        - Determine shallow aquifer seasonal trends in the Dry Creek valley.
        - Monitor any potential impacts to the shallow aquifer water level associated with the pumping center for the proposed Dry Creek development.

    - Renner: Shallow aquifer well located across Highway 55, due east of the proposed Dry Creek development project. Owner is willing to participate. Monitoring water levels in this well will provide:
        - Information related to the seasonal trends in the shallow aquifer system in this area.
        - Information related to potential influences from area canal systems and surface water features.
        - Monitor any potential impacts to water levels in the shallow aquifer associated with new pumping centers coming online.

- Central Area (4 wells), see Figure 3:
    - Randall: Shallow well, with historic USGS data available. Domestic well with minimal amounts of usage with an owner that would like to participate. Water level data collected from this well will provide information that:
        - Addresses seasonal water level changes due to irrigation practices, canal operations, and local withdrawals.
        - Investigates the hydraulic communication between the various aquifers (shallow, intermediate, and deep) in this area.

- Miezenkowsi: Intermediate domestic well located on the southern edge of the foothill area. Owner is willing to participate. Information collected from this well will:
    - Investigate potential responses from pumping centers coming online.
    - Provide information to understand the communication between the shallow, intermediate, and deep aquifers in the area.
    - Monitor seasonal fluctuations that may be attributed to surface water features.

- Banducci: Intermediate/deep domestic well that was originally included in the SPF monitoring network. Water level information collected from this well will provide information that:
    - Will address the connection between the deep, intermediate, and shallow aquifers in this area through comparison of water level trend data.
    - Investigates potential responses associated with large scale pumping centers coming online.
    - Monitors seasonal fluctuations associated with canal operations.

- Brecht: Intermediate domestic well located just south of the M3 project. Water level data collected from this well can provide:
    - Information related to the hydraulic communication between the shallow, intermediate, and deep aquifers in the area.
    - Information related to potential impacts to the intermediate aquifer zone from large scale pumping centers coming online.
    - Data to assess the significance of canal seepage on water level changes in the intermediate aquifer.

- Western/Northwestern Area (7+ wells), see Figure 4:
    - Cruikshank: Deep well completed on the top of Old Freezeout hill. Owners had well issues with the first well completion, and have had the well re-drilled without any current issues. Monitoring water levels in this well will provide information that:
        - Investigates the potential ground water connection between wells along Highway 16 down to the wells in the Emmett valley.
        - Monitors impacts from pumping centers in the vicinity of this well.

    - Lynn: Deep well along Willow Creek road. Domestic well with minimal amounts of usage. Good access and the owner is willing to participate. Water level information collected from this well will provide information that:
        - Correlates the Willow Creek water level trends with water level trends in the surrounding aquifers.
        - Investigates potential impacts from Willow Creek.

- Hovda: Deep well located mid-slope of Old Freezeout grade. A new domestic well used for domestic and landscaping uses. Water level data collected from this well will be used to:
    - Correlate water levels with the Emmett area wells to the water level fluctuations to wells in the greater Eagle area to confirm or deny the potential hydraulic connection between Basin 63 and Basin 65.
    - Monitor potential impacts from large scale pumping centers coming online.
    - Investigate potential responses in water levels to the irrigation district operations.

- Walker: Intermediate well completed down in the Emmett valley. Owner is willing to participate. Water level information collected from this well will provide information that:
    - Addresses potential responses to the canal system operations.
    - Investigates annual water level fluctuations with respect to surround aquifer changes.
    - Investigates the potential hydraulic connection between Basin 63 and Basin 65.

- Allen: Deep, unused domestic well that is located along Highway 16. This well appears to be in an ideal location for:
    - Investigating the hydraulic communication between the Willow Creek and Pierce Gulch aquifers.
    - Inspecting seasonal trends for correlation to other aquifers.
    - Monitoring any potential impacts associated with large pumping centers coming online.

- Swafford: Domestic, deep well just north of the M3 property. Owner is willing to participate, as information collected from this well will:
    - Provide insight as to potential impacts from M3 pumping center coming online.
    - Provide seasonal fluctuations in the Pierce Gulch Aquifer to be used to correlate to other aquifers in the area.

- Little Irrigation Well 1: Irrigation well that is no longer online with the irrigation system. Currently only being used for stock water purposes part of the year. Information from this well could provide information that:
    - Helps correlate Pierce Gulch Aquifer trends to those of various aquifers in the area.
    - Assesses potential impacts from large scale pumping centers coming online.

The remaining wells that have been currently inventoried have not been selected as potential data logger sites for various reasons including: no driller's report available, no access due to well construction, location with respect to other monitoring, owner permission, and importance of aquifer in which well is located. Although not equipped with continuous recording data loggers, these wells can provide valuable data through quarterly hand measurements. Therefore, the remainder of the wells on the list that are not specifically noted above will be considered candidates for hand measurements throughout the duration of the project.

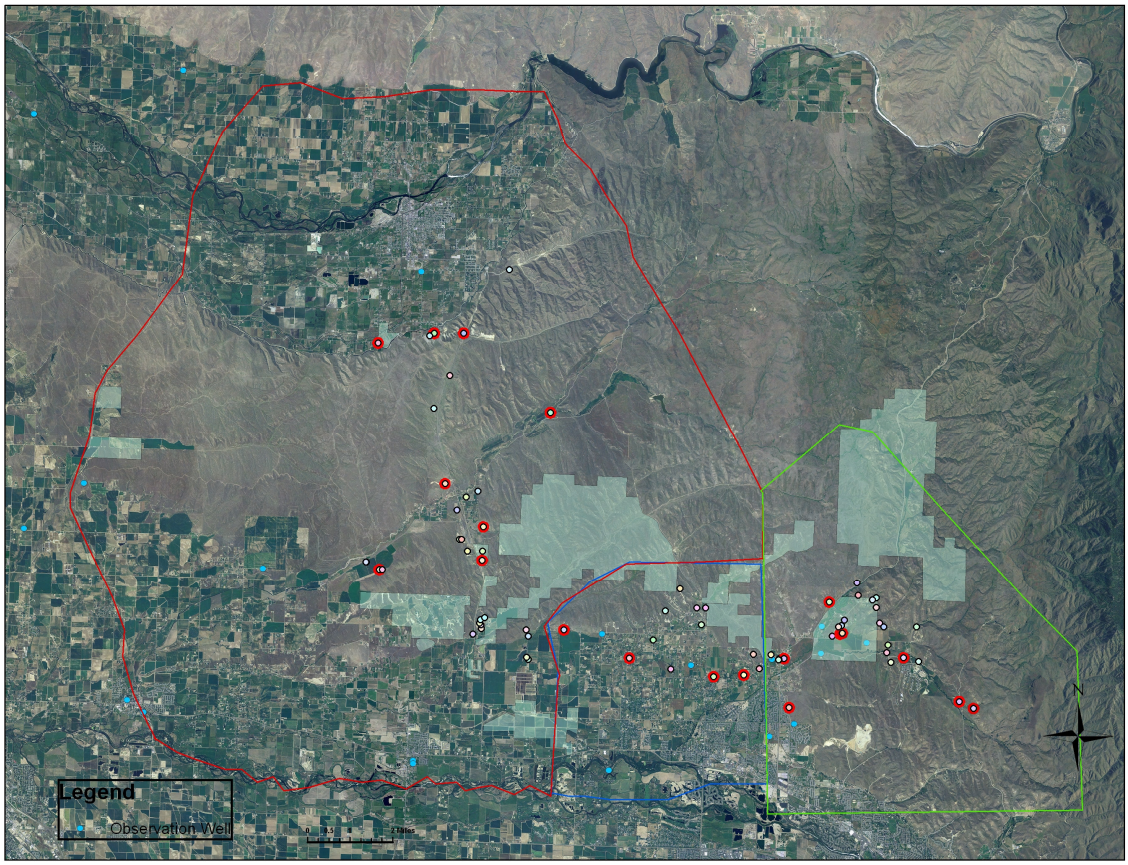

Figure 1. Locations of the 3 sub-areas with respect to the field inventoried wells.

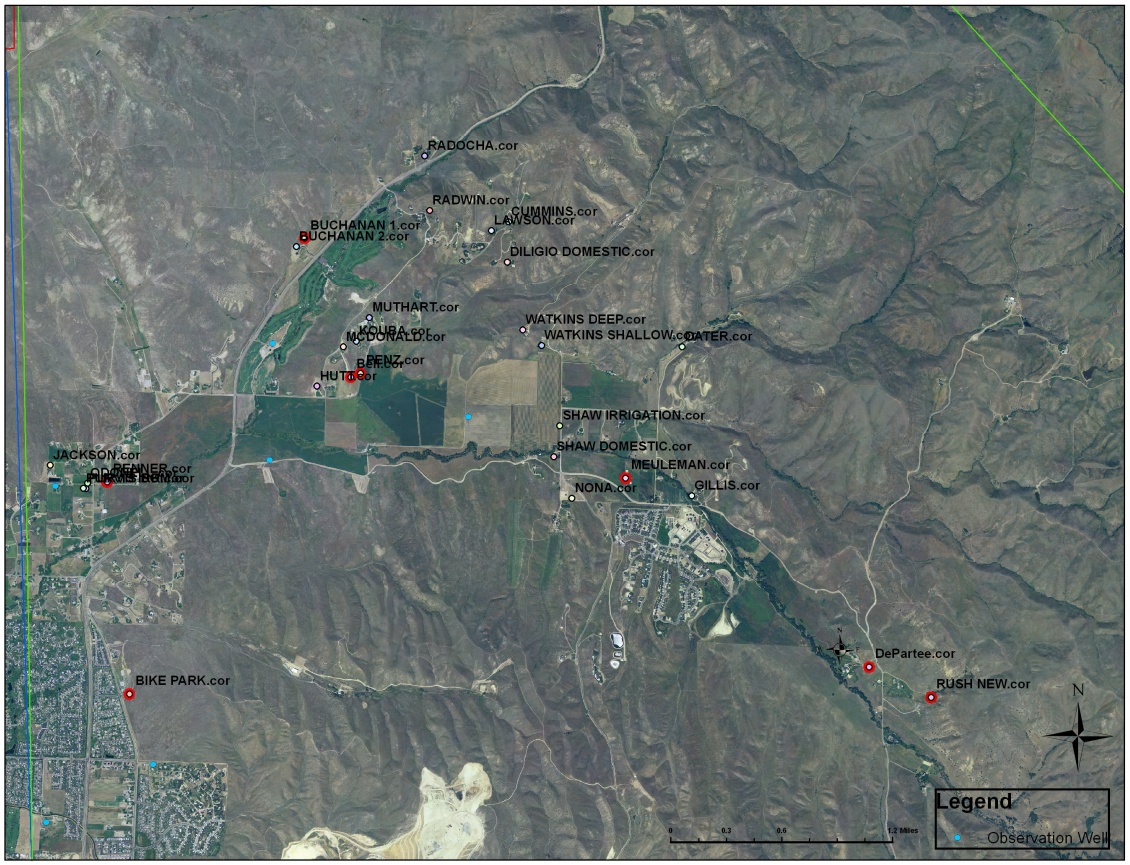

Figure 2. Map of "Eastern" sub area showing the locations of the wells that have been field inventoried. The wells highlighted in red are the wells selected as suitable data logger sites. The un-labeled blue dots represent existing water level monitoring sites.

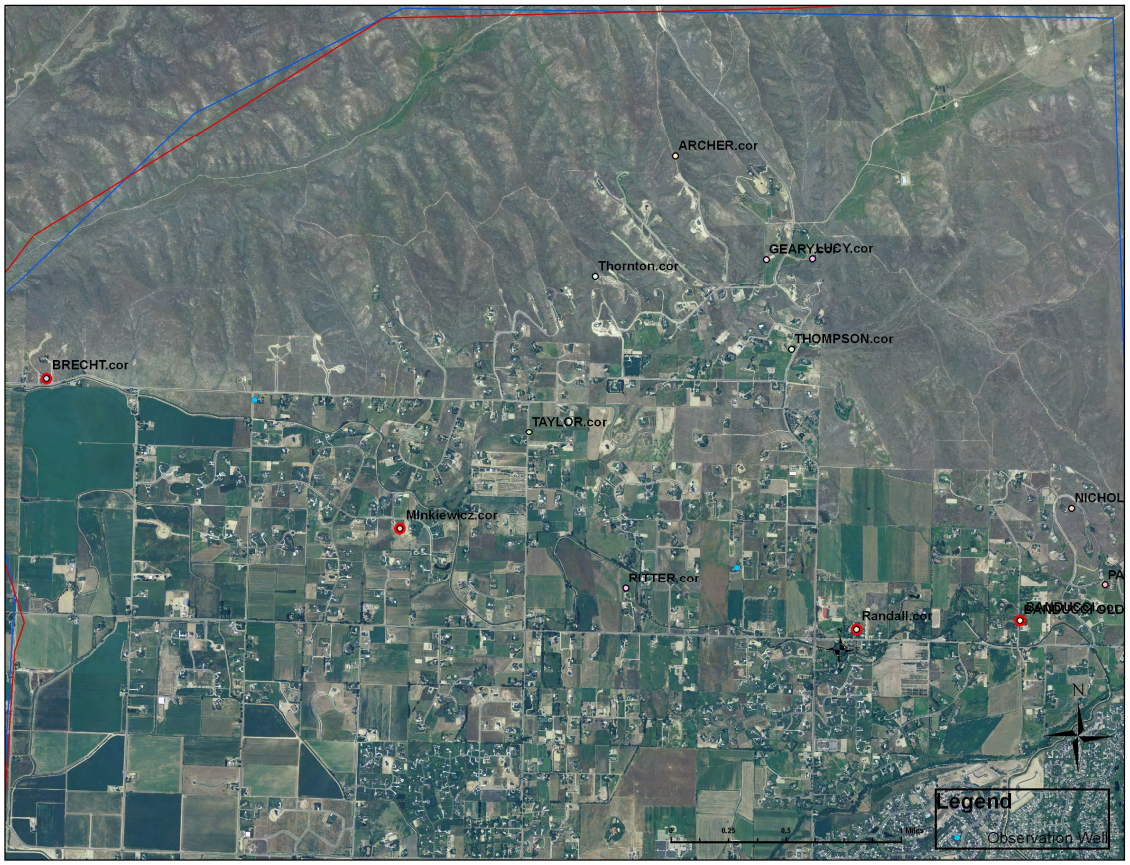

Figure 3. Map of "Central" sub area showing the locations of the wells that have been field inventoried. The wells highlighted in red are the wells selected as suitable data logger sites. The un-labeled blue dots represent existing water level monitoring sites.

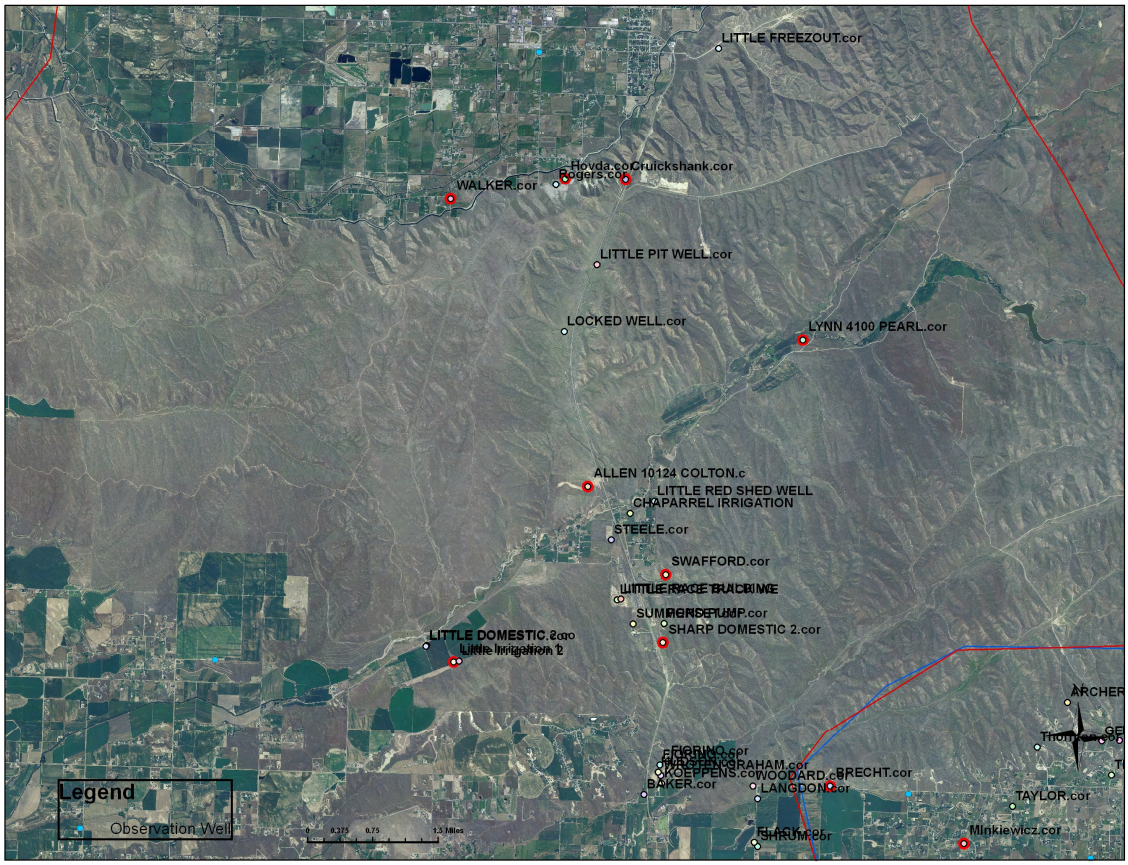

Figure 4. Map of "West/Northwestern" sub area showing the locations of the wells that have been field inventoried. The wells highlighted in red are the wells selected as suitable data logger sites. The un-labeled blue dots represent existing water level monitoring sites.