

Big Lost River Well Installation



Idaho Department of Water Resources

Report by Dennis Owsley

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Introduction

The Idaho Department of Water Resources (IDWR), through a Supplemental Environmental Project (SEP) grant from the United States Department of Energy, drilled and installed 18 shallow ground water wells in the Big Lost River valley in August of 2019. The purpose of the wells is to provide data to monitor ground water levels in the uppermost aquifer at various locations throughout the valley. Locations for the piezometers were selected based on the proximity to the Big Lost River and land owner permission. Ideally, the well locations would exist near an existing surface water gage site. Six locations were ultimately selected, ranging from south of Arco to south of Mackay (Figure 1). Four of the sites were privately owned, one was owned by the Idaho Department of Fish and Game, and one site was owned by the United States Bureau of Land Management (BLM). Access agreements were procured with all of the land owners and a contract was developed with a local drilling firm.

A hollow stem auger was used as the drilling method for these wells. IDWR staff observed and documented drill cuttings from all of the wells during the drilling, and split spoon samples were collected in five foot intervals on the deepest borehole at each site. Split spoon samples were logged and photographed to aid in the development of the lithologic profile for each site. All 18 of the wells were completed with 2" PVC casing, sand packs around the screened intervals, and full depth seals to the surface. Protective locking wellhead monuments were installed on each of the wells.

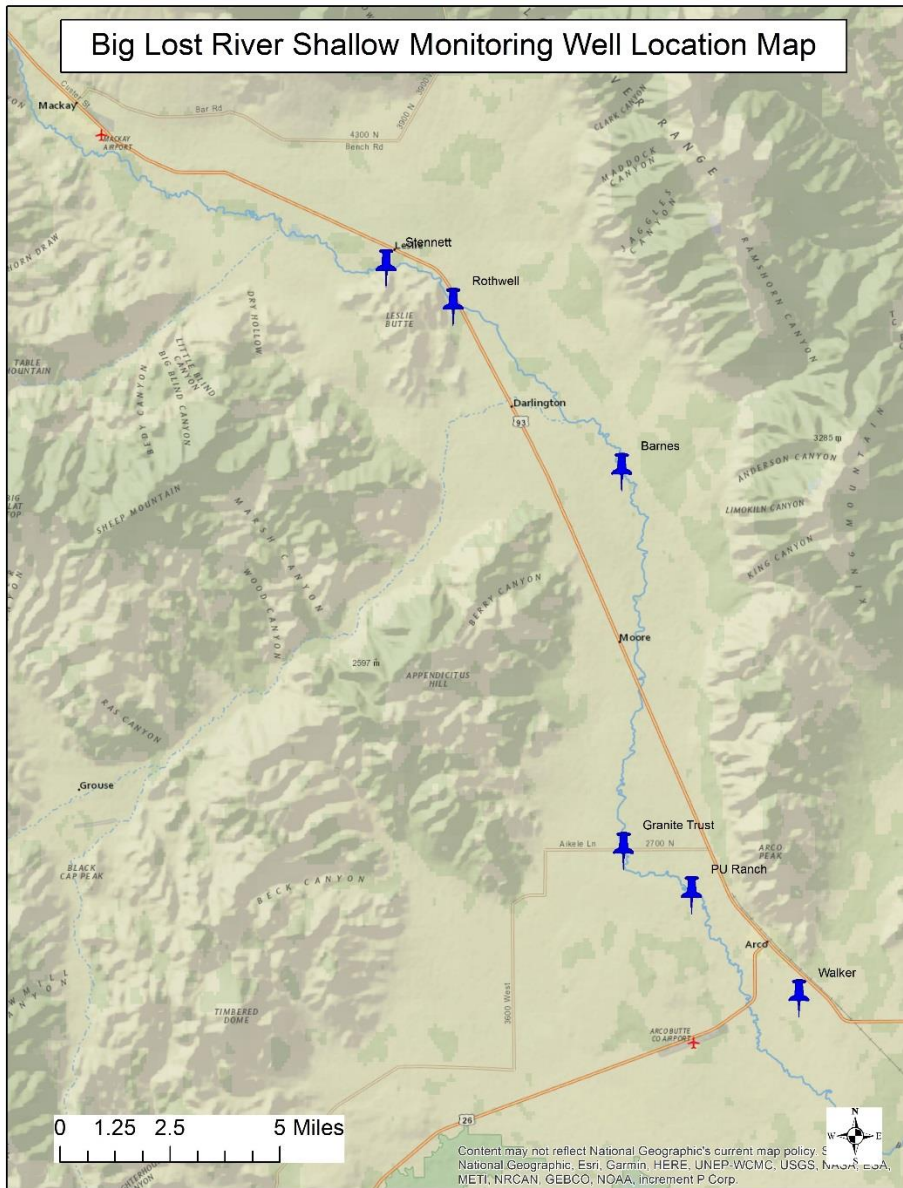


Figure 1. Map of the monitoring well locations.

Walker Site

The Walker site is located just south of Arco, Idaho, on a parcel of privately owned property (Figure 2). Drilling commenced on July 30, 2019 and was complete on August 1, 2019. The Walker site is approximately one mile east of the Big Lost River, and approximately 50' east of a lateral off of the Ferris Slough that was actively diverting water during the time of the drilling. Three piezometers were installed to depths of 20', 40' and 60'. An existing irrigation well completed to a depth of 80' is located approximately 50' to the northeast of the monitoring wells. Construction and lithologic details can be seen in Figure 3. The subsurface material encountered in these wells included 6' of topsoil, underlain by approximately 15' of gravels and sands. Beneath the gravels, fine grained sediments (clays and sands) made up the remained of the subsurface material. Dark heaving sands were encountered in the

bottom 12' that served as a natural filter pack for the 60' well. Depths to water in all three wells were similar, between 8 to 9' below land surface.

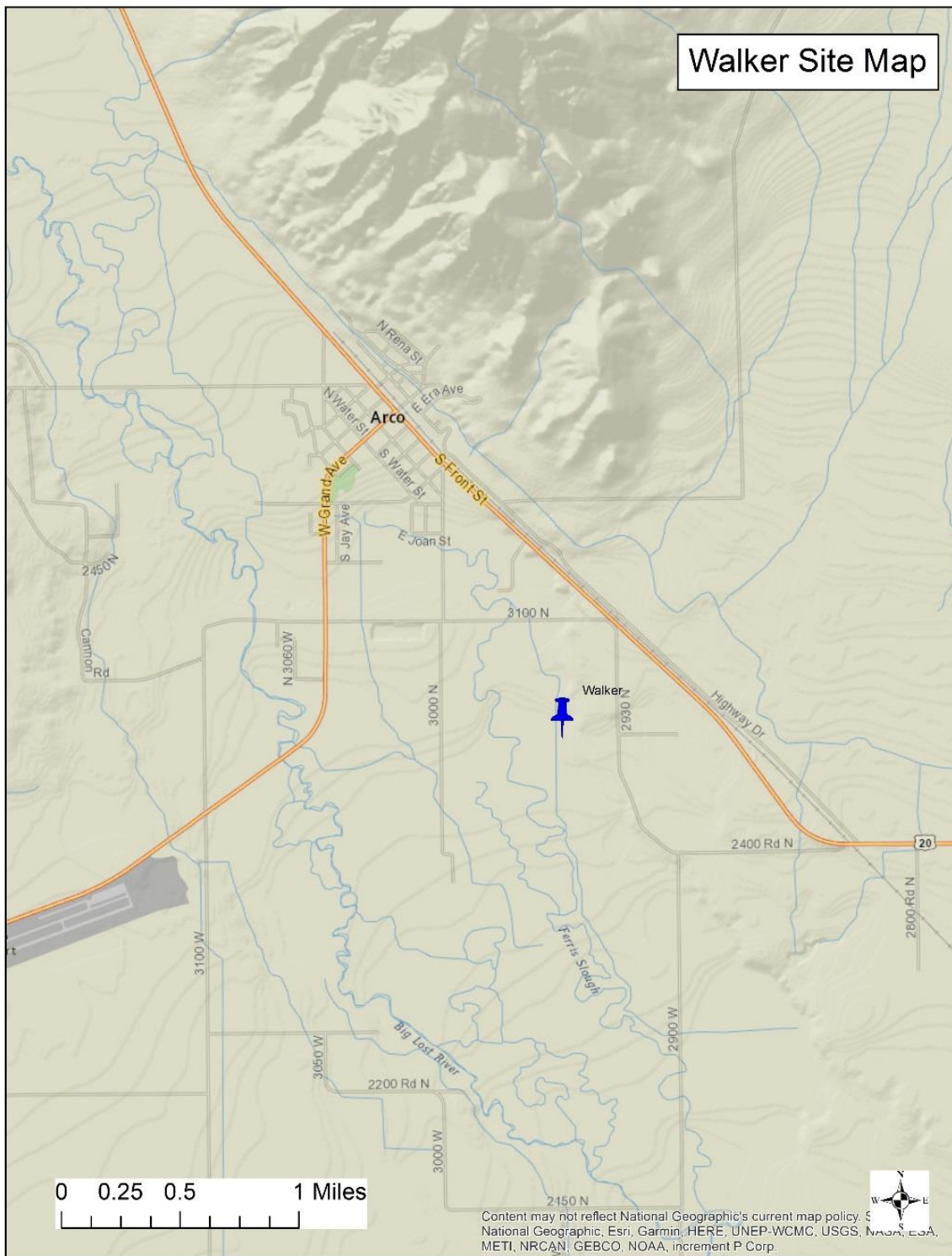
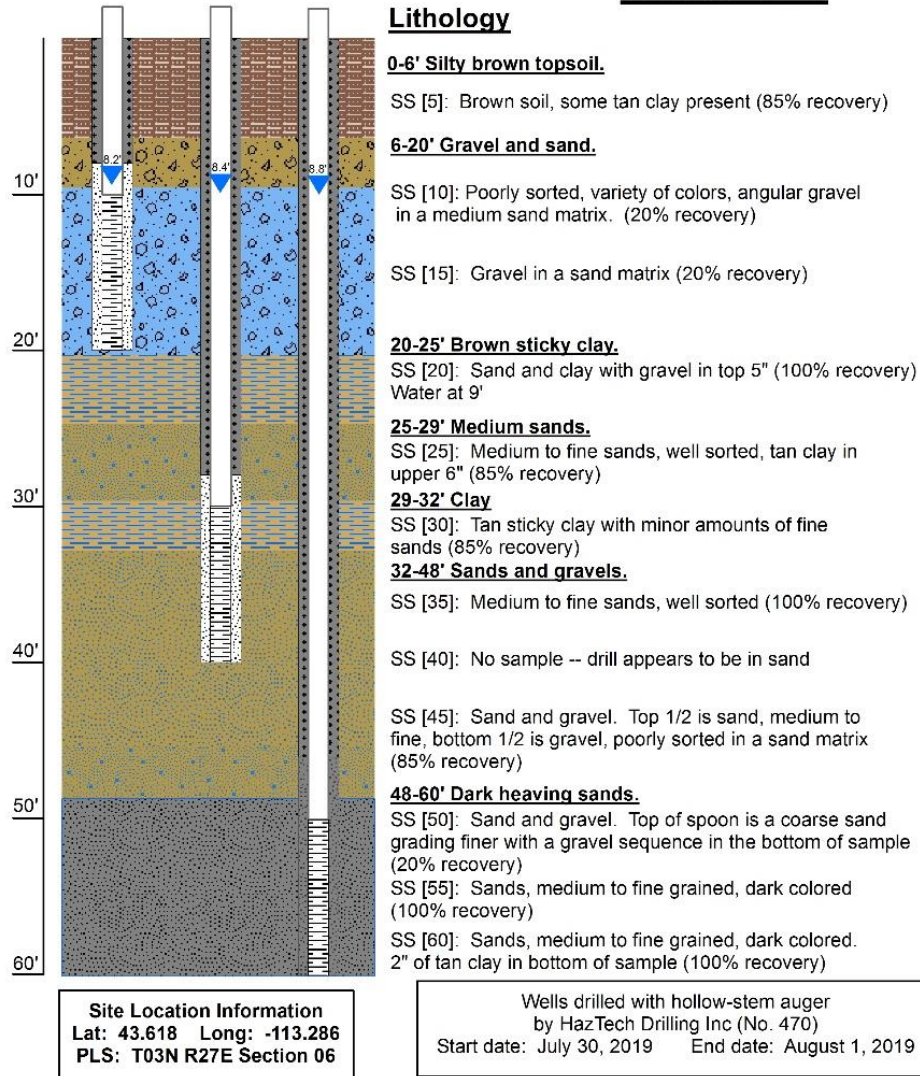


Figure 2. Walker site map.

Walker Site



Construction Details

Walker 20 -- D0083004
 10' Schedule 40 2" PVC screen [10-20']
 10' Schedule 40 2" PVC casing [+2.5-10']
 Sand pack: 225 lbs. poured [8-20']
 Well seal: 125 lbs. bentonite chips poured [surface-8']
 DTW = 8.2' BLS

Walker 40 -- D0083005
 10' Schedule 40 2" PVC screen [30-40']
 10' Schedule 40 2" PVC casing [+2.5-30']
 Sand pack: 250 lbs. poured [28-40']
 Well seal: 300 lbs bentonite chips poured [surface-28']
 DTW = 8.4' BLS

Walker 60 -- D0083005
 10' Schedule 40 2" PVC screen [50-60']
 10' Schedule 40 2" PVC casing [+2.5-50']
 Sand pack: Natural material [46-60']
 Well seal: 560 lbs cement through tremie [surface-46']
 DTW = 8.8' BLS



Figure 3. Lithologic and construction details for the Walker site wells.



Figure 4. Drill rig at the Walker site.



Figure 5. Final well completions at the Walker site.

PU Ranch Site

The PU Ranch site is located north of Arco, Idaho, on a parcel of privately owned property near the Arco Diversion (Figure 6). The site is located approximately 200' from the Big Lost River, which was flowing during the drilling. Drilling commenced on August 1, 2019 and was complete by August 2, 2019. Three piezometers were installed to depths of 20', 40' and 60'. Construction and lithologic details can be seen in Figure 7. The upper 37' of the subsurface was composed of gravel with sands. Below the gravels was a thick sequence of primarily dark sands with minor amounts of gravel. Water was encountered at approximately 5' below land surface. The depths to water in the 20' and 40' wells were similar, approximately 3' below land surface. The 60' well had a water level of approximately 8' below land surface, indicating a downward gradient between the two water bearing formations.

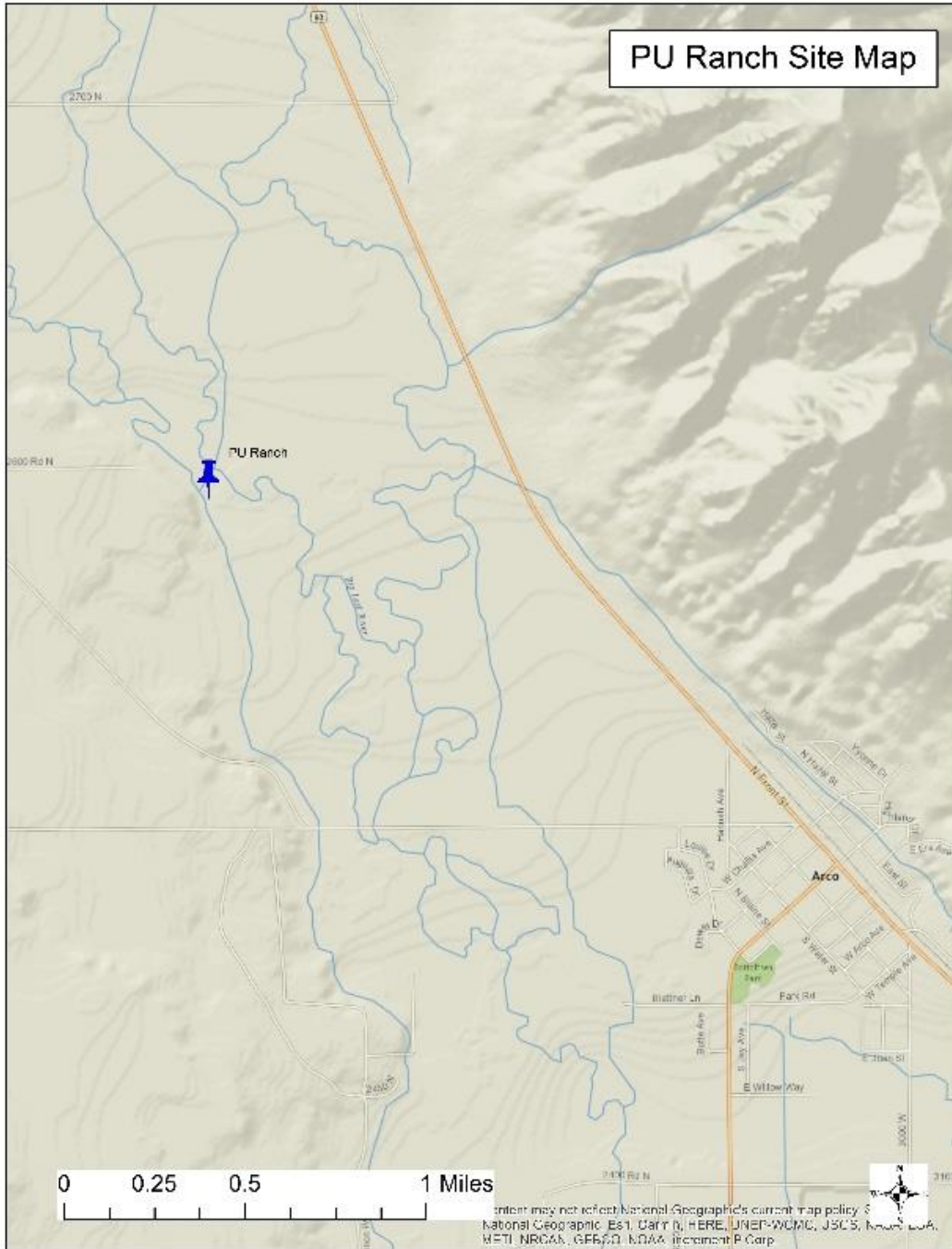
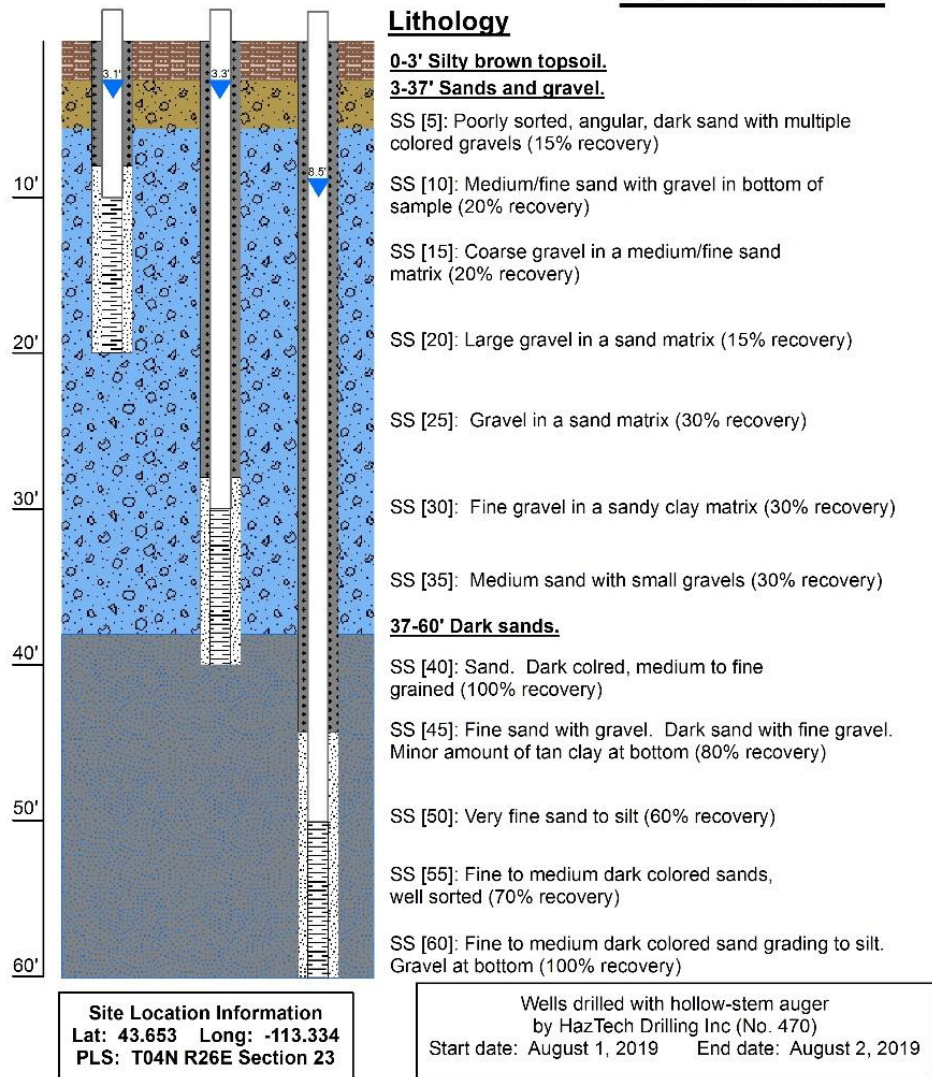


Figure 6. PU Ranch site map.

PU Ranch Site



Construction Details

PU Ranch 20 -- D0082992 10' Schedule 40 2" PVC screen [10-20'] 10' Schedule 40 2" PVC casing [+2.5-10'] Sand pack: 325 lbs. poured [8-20'] Well seal: 50 lbs. bentonite chips poured [surface-8'] DTW = 3.1' BLS
PU Ranch 40 -- D0082993 10' Schedule 40 2" PVC screen [30-40'] 10' Schedule 40 2" PVC casing [+2.5-30'] Sand pack: 175 lbs. poured [28-40'] Well seal: 290 lbs cement through tremie [surface-28'] DTW = 3.3' BLS
PU Ranch 60 -- D0082994 10' Schedule 40 2" PVC screen [50-60'] 10' Schedule 40 2" PVC casing [+2.5-50'] Sand pack: 350 lbs poured [46-60'] Well seal: 540 lbs cement through tremie [surface-46'] DTW = 8.5' BLS



Figure 7. Lithologic and construction details for the PU Ranch site.



Figure 8. Drill rig set up at the PU Ranch site.



Figure 9. Final completions of the PU Ranch wells.

Granite Trust Site

The Granite Trust site is located approximately five miles northwest of Arco, Idaho, on a parcel of privately owned property (Figure 10). The site is approximately 50' west of the Big Lost River channel, which was flowing at the time of the drilling. Drilling commenced on August 2, 2019 and was complete on August 3, 2019. Three piezometers were installed to depths of 20', 40' and 60'. Construction and lithologic details can be seen in Figure 11. Sequences of sands and gravels (primarily gravels) made up the lithology encountered while drilling these three wells. Depths to water were similar in all three wells, around 18' below land surface.

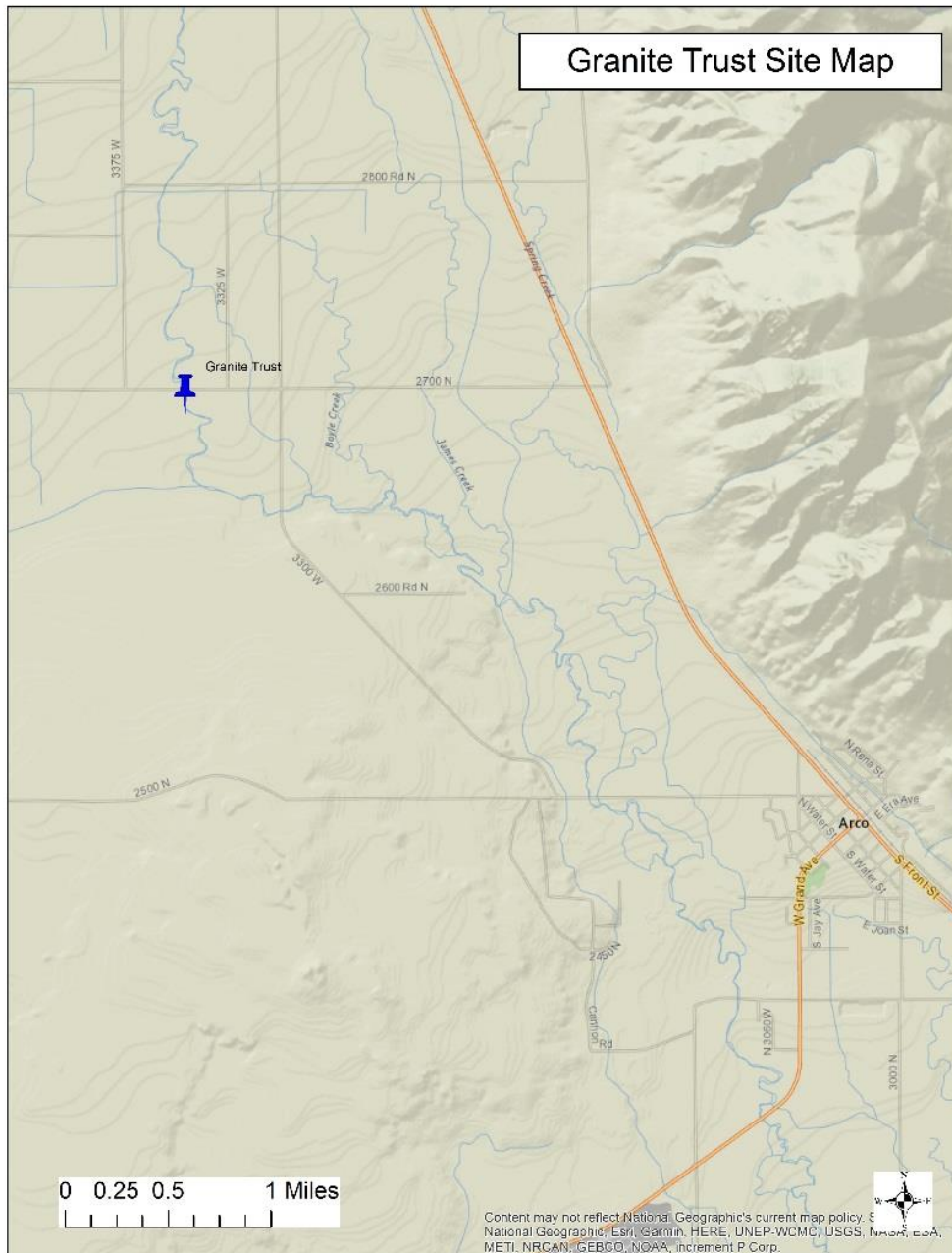
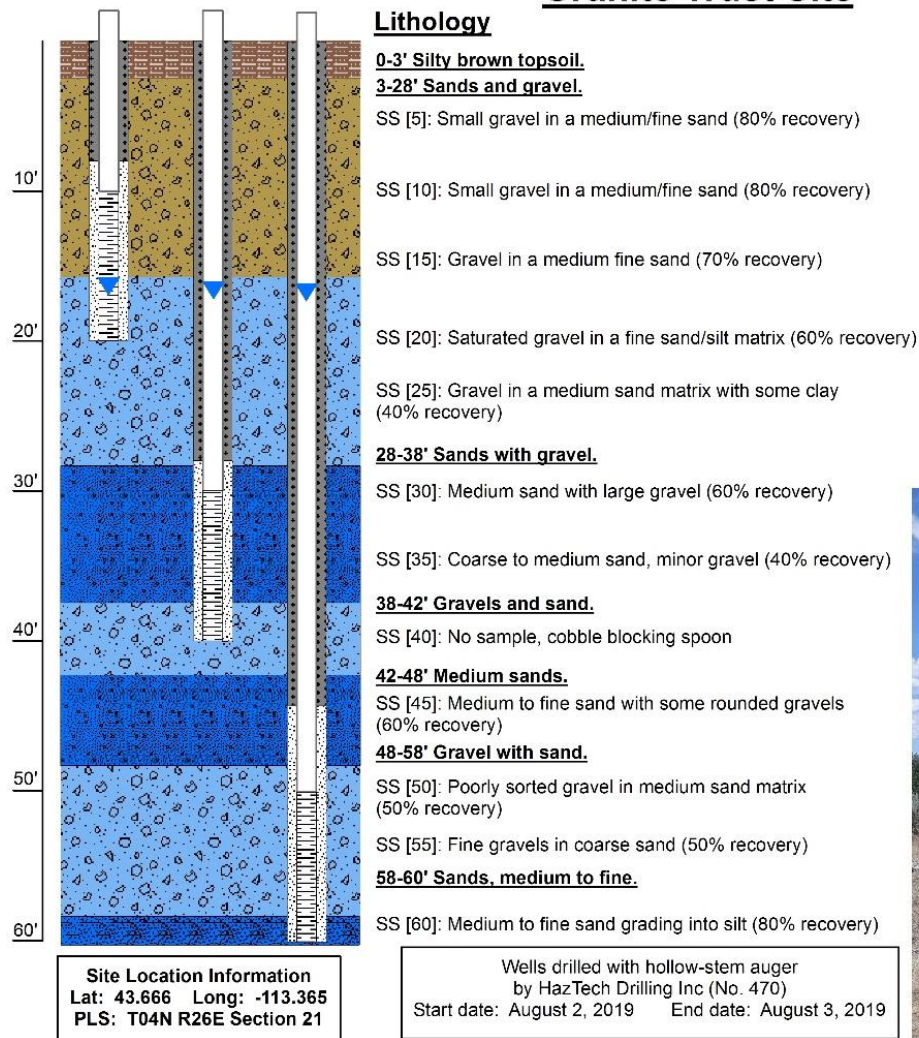


Figure 10. Granite Trust site map.

Granite Trust Site



Construction Details

Granite Trust 20 -- D0082989
 10' Schedule 40 2" PVC screen [10-20']
 10' Schedule 40 2" PVC casing [+2.5-10']
 Sand pack: 325 lbs. poured [8-20']
 Well seal: 150 lbs. bentonite chips poured [surface-8']
 DTW = 17.9' BLS

Granite Trust 40 -- D0082990
 10' Schedule 40 2" PVC screen [30-40']
 10' Schedule 40 2" PVC casing [+2.5-30']
 Sand pack: 250 lbs. poured [28-40']
 Well seal: 400 lbs bentonite chips poured [surface-28']
 DTW = 17.8' BLS

Granite Trust 60 -- D0082991
 10' Schedule 40 2" PVC screen [50-60']
 10' Schedule 40 2" PVC casing [+2.5-50']
 Sand pack: 200 lbs poured [45-60']
 Well seal: 540 lbs cement through tremie [surface-45']
 DTW = 18' BLS



Figure 11. Lithologic and construction details for the Granite Trust well



Figure 12. Final wellhead completions for the Granite Trust wells.

Barnes Site

The Barnes site is located north of Moore, Idaho, on a parcel of privately owned property (Figure 13). The Big Lost River channel is approximately one quarter mile east of the drill site and was flowing during the time of the drilling. Drilling commenced on August 3, 2019 and was complete on August 4, 2019. Three piezometers were installed to depths of 20', 40' and 60'. Construction and lithologic details can be seen in Figure 14. Beneath the top 7' of topsoil, saturated sands and gravels composed the majority of the subsurface encountered. The depth to water in all three wells was very similar, around 7' below land surface.

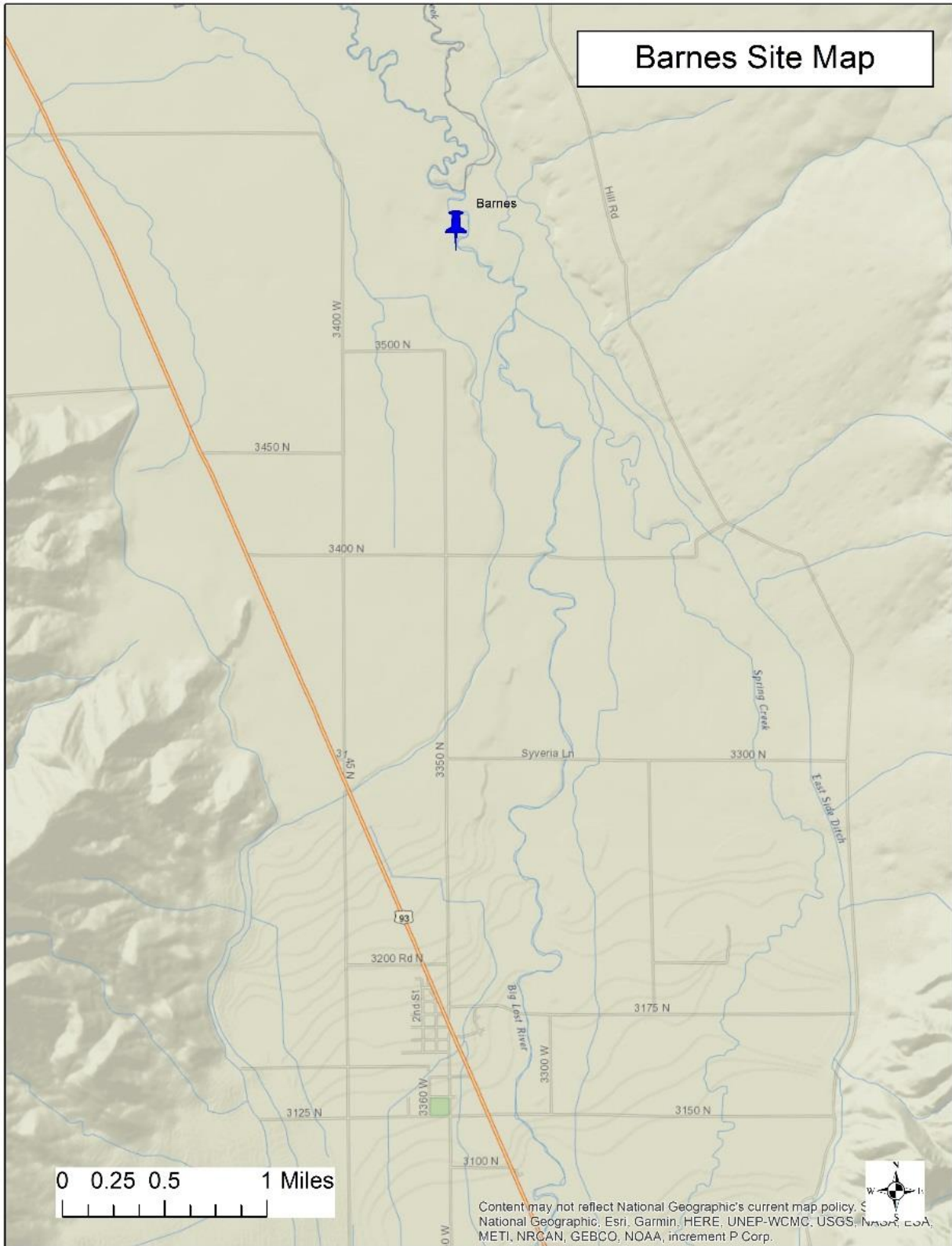
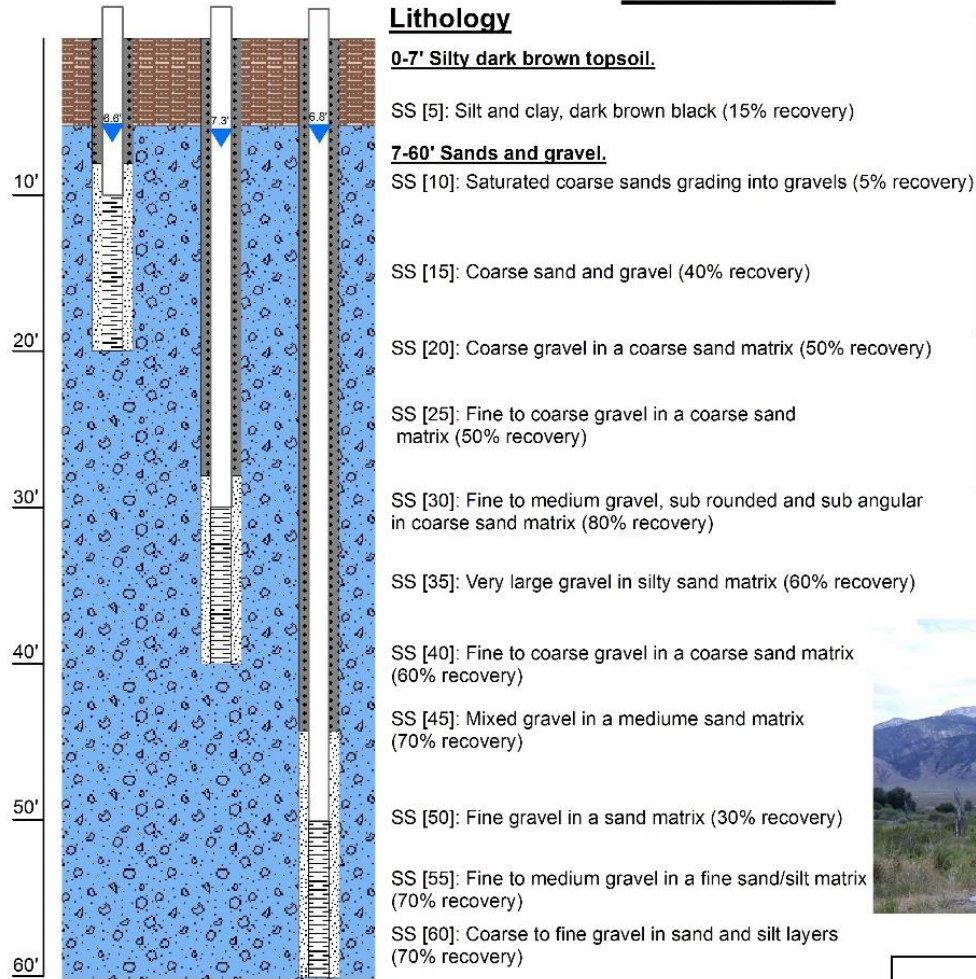


Figure 13. Barnes site map.

Barnes Site



Site Location Information
 Lat: 43.792 Long: -113.367
 PLS: T05N R26E Section 04

Construction Details

Barnes 20 -- D0082995
 10' Schedule 40 2" PVC screen [10-20']
 10' Schedule 40 2" PVC casing [+2.5-10']
 Sand pack: Natural material [8-20']
 Well seal: 125 lbs. bentonite chips poured [surface-8']
 DTW = 6.6' BLS

Barnes 40 -- D0082996
 10' Schedule 40 2" PVC screen [30-40']
 10' Schedule 40 2" PVC casing [+2.5-30']
 Sand pack: Natural material [30-40']
 Well seal: 400 lbs cement through tremie [surface-30']
 DTW = 7.3' BLS

Barnes 60 -- D0082997
 10' Schedule 40 2" PVC screen [50-60']
 10' Schedule 40 2" PVC casing [+2.5-50']
 Sand pack: 100 lbs poured [46-60']
 Well seal: 500 lbs cement through tremie [surface-46']
 DTW = 6.8' BLS



Wells drilled with hollow-stem auger
 by HazTech Drilling Inc (No. 470)
 Start date: August 3, 2019 End date: August 4, 2019

Figure 14. Lithologic and construction details for the Barnes site wells.



Figure 15. Final wellhead completions for the Barnes site wells.

Rothwell Site

The Rothwell site is located south of Leslie, Idaho, on a parcel of property owned by the United States Bureau of Land Management (Figure 16). The site is approximately 50' east of the Big Lost River, which was flowing at the time of the drilling. Drilling commenced on August 4, 2019 and was complete on August 5, 2019. Three piezometers were installed to depths of 20', 40' and 60'. Construction and lithologic details can be seen in Figure 17. The 20' well was dry upon completion and the water levels in the 40' and 60' wells were 28' and 43' BLS, respectively. The subsurface lithology was primarily sands and gravels.

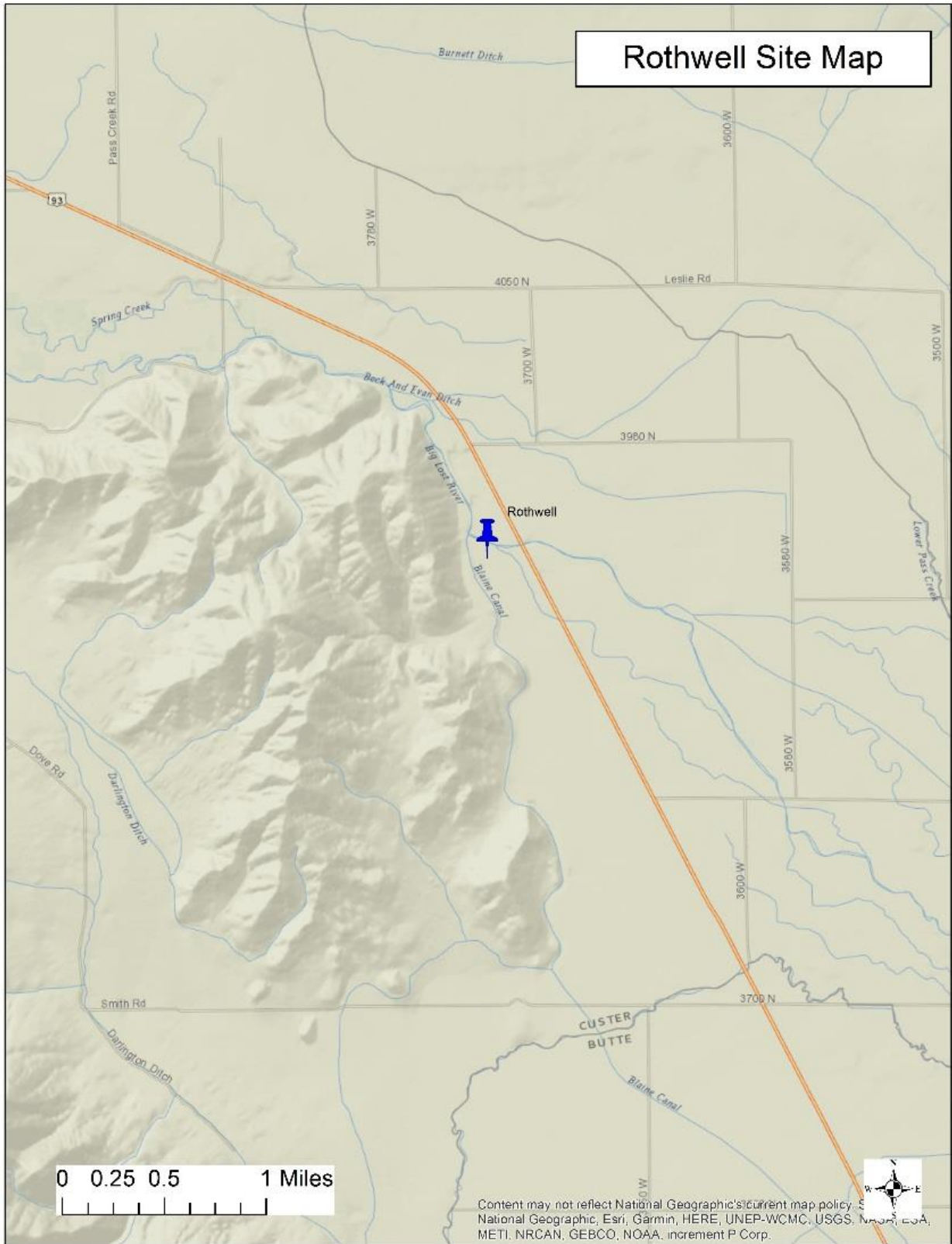
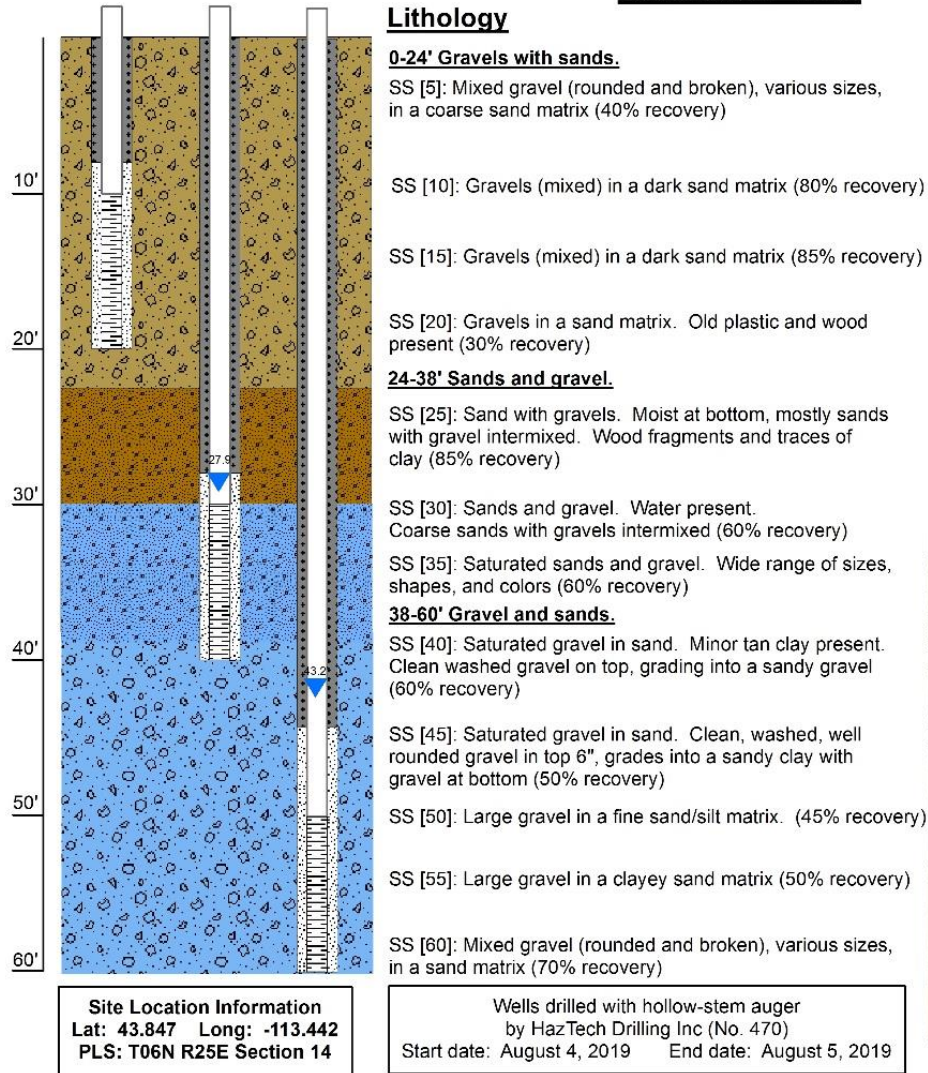


Figure 16. Rothwell site map.

Rothwell Site



Construction Details

Rothwell 20 -- D0082998
 10' Schedule 40 2" PVC screen [10-20']
 10' Schedule 40 2" PVC casing [+2.5-10']
 Sand pack: 350 lbs poured [8-20']
 Well seal: 125 lbs. bentonite chips poured [surface-8']
 DTW = DRY

Rothwell 40 -- D0082999
 10' Schedule 40 2" PVC screen [30-40']
 10' Schedule 40 2" PVC casing [+2.5-30']
 Sand pack: 100 lbs poured [28-40']
 Well seal: 425 lbs bentonite chips poured [surface-28']
 DTW = 27.9' BLS

Rothwell 60 -- D0083000
 10' Schedule 40 2" PVC screen [50-60']
 10' Schedule 40 2" PVC casing [+2.5-50']
 Sand pack: 200 lbs poured [45-60']
 Well seal: 500 lbs cement through tremie [surface-45']
 DTW = 43.2' BLS



Figure 17. Lithologic and construction details for the Rothwell site wells.



Figure 18. Drill rig at the Rothwell site.



Figure 19. Final wellhead completions at the Rothwell site.

Stennett Site

The Stennett site is located west of Darlington, Idaho, on a parcel of property owned by the Idaho Department of Fish and Game (Figure 19). Drilling commenced on August 4, 2019 and was complete on August 5, 2019. Three piezometers were installed to depths of 20', 40' and 50'. Construction and lithologic details can be seen in Figure 20. In general, the upper 50' of the subsurface at this site was gravel, underlain by a sequence of tan clay. Bedrock was encountered at 46' in the deep well and limited the total depth to 50', rather than the proposed 60' target depth. Based on the depths to water in the wells, it appears the river is perched in this area as the 20' well was dry, and depth to water in the 40' well was 39' and the depth to water in the 50' well was 47'.

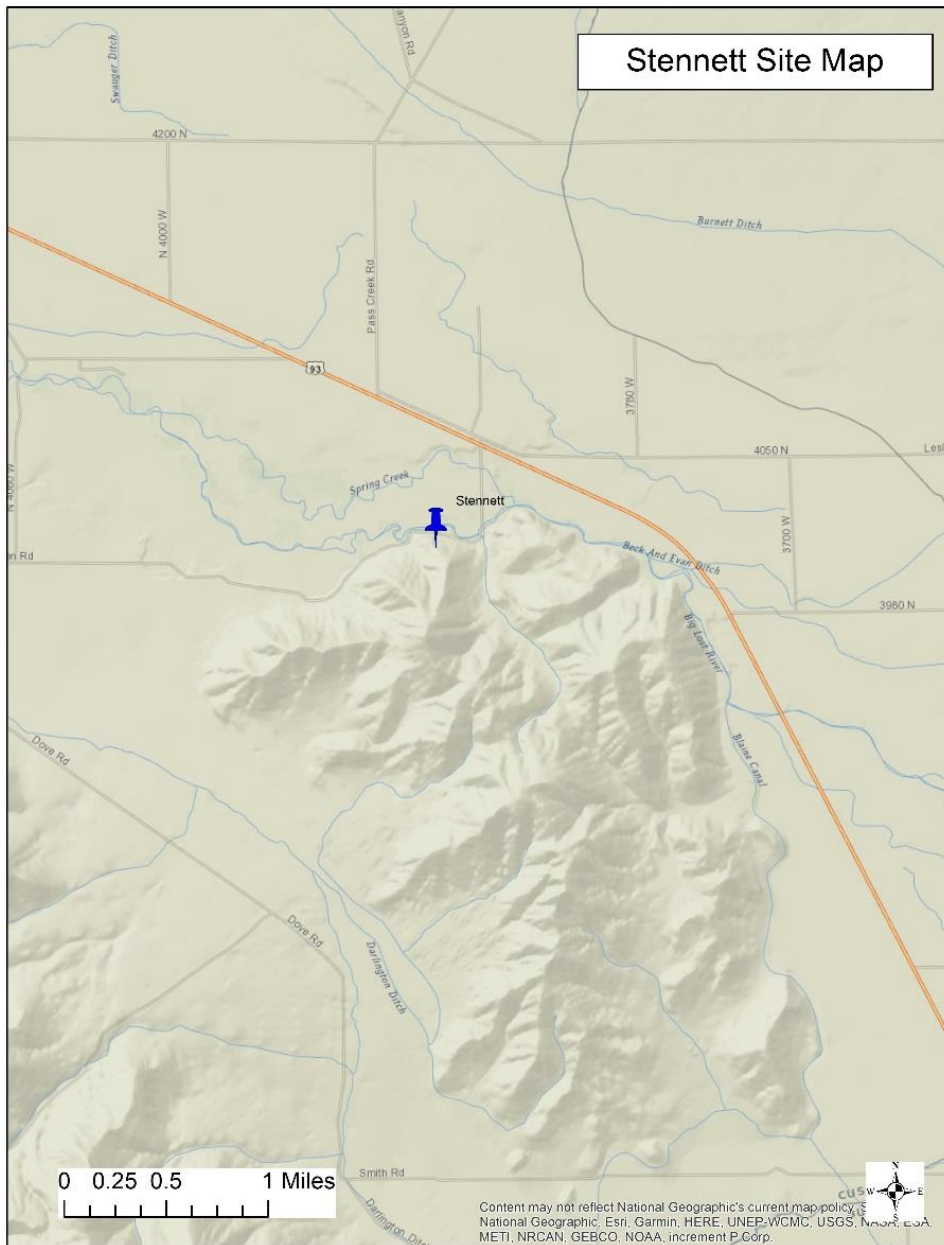
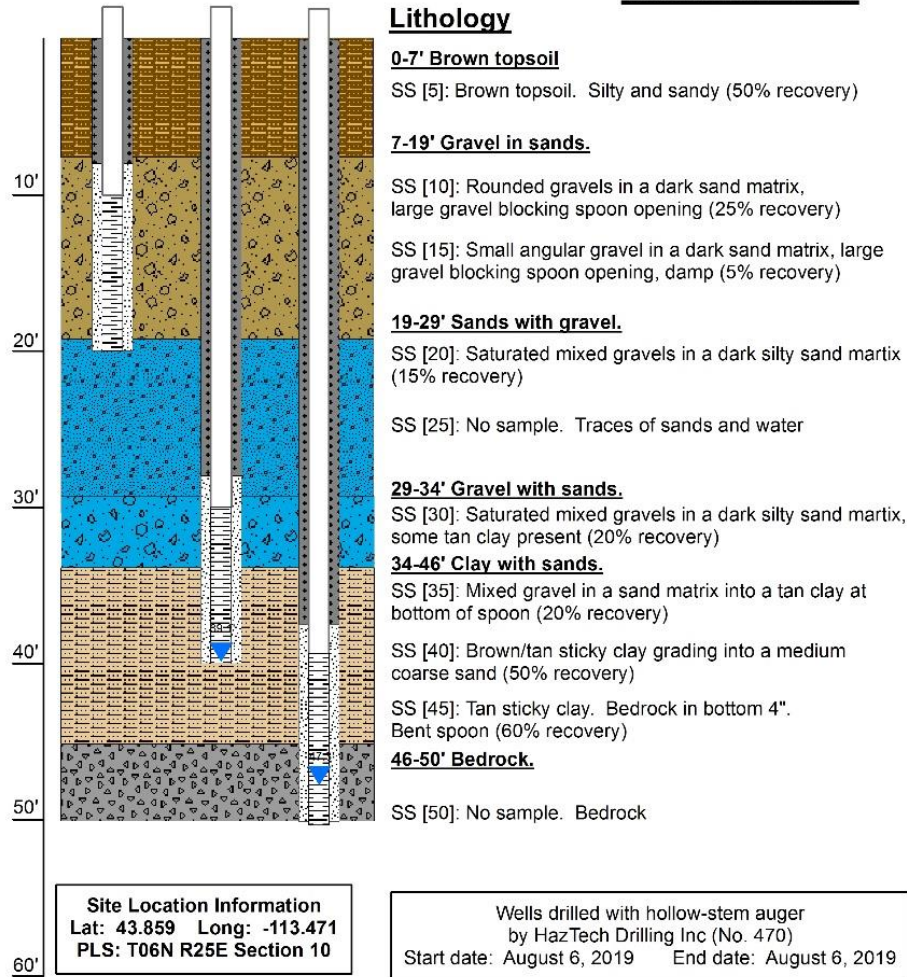


Figure 20. Map of the Stennett site.

Stennett Site



Construction Details

Stennett 20 -- D0083001 10' Schedule 40 2" PVC screen [10-20'] 10' Schedule 40 2" PVC casing [+2.5-10'] Sand pack: 225 lbs poured [8-20'] Well seal: 75 lbs. bentonite chips poured [surface-8'] DTW = DRY
Stennett 40 -- D0083001 10' Schedule 40 2" PVC screen [30-40'] 10' Schedule 40 2" PVC casing [+2.5-30'] Sand pack: 250 lbs poured [28-40'] Well seal: 350 lbs bentonite chips poured [surface-28'] DTW = 39.1' BLS
Stennett 50 -- D0083002 10' Schedule 40 2" PVC screen [40-50'] 10' Schedule 40 2" PVC casing [+2.5-40'] Sand pack: 300 lbs poured [38-50'] Well seal: 700 lbs bentonite chips poured [surface-38'] DTW = 47.3' BLS



Figure 21. Lithologic and construction details for the Stennett site wells.



Figure 22. Well rig set up at the Stennett site.



Figure 23. Final wellhead completions at the Stennett site.

Conclusions and Recommendations

The drilling and installation of 18 shallow wells along the Big Lost River was successfully completed in August 2019. The proposed total depth goals for 17 of the 18 wells were met; the Stennett site had one exception where bedrock was encountered limiting the 60' proposed well to only 50'. The wells are scheduled to be equipped with vented pressure transducers on direct read cables. The wells were not developed at the time of the completions. The intent is to develop the wells at the time of the instrument installation. As such, the depths to water reported in this report may change once the wells are developed.

Wellhead elevations need to be measured using a high accuracy GPS unit to further refine any vertical gradients between the wells. This data can be collected in conjunction with a future upcoming monitoring visit.

Even with the addition of the 18 new wells, there are still locations in the valley where data gaps exist for shallow aquifer monitoring. For example, there is a multiple mile stretch from just north of Arco to north of Moore where additional shallow well drilling would provide useful information to the Department and local water users. Another data gap exists near Darlington, an area known to have historic river losses. If funding is available, it is recommended that additional sites be sought to help fill in the existing data gaps in the valley.

Another recommendation for the use of these new wells is to conduct dye tracer tests in the shallow aquifer. Dye could either be released in one of the wells and monitored down-valley, or released into the river and monitored for in the new shallow wells. Research needs to be conducted to develop a potential plan for dye tracing tests.

Acknowledgements

The Department would like to thank the following property owners who allowed access for the well installations, and ultimately the success of this project. Harvey Walker (Walker site), Scott Slocum (PU Ranch site), Camille Babcock (Granite Trust site), Larry Barnes (Barnes site), the United States Bureau of Land Management (Rothwell site), and the Idaho Department of Fish and Game (Stennett site).