

Recommendations for location and construction of a water supply well at the Flight 93 National Memorial, Somerset County, Pennsylvania

A water-supply well is needed to provide potable water for visitors and staff at the planned facilities for the Flight 93 National Memorial in rural Somerset County, PA. The anticipated peak demand of 15,000 gallons per day requires a well capable of producing a sustained yield of 10 gallons per minute. Previous analyses of alternatives identified construction of a well, storage tank, and distribution on site as preferable to connecting to existing public water supply systems in the area. In general, the existing systems either do not have excess capacity to meet the park needs or are too distant to be more economic than constructing a new water system dedicated to park uses and needs. Also, by constructing its own water system, the park controls its own water source, rather than being dependent on other entities for water. Although the ongoing cost of operating and maintaining a water system are not trivial, both in terms of dollars and manpower.

James Casselberry provided a summary of hydrogeologic conditions in the area and provided recommendations for locations of test wells. Casselberry's report is an 8-page letter date April 25, 2005 and is contained in Appendix 3 of the *Water and Sewage Service Feasibility Study* (Eads Group, 2005).

To summarize the important points of Mr. Casselberry's report;

1. The bedrock unit at the surface under most of the park is the Allegheny Group. This rock unit is comprised of cyclic beds of sandstone, shale, coal, and clay. The coal has been mined from both surface and underground mines. The mining has caused acid mine drainage contamination of both surface and groundwater in the immediate vicinity of the mining operations.
2. Groundwater from wells completed in the Allegheny Group bedrock is expected to have poor water quality. Recent analyses of water samples from two well on the "Mock property" provide evidence of the poor quality of groundwater in the Allegheny Group.
3. Bedrock units of the Pottsville Group underlie the Allegheny Group. The Pottsville Group is comprised of two thick sandstone units that are separated by a 40-foot thick sequence of shale and clay which acts as a confining unit (the confining unit effectively isolates groundwater in the rock units above from groundwater in the rocks below the confining unit.)
4. The upper sandstone unit of the Pottsville Group contains pyrite and produces water with elevated concentrations of iron and manganese.
5. The lower sandstone unit of the Pottsville Group has less pyrite and therefore better water quality. Large yields of good quality water have been obtained from wells completed in the lower part of the Pottsville Group in the region surrounding the Flight 93 site.
6. The Mauch Chunk Formation underlies the Pottsville Group and is a source of large quantities of good-quality groundwater in the surrounding region.

Mr. Casselberry recommended construction of a test well completed in the lower sandstone unit of the Pottsville Group and the upper part of the Mauch Chunk Formation. These rock units are the source of good-quality groundwater from wells in the general vicinity of the Flight 93 site.

The confining unit in the middle part of the Pottsville Group should effectively isolate the poor-quality groundwater associated with the coal mining and coal beds from the groundwater in the lower part of the Pottsville Group and the Mauch Chunk Formation. The location/depth of the proposed test well is shown on the stratigraphic cross-section (Figure 1).

The yield of a well completed in the Pottsville and Mauch Chunk sandstones will be largely dependent on the number and size of fractures and fracture zones encountered by the well as it is drilled through the bedrock. The location and orientation of fracture zones can sometimes be detected by the occurrence of linear topographic features on the land surface. (Zones of fractured rock are more easily eroded than unfractured rock.) Mr. Casselberry identified several fracture traces as potential locations for test wells. Unfortunately, those sites are not on property parcels that are likely to be under park jurisdiction in the near future.

Additional topographic analysis was conducted by the author (L. Martin) to identify topographic features that might be representative of fracture traces on property that will be owned or controlled by the park service. The north-flowing intermittent stream valley on the west side of Lambertsville Rd. is probably the most prominent linear feature on, or near, the Flight 93 site. If the valley is associated with a fracture zone, there may be secondary fracturing extending into areas adjacent to the valley. There may be enough fracturing in the bedrock formations on the east side of the Lambertsville Rd. (on park service property) for successful completion of a water-supply well. A test well at this location would probably need to be 500-600 feet deep to penetrate the target aquifers; the lower part of the Pottsville Group and the upper part of the Mauch Chunk Formation. In his 2005 report, Mr. Casselberry estimated the cost of constructing and testing a well at \$30,000-45,000.

The recommended location for a test well is at the intersection of Lambertsville Rd. and Skyline Rd. (Figure 2). This location should be close enough to the linear valley to possibly intersect fractured bedrock. Presumably, electrical service is readily available along Lambertsville Rd. Construction of a water line from the well to locations in the Flight 93 site could occur in previously disturbed areas of the right-of-way along Skyline Rd.

There are many private residences located along Lambertsville Rd between Lambertsville and the Flight 93 site. Residents should be queried regarding their private, domestic wells. Information obtained about the depth, yield, and taste of their water would provide an indication of local groundwater resources. We might learn that an adequate amount of acceptable-quality groundwater is available from shallower aquifers.

I recommend contracting Mr. Casselberry to oversee construction of the test well and testing the quantity and quality of water encountered during drilling. Mr. Casselberry's report demonstrates a thorough understanding of local hydrogeologic conditions and expertise in well construction. It's imperative that we have someone with experience in identifying the various bedrock units from drilling samples to determine the correct depth of various features of well construction, e.g., determining the necessary depth of well casing and formations to be isolated by cementing the casing in place.

Recommendations

1. Query residents along Lambertsville Rd. regarding the depth, production, and water quality from private domestic wells.
2. Contract Casselberry & Associates to oversee construction and testing of a well near the intersection of Lambertsville and Skyline Rds.

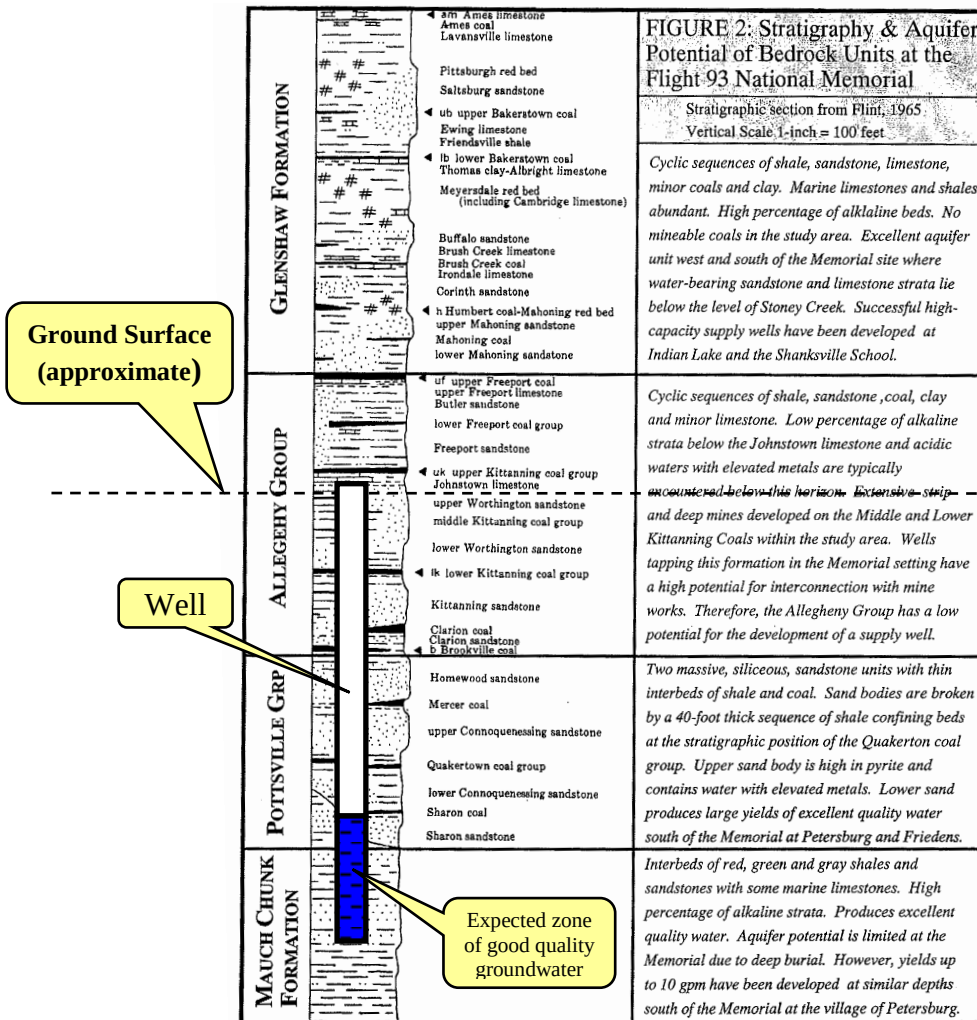


Figure 1. Stratigraphic column from Casselberry's report showing the approximate relation of a proposed well near the intersection of Skyline Rd. and Lambertsville Rd. with the underlying geologic formations.



Figure 2. Recommended location of a test well at the Flight 93 National Memorial.