Washington's Well

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Introduction

In 1966, the first home requested to be placed on Historic Winchester's list of old homes to be pre-served was that of City Councilman and Mrs. Ralph Lee Hardy located at 419 north Loudoun St. The Hardys called their home "Washington's Well." The home was named after the well in the south side yard. The well was dug 103 feet through solid limestone by George Washington's men during the French and Indian War and was within the walls of Fort Loudoun.1

Why was a well needed, how was it sunk into the bedrock, and was a spring struck? This paper will shed some light on possible answers.

Conception

When then Colonel George Washington proposed building a strong fort at Winchester, he included a well in the plans. Even though the hilltop that he proposed as a site for the fort was mainly limestone bedrock, a well was deemed essential. A secure source of water was a strategic necessity for a military fort. Water was needed for drinking, cooking, and watering any garden area within the walls of the fort for supporting the garrison. In addition, water was needed for fire suppression, for a blacksmith, and for sponging the cannon between rounds. Sometimes barrels of water were maintained for emergency use.

Forts relied on two methods of securing water. The first was to build a "covered way" to a nearby stream or lake. However, when the forts were under siege, soldiers were exposed to ambush as they drew water. Fort Cumberland used a covered way but later found it necessary to dig a well when Indians were bold enough "to fire upon those who ventured to the water's edge."2 Some forts were not near any body of water and thus had to use the second method, which was to sink a well. Fort Loudoun in Winchester was such a fort; however, sinking a well through bedrock proved no easy task.

Method of Sinking the Well

To dig this well, George Washington hired a miner by the name of John Christopher Heintz. While some references report Heintz "digging" the well, miners were said to "sink" wells or shafts whether used for water or mining.

At the present state of research, no primary source descriptions of the method of sinking used by Heintz have been found. However, according to several secondary sources, the method used since the early 18th century is the one that I will describe.

In order to sink a shaft into rock, miners of the 18th century used an iron tool to make a series of small-diameter deep holes in the bottom of the shaft. Then the holes were filled with black powder, plugged to confine the combustion gases, and shot. The broken rock was then loaded into buckets and hoisted out. When all of the lose rock was thus removed the next series of holes were drilled and the process repeated.

It is thought that the first use of blasting with black powder in mines was in Hungary in 1627. For various reasons, such as high cost and lack of suitable drilling tools, the use of black powder in mining and shaft sinking did not spread rapidly, although it was generally widely accepted by 1700. 3

For sinking a narrow diameter shaft, such as 6 or 8 feet, the holes were made by means of a 1-inch diameter steel shaft or "jumper" about 2 to 3 feet in length with a single cutting edge at one end, sometimes called an auger. The rod was grasped and struck repeatedly by a hammer (e.g., 4 lb.) as the shaft was turned. The process of one man swinging the hammer and holding his own drill rod or auger was called single jacking. In average rock, one man might "drill" eight inches in an hour. For almost 250 years, this method of drilling blast holes was improved upon only in the composition of drill steels and the manner of tempering them. An inventory of tools at Fort Loudoun taken by Lieutenant Charles Smith in May 1758 showed 26 Augers on hand. 4 A supply of sharpened augers needed to be kept on hand for Heintz and Lieutenant Smith reported to Washington in August 1758 that the blacksmith's bill "will run pretty high in making and pointing the orgors [augers] for the well." 5

After the hole was formed and cleaned out, black powder was poured into the bottom and pushed in with a wooded rammer and a fuse was added. Some wadding, tow, or paper was then forced down followed by other materials called tamping to fill the hole. The tamping was forced down with a copper or bronze tamping rod to avoid sparks. 6 The proportion of powder and tamping in the hole was determined by the properties of the rock and determined by several trials.

Black powder was an extremely dangerous blasting medium. It had to be ignited either by flame or intense heat. The original fuse systems of the 18th century were thin lines of the powder itself or crude fuses made of straw, goose quills, paper, or other combustible material combined with sprinklings of powder. Burning speed of this type of fuse was extremely unreliable. This must have been especially challenging to Christopher Heintz since, as the well sunk deeper, he would have had to be hauled up out of the well shaft before the powder ignited or have some kind of “blast shield” to afford protection. 7

The shafts were drilled on the “center-cut” principle. Six to ten holes would have been drilled on a slant toward the middle of the shaft, separated on the top but converging toward the bottom thus forming a wedge known as the “sump”, “bench”, or “reliever” holes were then drilled in a more nearly vertical direction toward the walls of the shaft as depicted in Figure 1.

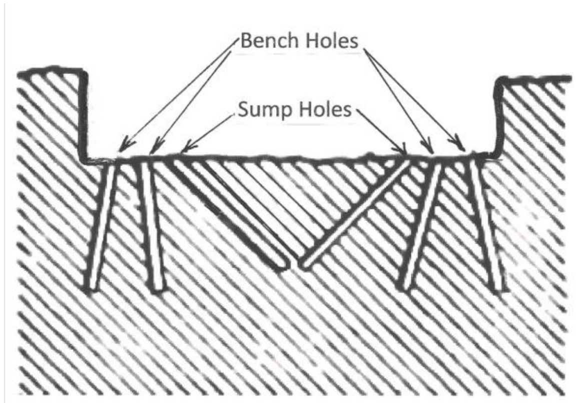


Figure 1

Pattern of Holes drilled into Rock. Source: Donaldson, page 70, Figure 31

After the sump holes were shot and rock removed a cavity was thus formed which accommodated the rock subsequently blasted by shooting the “bench” holes. The walls of the shaft were then dressed, if necessary, with a pickaxe to be plumb with the upper shaft walls. 8

The progress of sinking the well therefore must have been a slow, laborious, and dangerous undertaking. Among the problems that would have been faced by Heinz were: the drill rod needed frequent sharpening, the 6 foot diameter shaft provided limited space in which to work, keeping the gunpowder dry in a damp environment, the danger of anything falling down from the top of the shaft, the progressive darkness at the bottom of the well as the well was sunk deeper, the air becoming stale or foul at the bottom of the well, and the danger of using candles to provide light. 9

There is evidence of the use of this method on the walls of the well of Fort Loudoun. Figure 2 is a photo of the wall of the well at a depth of 8 feet. The outer half of the vertical hole used to blast the “bench” is clearly evident. Just below it to the left is the outer half of another vertical hole used to blast the bench in the next series. The horizontal line at the bottom of the first hole defines the fracture line from its blast.

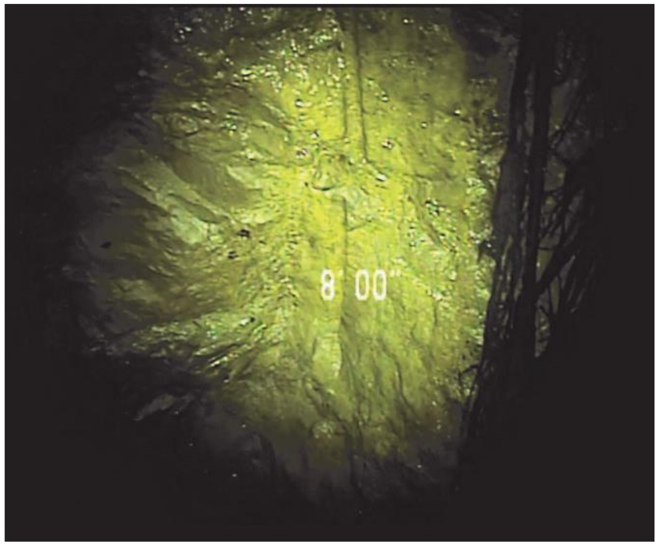


Figure 2
Wall of Well at 8-foot depth. Source: French & Indian War Foundation.

Christopher Heintz was paid a total of nearly £32 in April, July, August, and October 1757, during which time the well was sunk to a depth of about 90 feet. 10 In April 1758, Heintz was paid £25:18, £6:10, and £10 for work August through December 1758. 11

In mid-July it appears that money appropriated to build Fort Loudoun was running out, but the Governor and council ordered the work on the well to be carried on. By September 7th, the well was 103 feet deep without yet hitting a spring. 12

However, on September 22nd Heintz was paid £2.8 for “working in the barracks yard 16 days in blowing rock by digging and blasting 18 feet in his well”. (Note that this would have made the well 108 feet deep.)

On October 12th Smith reported that the miner was paid £25 with £20 more due. Although the Military Account does not appear to reflect these payments, this suggests that the well may have been sunk even deeper. 13

Note that a well six feet in diameter and 103 feet deep full of water would provide a storage reservoir of nearly 20,000 gallons of water even if it were merely used as a cistern for rainwater from the roofs of the two nearby barracks.

The Well Curb

There does not appear to be a record of the above ground appearance of the well at Fort Loudoun. According to secondary source information, wells dug between the 17th and 18th century were usually finished with what was known as a curb or lip and with necessary equipment to draw water. 14 In addition, sometimes the well was completely covered with wood planks provided with a trap door for access to the well. My research has not found any original accounts of curbs or coverings in French and Indian War era forts except for the wells at the French Fortress Louisbourg, In Nova Scotia, Canada. For these wells, evidence has been found for curbs in a number of original accounts and archeological evidence. 15

The great majority of the structural data established in these accounts dates after the British occupation of 1745-1749.The findings approximately establish an elevation of the lips (curbs) of from 1-3 feet (based on five wells). The lips were made of cut stone, were round and had an inside lining of boards. The well in the inner courtyard of the Kings Bastion had a height of “1 pied 8 poucesz” “(approximately 20 inches). Figure 3 is a photo of the reconstructed well in the courtyard of the King’s Bastion at Fortress Louisboung. However, there is no archeological evidence for or against the use of a well curb around Washington’s Well. Note the “gallows” which supports a pulley which would have been used to attach a rope and bucket.

Figure 3
Well in the King's Bastion, Fortress Louisbourg Photograph by author

Method of Drawing Water from the Well

There also does not appear to be a primary record of the manner in which water was drawn from the well at Fort Loudoun nor the level of the water in the well when finished. Therefore, one must look to other wells of the period for guidance as to what may have been used to get water from the well. One must also consider how the water requirements of a Fort influenced the method that the fort selected for drawing water.

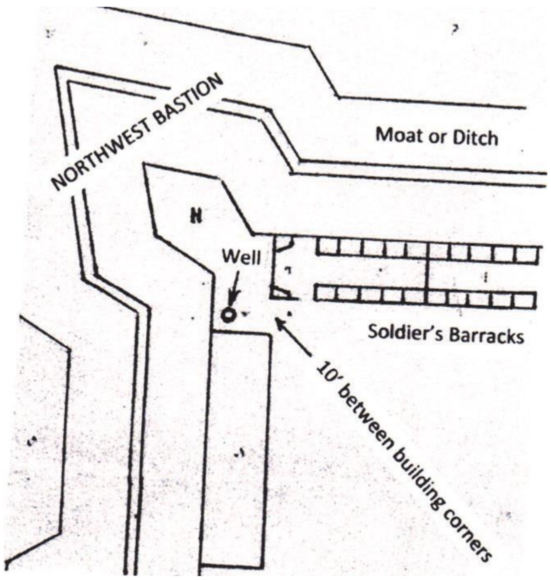
Most depictions of Washington's Well show either a hand pump or a windlass being used. Hand pumps of the kind usually depicted, however, were not invented until the 19th century. While the windlass may have been used at the time, we must consider the volume of water that is required to daily sustain a garrison of 400 men and the time required to draw this water from the well turning the crank of a windlass.

Another method used in the 18th century was to draw the water from the well using a "well-sweep" (sometimes called a "shadoof"). The well sweep consists of an upright frame on which is suspended a long pole about one fifth of its length from one end. On the end of the long length of the pole hangs a bucket while the short end is weighted to balance the long end with the bucket filled with water as depicted in Figure 4. There is a reference to one being outside a fort in Connecticut in 1794 and well sweeps are depicted in drawings of wells in French and Indian War forts in Pennsylvania by Charles Stotz.

Figure 4
Well Sweep at Fort Vancouver Photo courtesy of U.S. National Park Service

The advantage of the well sweep is that it minimizes and distributes the force needed to draw water. It was recently found that a well sweep could enable outputs of 10.3 to 34.6 gallons per minute.16 However, a close look at Washington's plans reveals that there is little room for a well sweep without impeding access to the northwest bastion. The well is less than three feet from the west curtain wall and less than three feet from the north wall of the west barracks. There is only about 10 feet between the corners of the two buildings (see Figure 5). Furthermore, as the water level in the well recedes, a longer pole and rope are required to draw water from the well. The only area left for the well sweep pole is between the north end of the northwest barracks and the west end of the north barracks. In that position the pole would block quick ingress and egress to the northwest bastion.

Figure 5



Northwest quarter of Fort Loudoun. Source: *George Washington Papers,* Series 4, 1756

The last method of drawing water used in this period is that of a gallows and pulley. This method requires a horizontal member above the well to which is attached a rope and pulley. While this method is the most physically demanding, more than one soldier can man the rope and considerably increase the rate of water draw near to that of the well sweep. The wells at Fortress Louisbourg used this system for drawing water as previously noted and shown in the photo of the well in the courtyard of the Kings Bastion, Fortress Louisburg, (Figure 3).

After the F&I War

After the French and Indian War, Fort Loudoun was used by the militia during the Indian uprising called Pontiac's War, during Dunmore's war, and during the Revolutionary War. After the threats of Indian attacks on the settlers ceased, the Fort began to deteriorate and fall into ruin. It appears that by 1843 the Fort had completely deteriorated. Loudoun Street was extended North through the Fort's South and North Walls and the land upon which the western half of Fort was built had other structures erected. When William Clark sold land to Joseph Baker in 1837,17 the deed specified that Clark, his heirs or assigns had the "right to lay pipes to the Fort Well and conduct water from the same." In 1842, William Clark sold a lot to Ettinger which was immediately adjacent to the land of Baker, with the proviso that "the right to water the premises herein conveyed as the same is reserved to said Clark in his deed to Joseph Baker"18 When Baker sold land to Casey in 1855, it carried "the right to use the water in the well on the lot occupied by Rev Graham (419 N. Loudoun St.) with the privilege of ingress and egress through the gate for that pur-pose."19 When Baker's lot (419 N. Loudoun) was conveyed to Wilson in 1860 it was "subject to the right of the owners of the adjoining lot to the use of the water in the well on the lot". 20

During the Civil War, the water in the well evidently merited a guard (presumably to keep the well from being poisoned). 21 Figure 6 is a drawing made by James Taylor during the Civil War which shows the appearance of the well with a soldier guarding it.

Figure 6
Sketch of the Fort Loudoun Well by J. Taylor, 1864. Courtesy of the Winchester-Frederick County Historical Society, Stewart Bell Jr. Archives, Winchester, VA

Thus, it appears that there was an ample supply of water from "Washington's Well" through the first half of the 19th century. After Winchester piped water to the area, the water usage from the well declined.

The 20th Century

There evidently was a good supply of water which could be obtained from the well from the Civil War period through the middle of the 20th century. The well is mentioned in several local histories. Cartmell writes that the well "afforded an ample supply of good water" and that as of that time was "in a good state". 22 Footnotes in Kercheval relate that the water in the well rose near the surface and in great floods of rain had been known to overflow and discharge a considerable stream of water. The overflow was believed due to a source of supply coming from a more elevated location "probably the slope of Little North Mountain." 23

In 1923 it was reported that "the water that the young women of the Fort Loudoun Seminary drink is from a well 103 feet deep. The well described was certainly "Washington's Well" since it is located adjacent to the Seminary.

In 1966, a newspaper article reported that "Washington's Well' "still has an inexhaustible supply of water. 24

Ann Hardy, who lived at 419 N Loudoun until her death, related in 1970 that when "Washington's Well" was dug, a spring was struck at 105 feet which fed the well and filled it to within four feet of the top where it had remained. She described the water as "clear, cold and simply delicious." 25 At present the water is 10-12 feet from the top of the well.

By the early 20th century, the well not only was relied upon for water but was recognized as a historic site in memory of George Washington and Fort Loudoun. A number of postcards show the well as it then appeared. One of these postcards is shown in Figure 7.

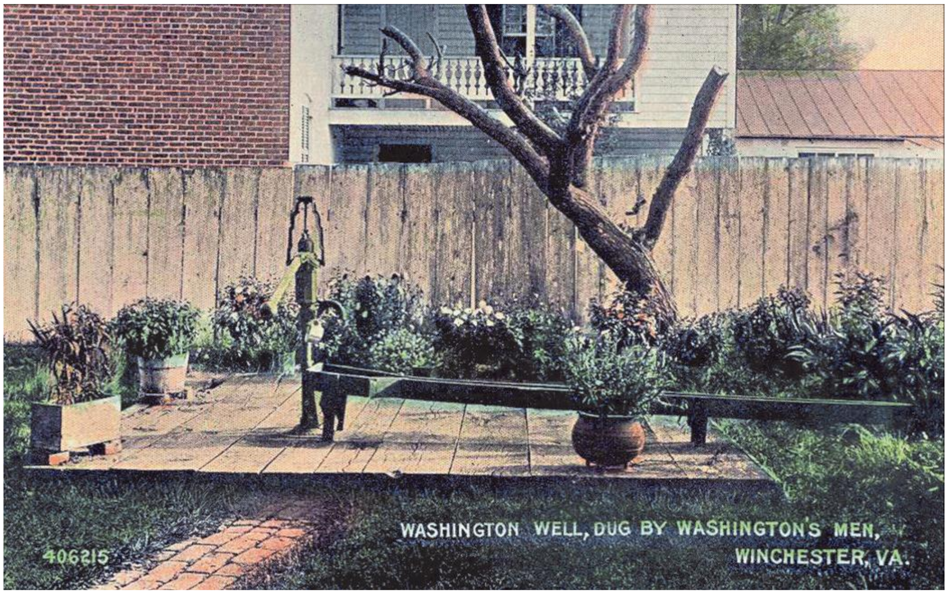


Figure 7
Postcard of Washington Well c. 1910. Courtesy of Winchester-Frederick County Historical Society, Stewart Bell Jr. Archives, Winchester. VA.

Analysis of the Water

While no record of the quality of the water drunk during the middle of the 20th century have been found it was thought prudent to test the water brought up through the present pump to acess the present quality of the water in Washington's Well. Tests were made on the water at the Laboratories of Virginia Tech in Blacksburg, Virginia.

The water testing covered 14 common contaminants, including Iron, Manganese, Sulfate, Hardness, Sodium, Copper, Nitrate, Arsenic, Fluoride, pH, Total Dissolved Solids, Coliform Bacteria, E. Coli Bacteria, and Lead.[i]

Results of these tests showed that the water had high dissolved solids (496 mg/L), high hardness (294 mg/L), low pH (6.6), and the presence of Coliform Bacteria and E. Coli Bacteria. Results also showed that the elemental and mineral contaminants were below the recommended limits for drinking water except for Iron, Cadmium, and Lead.

The high Iron content (1.16 mg/L) likely arises from the iron standpipe which can be seen severely corroded in photos taken in the well. Water pumped from the well after flushing the pipe showed reduced Iron content (0.43 mg/L) but still above the maximum for drinking water. The levels of cadmium and zinc were also reduced after flushing the pipe indicating that those two elements likely arose from the galvanization of the iron pipe.

The source of the Lead, however, is more of a mystery since the lead level was not reduced by flushing the pipe. One possible source is lead musket balls or bullets thrown in the well during the wars.

Revealing the Well

Mrs. Ann Hardy relates that when she was a little girl her grandfather caught her trying to fish through an opening in the top of the well and decided to cover it with railroad tracks laid side by side and sealed completely in concrete. For almost 100 years that concrete pad has covered the well and memories of the appearance of the well beneath it had faded when the French and Indian War Foundation acquired the property.

In May of 2013 the Foundation contacted Subsurface Technologies, Inc., of Rock Tavern, New York, to find out if it were possible to obtain photos within the well. They replied that it was possible and volunteered to do a video survey by lowering a video camera into the well and continuously recording images of the walls of the well as it was lowered.

To gain access to the well five 6-inch diameter holes were bored through the concrete slab with a diamond core bit thus revealing what was below the slab. The first hole was drilled 16 inches from the north edge of the slab in line with the pump. It was found that this position was in fact just within the north wall supporting the slab and revealed one of the railroad rails, mentioned above, partially blocking the hole that was drilled. Inspection of four subsequently drilled holes revealed that the iron railroad rails were positioned in an east-west direction about 12 inches to 16 inches apart and were supported by the east and west walls. The positions of these rails limited the locations that holes could be drilled.

It was found that the well is not centered beneath the concrete slab nor is it as large as the slab. There was a "shelf" about six feet below the slab sloping up to the west-ern support wall. The edge of this "shelf or ledge" appeared to be the beginning of the well going into the solid rock.

The five holes that were drilled allowed enough light to enter the cavity beneath the slab for photography and to enable estimation of the diameter of the well which appeared to be 6 feet 6 inches.

The video camera lowered through the most central hole recorded a 360-degree image of the well cavity above the water line. The camera was then lowered to record images of the walls of the well until it reached a depth of 75 feet. At this depth a debris field was encountered containing various objects and silt.

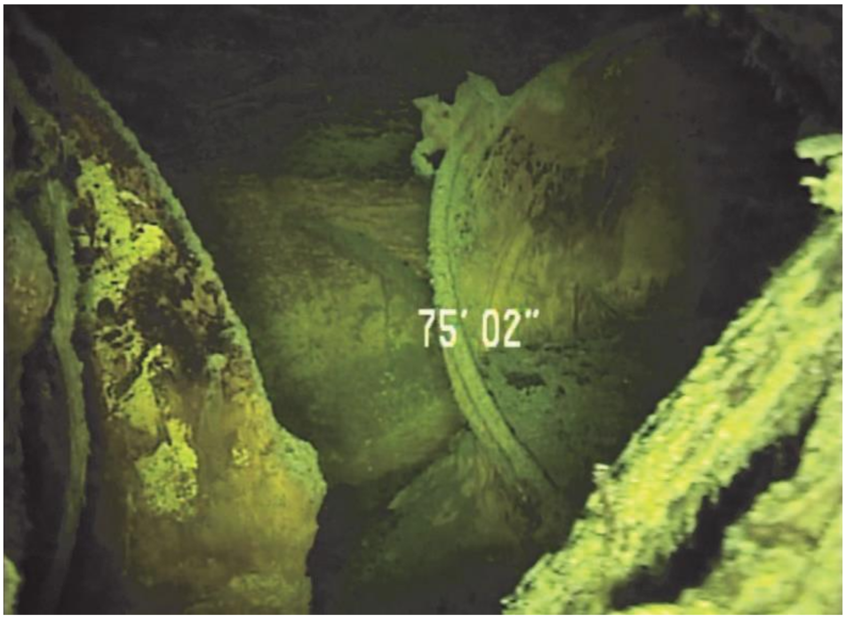


Figure 8
Top of debris in well at 75-foot depth. Source: French and Indian War Foundation

Since records indicate that the well was at least 103 feet deep it therefore appears that there is at least 28 feet of debris in the bottom of the well dating from 1757 to the beginning of the 20th century when the concrete slab was poured. Eighteen feet of sediment may have already accumulated by 1856 from information in a newspaper account.26 It appears from the photo that part of the debris may be the remains of a windlass such as depicted in the Taylor sketch, Figure 6.

Until the well is excavated the true depth will not be known with certainty. Nor will we know the treasures that remain hidden in its depths until we get to the bottom of it.

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3 C. Graham, V. Evans, "History of Mining: The Evolution of Shaft Sinking Systems (part2)," *Canadian Institute of Mining Magazine*, September-October 2007.

4 Charles Smith to Washington, Report on Tools at Fort Loudoun, May 16, 1758, *Papers of George Washington*, Library of Congress, 1741-1799: Series 4, General Correspondence.

5 Charles Smith to Washington, August 5, 1758, *Papers of George Washington*, Library of Congress, 1741-1799: Series 4, General Correspondence.

6 Ernest Spon, *Sinking and Boring Wells*, E. & F.N. Spon, London 1875, pp. 44-53.

7 Graham, Op cite.

8 Francis Donaldson, *Practical Shaft Sinking*, 2nd ed., McGraw-Hill Book Company, New York, 1912, pp. 66-71.

9 Maj.-Gen. Sir John Burgoyne, *Rudimentary Treatise on the Blasting and Quarrying of Stone*, John Weale, London 1849, p 66.

10 Charles Smith to Washington, Feb 23, 1758, *Papers of George Washington*, Library of Congress, 1741-1799: Series 4, General Correspondence.

11 Virginia Military Accounts Sept 1755-Dec 1758, *Papers of George Washington*, Library of Congress, 1741-1799: Series 5, Financial Papers.

12 Charles Smith to Washington, Sept 7, 1758, *Papers of George Washington*, Library of Congress, 1741-1799: Series 4, General Correspondence.

13 Charles Smith to Washington, Oct 12, 1758, *Papers of George Washington*, Library of Congress, 1741-1799: Series 4, General Correspondence.

14 Diderot, *Encyclopedia ou Dictionaire raisonne des Sciences*, Neufchatel, 1765, tome XIII, pp. 563-564.

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17 Frederick County Virginia Deed Book 66 page 306.

18 Frederick County Virginia Deed Book 71 page 58.

19 Winchester Virginia Deed Book 10 page 127.

20 Winchester Virginia Deed Book 11 page30.

21 Taylor, Sketch of Fort Loudoun Well 1864, Winchester Frederick County Historical Society, Stewart Bell Jr. Archives, Winchester, VA.

22 T. K. Cartmell, *Shenandoah Valley Pioneers and Their Descendants: A History of Frederick County, Virginia*, Chesapeake Book Company, 1908; 1963, p. 130.

23 Samuel Kercheval, *A History of the Valley of Virginia*, 1833, Sixth Edition, (Third Printing-Fourth Edition) C.J. Carrier Co., Harrisonburg Virginia, 1981, p. 70.

24 *Winchester Evening Star,* February 16, 1966.

25 *Winchester Star*, May 1, 1970.

27 *Baltimore Sun*, September 2, 1856.

[i] Water Quality Test Results for Washington's Well.