

6.0 ALTERNATIVE #2 – REPLACEMENT OF WELL A AT THE FENTON RIVER WELLFIELD

6.1 ASSESSMENT OF FEASIBILITY

This alternative contemplates replacement of Well A at the existing Fenton River wellfield for the purpose of increasing the yield from this supply to meet (in whole or in part) the identified water supply needs. This alternative would relocate the point of withdrawal for Well A to a replacement well (Well E) located a greater distance from the Fenton River. The intent of this replacement would be to utilize the new well during low streamflow conditions in the Fenton River. The University's available water may therefore increase during low-flow months as a result of this alternative, thus increasing system margin of safety during these periods. As stated in the 2011 *University Water Supply Plan*, the ability to provide some supply during the summer months when the Fenton River Wellfield would normally be shut down would restore margin of safety (MOS) in the short term but would not provide the increment of water believed necessary to supply the University's future committed demands or to supply to Mansfield Four Corners. As such, this alternative is being evaluated as a potentially supplemental component to be potentially implemented in conjunction with one or more of the remaining alternatives.

University graduate students have been conducting modeling of the aquifer at the Fenton River Wellfield under the guidance of Dr. Glenn Warner, P.E. of the Department of Natural Resources and Dr. Amvrossios C. Bagtzoglou of the Department of Civil and Environmental Engineering. The model utilized in the 2006 *Fenton River Study* has been updated with additional geophysical data. Specifically, additional geophysical studies have been performed near the Fenton River Wellfield utilizing ground-penetrating radar. The information gleaned from the ground-penetrating radar studies has led to a greater refinement of the bedrock surface in the model for the vicinity of the wellfield.

The geophysical work has indicated that a preferred area for a replacement well (to be designated as Well E) approximately 350 feet southwest from existing Well A, is roughly 13 meters (46 feet) deep to bedrock. While this depth is less than the stratigraphy at Well B, Well C, and Well D (70 feet, 63 feet, and 59 feet, respectively as reported in the 2011 *University Water Supply Plan*), it is still deeper than the well depth of Well A (28 feet). A new well located in this area would likely have a similar yield to the remaining wells at the wellfield (300 gpm or more).

In general, geophysical data show that some areas of the bedrock surface in the vicinity of the Fenton River Wellfield are deeper than originally thought, providing additional saturated thickness that could be beneficial to a new well location. The new geophysical information collected at the wellfield was incorporated into the model in late 2011 and early 2012, with modeling scenarios being programmed and simulated during spring 2012. The model was run under various scenarios to determine the potential impact on streamflows (and therefore fisheries habitat) in the Fenton River.

The updated model has been utilized to evaluate the relocation of Well A to several locations. The preliminary findings indicate the following:

1. A comparison of Scenario 10 and Scenario 1 as presented in the 2006 *Fenton River Study* using the updated model produces similar changes in streamflow to those same scenarios presented in the 2006 *Fenton River Study*. Scenario 1 presented a pumping condition based on existing well locations, while Scenario 10 presented a pumping scenario where Well A was relocated 250 feet southwest of its present location. The distance of 250 feet was initially evaluated because it would have allowed relocation without the need for a water diversion permit.
2. Relocation of Well A to points farther from the Fenton River appears to have limited benefit to instream flows. Less than a 0.1 cfs reduction in streamflow loss was observed as compared to Scenario 1 under the same operating scenario.
3. Preliminary results suggest that a management scheme that includes shutting down the Fenton River Wellfield from June 1 through August 15 of each year, and then alternating pumping of Well A and Well D from August 15 through November 1 of each year, would have more benefit to instream flows than relocating Well A.

Although the findings of the additional modeling are helpful for informing a discussion of potential future wellfield management scenarios, the University has already identified an option in its water supply plan that allows use of the Fenton River Wellfield throughout the summer as long as the existing operational protocols are followed, with the ability to operate Well D in September. Therefore, a benefit to margin of safety is not realized by shutting down the Fenton River Wellfield from June 1 through August 15 of each year, and then alternating pumping of Well A and Well D from August 15 through November 1.

Preliminary modeling results indicate that the alternating use of Well A and Well D following a significant rest period for the entire wellfield (June 1 through August 15 at a minimum) would result in a reduction of instream flow impacts of 0.4 cfs when compared to the continuous pumping of all wells under Scenario 1 from the 2006 *Fenton River Study*. As the wells were pumped at their registered rates for this modeling, additional benefits could be realized utilizing reduced rates. Future modeling and field efforts will focus on the following:

- Alternating pumping of Well A and Well D at lower rates following a summer shutdown period as noted above;
- Pumping Well B and perhaps Well C directly into the river to buttress instream flow while some combination of Well A and Well D are pumping; and
- A pumping test during a low-flow period to confirm the modeling results for the most promising management scenario.

Should these efforts confirm that the preliminary modeling prediction that alternating use of Well A and Well D following a significant rest period for the entire wellfield will have a sustainable reduction in instream flow impacts, then steps could be taken to revise the recommendations of the *Fenton River Study* utilized for the operation of the Fenton River Wellfield in the *Wellfield Management Plan* with the proper consensus from applicable regulatory authorities.

Replacing the function of Well A with Well E would not allow additional water to be produced at the Fenton River Wellfield. The wellfield would continue to be operated under the protocols

established by the 2006 *Fenton River Study* as outlined in the 2011 *Wellfield Management Plan* that specify that the wellfield should reduce withdrawals when flow in the river drops to six cfs and cease withdrawals when the flow in the river reaches three cfs as measured at Old Turnpike Road.

In addition, relocation of the withdrawals of Well A to Well E will result in a negligible benefit to instream flows.

Because the recent modeling efforts by the University have not demonstrated a benefit to margin of safety or streamflows in the Fenton River as a result of moving Well A, this alternative fails the test of project does not meet the project need.

Despite the fact that this alternative does not meet the purpose and need, the University may have the need to replace Well A in the future for operational flexibility or other reasons. Thus, the potential impacts are evaluated herein.

6.2 LAND USE AND ZONING

The Fenton River Wellfield is owned by the University of Connecticut. It is located in what is predominantly designated as a Conservation Area on *Conservation and Development Policies Map* of Connecticut. The Fenton River corridor is designated as a Preservation Area. The existence and use of public water supply wellfields within Conservation lands is consistent with the State plan provided that water is not directed to spur development in areas not designated as appropriate for public water service.

Similarly, the 2010 WinCOG Land Use Plan denotes the area of the Fenton River Wellfield as a Priority Preservation Area, with the Fenton River corridor being a High Priority Preservation Area. The WinCOG plan notes that this area is denoted as such because, at a minimum, it consists of preliminary and final aquifer protection areas (APAs) as delineated by the CT DEEP. Thus, the use of this area for public water supply purposes is consistent with the regional plan.

The 2006 Mansfield *Plan of Conservation and Development* designates the vicinity of the Fenton River Wellfield is a “Low Density Residential Area.” However, the Plan also recognizes that the vicinity of the Fenton River Wellfield is a significant interior forest tract and therefore a potential conservation area. Agriculture is not practiced at the Fenton River Wellfield.

The University completed the *East Campus Plan of Conservation and Development* in 2004. This plan notes that approximately two-thirds of the East Campus area (designated as the area bounded by Route 195, Old Turnpike Road, the Fenton River, and Gurleyville Road) is forested and managed by the College of Agriculture and Natural Resources as the 440-acre Fenton Forest Tract. The Plan designates the area in the vicinity of the Fenton River Wellfield as a Preservation Area to protect the large contiguous forest parcel near the wellfield and to protect the water quality recharging the wellfield and draining to the Willimantic Reservoir downstream. The implication is that the use of the Fenton River Wellfield is consistent with the designation of Preservation Area in the *East Campus Plan*.

The *East Campus Plan* recommends that development be avoided within the Preservation Area. Maintaining existing agricultural facilities and continuing forest management and environmental education activities are allowable. In addition, renovations and/or facility upgrades to existing

structures to accommodate federal requirements and guidelines are allowed. The construction of a new well and an access road would have a minimal development footprint and is not the type of development that is typically regulated in land use plans (i.e. residential, commercial, industrial, or institutional). The overall use of the parcel (i.e. public water supply) is believed to be consistent with both the *East Campus Plan* and the *Conservation and Development Policies Plan of Connecticut*.

6.3 SOCIOECONOMICS

The socioeconomic impact of this alternative would be similar to that of the no action or no-build alternative. A very small socioeconomic benefit would be realized under this alternative since the University would hire contractors to perform clearing, install the new well and associated pipelines, and likely to replace the old 10-inch diameter water main leading up Horse Barn Hill from the wellfield.

6.4 COMMUNITY FACILITIES AND SERVICES

The construction of Well E would require clearing, pipeline installation, and construction of an access road off the existing access road at the Fenton River Wellfield. The Connecticut Forest and Park Association has noted that the Fenton River Wellfield is part of a parcel with a conservation restriction through the association. This area is used for passive recreation and has limited vehicular access that provides scenic hikes along the Fenton River unobstructed by vehicular traffic.

The new well would be located landward from the Nipmuck blue-blazed trail in this area, which is a State-designated greenway. The UConn Forest would continue to be Preservation land as noted by the 2004 *East Campus Plan of Conservation and Development* and additional development would not occur on the parcel. The siting and design of improvements to support construction of Well E could be conducted in such a manner as to mitigate impacts to recreation in the area.

The impact to the remaining community facilities and services from this alternative would be similar to that of the no action or no-build alternative. One difference is that there could be a minimal construction period impact to educational facilities located along Horse Barn Hill Road during the replacement of the 10-inch diameter water main leading to the campus. However, this construction period impact would be both minimal and temporary.

6.5 AESTHETIC AND CULTURAL RESOURCES

According to the 2006 *Plan of Conservation and Development* for the Town of Mansfield, the Fenton River Wellfield is not located in an area of historical or archaeological resources. The State Historic Preservation Officer and the State Archaeologist have been included in the scoping process; neither has raised concerns for this site.

The Fenton River Wellfield is an area of aesthetic and visual resources associated with mature forest and scenic views of the Fenton River. A minimal impact to aesthetic and visual resources would be realized in the vicinity of wellfield due to the creation of a new well. The finished

infrastructure would be similar to the existing infrastructure at the Fenton River Wellfield. Such a project may also afford the opportunity to perform rehabilitation of the exteriors of other buildings at the wellfield.

Impacts during the construction period could include the presence of construction equipment and the fencing off of certain areas to prevent unauthorized access to the work area. These impacts would be minor and temporary.

6.6 PUBLIC WATER SUPPLY

Replacement of Well A may provide for additional system flexibility for the operation of the Fenton River Wellfield such that it provides a benefit. Well replacement would not increase the University's water system MOS and would not have a significant benefit to instream flows in the Fenton River.

6.7 OTHER PUBLIC UTILITIES AND SERVICES

6.7.1 SANITARY SEWER

The effects to sanitary sewer services from this alternative would be similar to that of the no action or no-build alternative.

6.7.2 STORMWATER SYSTEMS, BRIDGES, AND CULVERTS

The effects on stormwater systems from this alternative would be similar to that of the no action or no-build alternative. Stormwater facilities at the Fenton River Wellfield are limited to a few cross culverts located on the paved access road leading to the vicinity of the treatment building and Well A. The installation of new or replacement water mains would need to be designed to avoid such culverts, but this would not be expected to be an issue, as the cross culverts consist of relatively small diameter pipes installed at shallow depth, while water mains are installed at a deeper depth.

6.7.3 ENERGY, ELECTRICITY, AND NATURAL GAS

Electrical service would be necessary to operate a new well and would need to be extended from existing lines at the Fenton River Wellfield. However, the existing Well A would be placed out of service, so the direct electrical impact from the new well would be minimal assuming a similar amount of pumping to existing conditions. The new pump house would have modern energy-efficient infrastructure installed that may result in less electrical usage than that at the existing Well A pump house (originally installed in 1927). The replacement of the 10-inch water main leading to the Main Campus would need to avoid above-ground or underground electrical lines and any natural gas lines in the area. Natural gas lines do not exist at the Fenton River Wellfield.

6.7.4 TELECOMMUNICATIONS SERVICE

A new pump house installed at the Fenton River Wellfield would require telecommunication service to connect to the University's Supervisory Control and Data Acquisition (SCADA)

system for monitoring pumping rates, treatment, storage levels, water distribution, and water quality. This system is already installed at the Fenton River Wellfield, so the SCADA instruments located in the new pump house would need only to tie into the existing utility cable.

The installation of a new well at the Fenton River Wellfield would not result in a direct impact to other telecommunications infrastructure, although the replacement of the 10-inch diameter water main leading to the Main Campus could be conducted in areas near such utilities. Installation of water mains will need to temporarily avoid overhead lines during construction and permanently avoid existing underground lines. Construction-related traffic delays could impede field crews installing new services or repairing existing utility lines.

6.8 TRAFFIC, PARKING, AND OTHER TRANSPORTATION

Impacts to traffic, parking, and other transportation from the installation of a new well at the Fenton River Wellfield would be minimal. The only impact to traffic and other transportation at the wellfield site would be an increase in construction traffic along Gurleyville Road and minimal impacts to recreational biking near the wellfield. In addition, temporary impacts to traffic, parking, and other transportation could occur during the replacement of the 10-inch diameter water main along Horse Barn Hill Road. These impacts could be mitigated by performing the construction during the summer period when traffic and parking demands along this roadway are minimized.

6.9 WETLAND RESOURCES

The Fenton River Wellfield in the vicinity of Well E was evaluated by a wetland soil scientist. The area where Well E would be installed is located near wetlands, potential vernal pools¹, and an intermittent watercourse. Access to the site includes a paved utility easement from Gurleyville Road that enters the vicinity of the pumping station from the south, and an unpaved utility access road that approaches the pumping station from Well D to the southeast.

The intermittent watercourse flows down from Horse Barn Hill to pass under the paved access road and turns southeast towards a wetland area. A larger wetland area is located downstream (southeast) between the potential new well location and private property located to the south of the pumping station. A 25-foot by 75-foot puddle was observed near the shooting range at the southeastern edge of the 1,000-foot well radius; however, it did not appear to have significant wetland functions.

A number of wet depressions occur in the vicinity of the proposed well that appear to have the characteristics of vernal pools. The area just downstream from the paved access road has a potential vernal pool, and additional areas with potential vernal pools were also noted at a distance of 180 feet to 300 feet west of the existing pumping station. The wetland vegetation consists of red maple and American elm in the canopy with high-bush blueberry, spice bush,

¹ A vernal pool is defined as a temporary body of water occurring in a shallow depression of natural or human origin that fills during spring rains and snow melt and typically dries up during summer months. Vernal pools support populations of species specially adapted to reproducing in these habitats, including wood frogs, mole salamanders, fairy shrimp, fingernail clams, and other amphibians, reptiles, and invertebrates. Vernal pools lack breeding populations of fish.

winterberry, Japanese barberry, skunk cabbage, sensitive fern, and tussock sedge (in sunny areas) in the understory.

The final location of the proposed well and associated structures and infrastructure would need to be sited to avoid impacts to these wetlands and vernal pools.

Potential Direct Wetland Impacts

The area near Well E is located 50 feet or more away from wetland boundaries in accordance with DPH well siting regulations. However, inland wetland soils have been mapped to the south and southeast of existing Well A, and two areas that may contain vernal pools are also located in the vicinity of the paved access road leading to the pumping station. Wetland boundaries would need to be delineated in the field by a professional wetland scientist prior to considering a final location for Well E to ensure the well location would be more than 50 feet from the nearest wetland boundary. In addition, the potential vernal pools would require further study during the spring months to determine functions and values prior to considering a final location for Well E.

A potential replacement of the 10-inch diameter water main from the wellfield to the campus would pass beneath two intermittent watercourses and one potential wetland area based on soils mapping. The intermittent watercourses are small and can likely be avoided through the use of directional drilling techniques. The potential wetland area is located in an agricultural field east of Horse Barn Hill. This area is unlikely to support wetlands with significant functions and values.

Potential Drawdown Impacts

The timing and magnitude of drawdown impacts change based on the location of a well in proximity to nearby wetlands. The Fenton Wellfield is typically shut down during the summer months under current management protocols. The creation of a management scenario that allows for additional summertime pumping would result in an extension of drawdown impacts in the vicinity of these riparian wetlands.

Wetlands were noted along an intermittent stream that passes beneath the paved utility access road and to the south of the proposed area for installing Well E. Since Well A is currently located near the river, it is likely that existing wetland impacts due to pumping at this location are relatively minimal. The installation of a new well closer to this wetland corridor could have greater drawdown impacts, resulting in a slight to moderate impact to wetlands depending on the final location of Well E.

Vernal pools located in sand and gravel soils are at a higher risk of dewatering from the use of production wells than vernal pools located in soils with less hydraulic conductivity. Dewatering would potentially occur during the spring months when withdrawals from the Fenton River Wellfield are typically not restricted by the low-flow protocols in the University's *Wellfield Management Plan*. The nearest potential vernal pool area to Well A is located approximately 300 feet to the southwest. Assuming that this potential vernal pool complex indeed consists of vernal pools, installing Well E could potentially have greater impacts on this potential vernal pool complex than existing Well A unless Well E was installed more than 300 feet away.

The final location of a well and associated structures and infrastructure would need to be sited to avoid significant drawdown impacts to the nearby wetlands and vernal pools, if they are confirmed to exist..

6.10 BIOLOGICAL ENVIRONMENT

The 2004 *East Campus Plan of Conservation and Development* notes that the Fenton Forest Tract surrounding the Fenton River Wellfield is the largest contiguous forest parcel in the entire University system. Secondary growth upland central hardwoods dominate both the tract and the region. Upland vegetation near the Fenton River Wellfield is predominantly drought-tolerant and consists of mixed oaks, hickories, white pine, and Eastern hemlock in the canopy. Black birch saplings, mountain laurel, low-bush blueberry, and princess pine dominate the understory. The area is considered to be excellent wildlife habitat and a significant wildlife corridor.

The oldest timber stands (60 to 105 years old at the time of the study) are centrally located or found near the Fenton River. These areas, including the Oguswitz Meadow, were considered to be significant and thus designated as special forest lands. The proposed location for Well E is located near the edge of one of these special forest tracts. Thus, final location of Well E would need to be reviewed prior to construction by faculty of the Department of Natural Resources and the Environment to avoid impacts to these forest tracts.

The construction of Well E would require clearing and pipeline installation. The NDDDB was contacted for a review of potential State-Listed species on or within the vicinity of the Fenton River Wellfield. The correspondence from the NDDDB reported that American kestrel (threatened) and Wood Turtle (special concern) are located within the vicinity.

As the NDDDB is updated every six months, the NDDDB recommends that another NDDDB review occur prior to the start of a project if it does not occur within 12 months of the date of the NDDDB review letter.

6.11 INLAND FISHERIES

The Connecticut DEEP fisheries staff are supportive of the University's efforts to curtail pumping at the Fenton River Wellfield as outlined in the 2006 *Fenton River Study* and the 2011 *Wellfield Management Plan*. Since this alternative does not create a new well, but rather relocates an existing well, the relocation of Fenton River Wellfield Well A will have no additional impacts on fisheries resources in the Fenton River provided that the University continues to abide by the protocols set forth in the above documents. Specifically, the low-flow protocols require a reduction of withdrawals at streamflow levels (as measured at the USGS gauging station on the Fenton River at Old Turnpike Road) between six cfs and three cfs, and eventual cessation of wellfield withdrawals at three cfs.

University graduate students have been conducting additional modeling of the aquifer at the Fenton River Wellfield under the guidance of Dr. Glenn Warner, P.E. of the Department of Natural Resources and Dr. Amvrossios C. Bagtzoglou of the Department of Civil and Environmental Engineering. The modeling results have indicated that the relocation of the point of withdrawal from Well A farther from the Fenton River appears to have limited benefit to

instream flows. Less than a 0.1 cfs reduction in streamflow loss was observed as compared to Scenario 1 in the 2006 *Fenton River Study* under the same operating scenario.

It is arguable that a 0.1 cfs benefit to instream flows would be imperceptible to fish living in the river. Given the marginal benefit to instream flow shown by the preliminary modeling, it is believed that the replacement of Well A would provide a negligible benefit to fisheries habitat.

Construction related impacts to fisheries in the Fenton River associated with this alternative could be avoided through the use of best management practices for sedimentation and erosion control.

6.12 WATER QUALITY AND STORMWATER MANAGEMENT

6.12.1 SURFACE WATER RESOURCES

The Fenton River Wellfield lies adjacent to the Fenton River (basin #3207). The surface water in the Fenton River is classified as B/AA, indicating that is suitable for fish and wildlife habitat, recreation, navigation, and industrial and agricultural water supply. This classification begins downstream of the former landfill located on Meadow Road in Willington. The State's long term goal is to improve surface water quality in the Fenton River to class AA, meaning that the surface water in the river could be used for public water supply. This classification goal is likely related to the presence of the Willimantic Reservoir that is used by Windham Water Works (WWW) downstream. All tributary streams to the Fenton River throughout East Campus are designated as class AA indicating that they are of high quality.

The Fenton River in the vicinity of the Fenton River Wellfield has a fish consumption advisory and is listed as not meeting the requirements for aquatic life in the Connecticut 305b Assessment. The reasons provided for the river not meeting the requirements for aquatic life indicate that flow alteration and baseflow depletion from groundwater withdrawals is causing the river to not meet the standard of designated use.

Replacement of Fenton River Wellfield Well A will not have an impact on the surface water quality classification of the Fenton River. The relocation of the well will not result in the creation of new pollution sources, nor will it result in additional withdrawals from the aquifer. In addition, construction period impacts to surface water quality are not expected, as best management practices would be used to prevent construction debris or sediment from depositing in the Fenton River.

6.12.2 GROUNDWATER RESOURCES

The Fenton River Wellfield is designated as an area of high groundwater quality (Class GAA) designated for existing or proposed public drinking water supplies or their contributing watersheds. The installation of a new well at the Fenton River Wellfield and associated water mains is consistent with this classification and would not lead to a deterioration of groundwater quality.

Homeowners located along Codfish Falls Road utilize private wells to provide water supply to their properties. The installation of a new well at the Fenton River Wellfield and associated water mains is not expected to cause any impact to the water quantity available from those wells or the

water quality. The overall amount of water withdrawn from the Fenton River Wellfield would be lower than it was prior to the establishment of the Fenton River Wellfield operating protocols, and no impacts occurred at that time. Additionally, most private wells are drilled into the underlying fractured bedrock aquifer, which is not influenced by pumping of the Fenton River wells. If private gravel packed or dug stratified drift wells were identified near the wellfield, these wells would need to be monitored during any pumping tests to determine the potential level of impact. However, most areas served by wells are located relatively distant from the proposed well locations such that this is not expected to be a concern.

6.12.3 STORMWATER MANAGEMENT

Stormwater facilities at the Fenton River Wellfield are limited to a few cross culverts located on the paved access road leading to the vicinity of the treatment building and Well A. The installation of new or replacement water mains would need to be designed to avoid such culverts, but this should not be an issue as the cross culverts consist of relatively small diameter pipes installed at shallow depth, while the water mains will be installed at a deeper depth. Finally, the use of best management practices related to sedimentation and erosion control would be expected to reduce stormwater quality impacts during the construction period.

6.13 FLOOD HAZARD POTENTIAL

The Fenton River has a 1% annual chance floodplain mapped in the vicinity of the Fenton River Wellfield. This floodplain does not contain defined base flood elevations. While the potential locations for Well E do not appear to be within the 1% annual chance floodplain of the Fenton River, the eventual location of Well E would require survey to determine if the new pump house would be located within the floodplain. If so, the pump house would need to be flood proofed such that the floor elevation is at least one foot above the estimated flood elevation. The proposed location for Well E would also need to comply with Connecticut DPH requirements for distance from annual high water marks. Stream channel encroachment lines (SCELs) are not mapped along the Fenton River.

6.14 PHYSICAL ENVIRONMENT

6.14.1 TOPOGRAPHY

The topography of the area in the vicinity of the Fenton River Wellfield is fairly flat and roughly 300 feet above sea level. Horse Barn Hill rises swiftly to the west over 400 feet in elevation to a maximum elevation of 703 feet. The hillside increases at an average of approximately 15% up to Horse Barn Hill Road, but is more than 45% steep in places. The location for Well E would need to be in an area that is generally higher than the surrounding topography such that it will not be subject to direct runoff in order to comply with Connecticut DPH well siting requirements.

6.14.2 SURFICIAL GEOLOGY

The surficial geology of the Fenton River Wellfield includes the following types of surficial geology based on the *Quaternary Geologic Map of Connecticut and Long Island Sound Basin* published by the USGS in 2005:

- Floodplain alluvium overlying sand and gravel (post-glacial deposits); and
- Gravel deposits from a related series of sediment-dammed ponds (Mount Hope-Fenton River deposits).

These coarse-grained stratified drift deposits have a high transmissivity and can yield a significant amount of water. As noted in the 2011 University *Water Supply Plan*, average pumping rates for Well A, Well B, Well C, and Well D are 327 gpm, 532 gpm, 271 gpm, and 360 gpm respectively when those wells are operational. The 2011 University *Water Supply Plan* also estimated safe yields for each of the four wells (200 gpm, 465 gpm, 405 gpm, and 0.35 mgd) for Well A, Well B, Well C, and Well D, respectively. The safe yield of the wellfield was estimated in this document at 1.56 mgd, a rate higher than the registered withdrawal rate of the Fenton River Wellfield.

The University prepared a groundwater model of the Fenton River Wellfield and surrounding area as part of the Fenton River Study. The reader is referred to the 2006 *Fenton River Study* for a description of the previous model. Additional geophysical work has been performed since 2006 that has refined the bedrock surface used in the model. This work has indicated that a preferred area for Well E approximately 350 feet southwest from existing Well A is roughly 13 meters (46 feet) deep to bedrock. While this depth is less than the stratigraphy at Well B, Well C, and Well D (70 feet, 63 feet, and 59 feet, respectively as reported in the 2011 University *Water Supply Plan*), it is still deeper than the well depth of Well A (28 feet). A new well located in this area would likely have a similar yield to the remaining wells at the wellfield (300 gpm or more).

Areas located to the west of the Fenton River Wellfield are mapped as glacial till. These areas are steeply sloped leading up to Horse Barn Hill.

Soil types in the vicinity of the Fenton River Wellfield include the following:

- Catden and Freetown soils, a very-poorly drained deep organic soil located in the wetland between Well A and Well D;
- Hinckley gravelly sandy loam (15 to 45 percent slopes), an excessively drained Glaciofluvial soil located along the slope of Horse Barn Hill and the hill between Well A and Well D;
- Occum fine sandy loam; a well-drained alluvial floodplain soil;
- Pootatuck fine sandy loam, a moderately well-drained alluvial floodplain soil;
- Rippowam fine sandy loam, a poorly-drained alluvial and floodplain soil; and
- Udorthents-Pits complex (gravelly), a moderately well-drained soil that was influenced by a former gravel operation between Well A and Well D such that the original soil type cannot be conclusively determined.

The proposed Well E would most likely be installed in soils classified as Hinckley gravelly sandy loam near the northern terminus of the Udorthents-Pits complex.

6.14.3 BEDROCK GEOLOGY

The bedrock geology underlying the Fenton River Wellfield includes the Lower Member of the Bigelow Brook Formation, the Brimfield Schist, and the Hebron Gneiss according to the 1985 *Bedrock Geologic Map of Connecticut*.

- The Lower Member of the Bigelow Brook Formation is comprised of gray, medium-grained granofels. This formation occupies the area of the wellfield near Well A, Well B, and Well C.
- An intrusion of what may be the Brimfield Schist trends northeast from the area between Well A and Well D. The Brimfield Schist is a gray, rusty-weathering, medium- to coarse-grained inter-layered schist and gneiss.
- The Hebron Gneiss is an inter-layered dark-gray schist and greenish gray, fine- to medium-grained calc-silicate gneiss. This bedrock type is present in the vicinity of Well D.

Bedrock in the vicinity of the wellfield generally strikes southwest to northeast and dips 25 degrees or more to the northwest. A fault line passes generally east to west through the Fenton River Wellfield approximately halfway between Well A and Well D. This fault line is not defined but is located along the contact between the Hebron Gneiss and the remaining two formations.

The Fenton River Wellfield withdraws water from the stratified drift aquifer and has done so since 1927. Because water would not be withdrawn from the Fenton River Wellfield at rates higher than its registered diversion, impacts to nearby private wells in the bedrock aquifer are unlikely.

6.15 AIR QUALITY AND NOISE

The installation of a new well at the Fenton River Wellfield and associated new water mains and utility work will not result in a degradation of air quality. The new pump house would have electric heat and would receive emergency power from the existing centrally-located generator at the wellfield.

Minor, localized, temporary construction impacts to air quality in the vicinity of the wellfield are expected and unavoidable. For example,

- Additional construction traffic would be realized on Horse Barn Hill Road and Gurleyville Road resulting in an increase in vehicular emissions near the site. Overall, these emissions are expected to have a minimal impact on air quality; and
- Construction activities would be expected to generate a minimal amount of fugitive dust and mobile source emissions. Such sources of dust are attributed to construction vehicle disturbance during hauling, loading, dumping, and bulldozing on any areas of proposed development or construction. Meteorological conditions, the intensity of the activities, and the soil moisture content govern the extent to which particles will become airborne.

The installation of a new well at the Fenton River Wellfield and associated new water mains and utility work would not result in any long-term noise impacts. The potential location for Well E is far removed from any residences (the nearest residence is located approximately 1,100 feet to the northeast on Codfish Falls Road) through dense forest. Given the distance between the proposed construction area and sensitive noise receptors, no significant construction-related noise impacts are expected in this area. While temporary impacts associated with the construction of new water

mains would be realized along Horse Barn Hill Road, the majority of construction activities associated with this alternative will occur during daylight hours.

6.16 SOLID WASTE, HAZARDOUS MATERIALS, & POTENTIAL POLLUTION SOURCES

The potential area identified for Well E is located in an area with few potential pollution sources. No major spills or releases have been identified at or near the wellfield based on information readily available from Connecticut DEEP. The following potential pollution sources have been identified in the general vicinity of the Fenton River Wellfield.

- The Fenton River Wellfield is located downstream from a closed mixed waste landfill that was located adjacent to the Fenton River in Willington. Surface water quality downstream from this landfill is classified as B quality, indicating that pollutants may or have the potential to be leaching into the surface water;
- Groundwater contamination at Mansfield Four Corners could drain to Mason Brook, a tributary to the Fenton River upstream of Old Turnpike Road;
- Agricultural wastes are temporarily consolidated on Horse Barn Hill Road upstream from unnamed tributaries to the Fenton River that pass near the Fenton River Wellfield. These wastes are frequently hauled to the new Compost Facility located near the Depot Campus. The frequent transport significantly reduces the amount and the duration of any agricultural wastes temporarily stored in the Horse Barn Hill area.
- The University has a generator with a fuel tank at the Fenton River Wellfield. This tank would likely be located within 200 feet of the new well;
- The University stores water treatment chemicals in the vicinity of the proposed well;
- The University operates a Main Accumulation Area (MAA) off Horse Barn Hill Road in the bio-behavioral science complex. The MAA is used for the temporary (less than 90-days) storage of chemical (RCRA hazardous waste), low-level radioactive, and biological/medical waste generated by the University's academic, research, and teaching laboratories and other operations. Surface drainage near this facility drains to Roberts Brook in Valentine Meadow and reaches its confluence with the Fenton River upstream of Fenton River Well D and downstream of existing Fenton River Well A. As Roberts Brook is a perennial stream associated with surface drainage, it is not considered a conduit to groundwater and the MAA is therefore beyond the Level A aquifer protection area (APA) for the Fenton River Wellfield. Given the proximity of the proposed location of Well E to Well A, it is considered unlikely that the Level A APA for the wellfield would change to include this facility. The MAA has never experienced a release of any of its stored materials, is properly equipped with secondary containment, and is managed and regularly inspected in accordance with all applicable regulations.
- A firing range was previously located at the Fenton River Wellfield approximately 1,000 feet southeast of Well A. Lead shot from this operation is considered to be a potential pollution source.

Out of the above list, the only pollution sources with any potential to affect Well E are the fuel tank, water treatment chemicals, and lead shot from the former firing range:

- The Connecticut DPH notes that a separation distance of 200 feet is required from any liquid fuel storage tank or piping. However, since this fuel source is for the purpose of providing emergency power generation to the wellfield, Connecticut DPH allows for secondary containment to be placed around the tank to prevent ground water contamination when the tank is within 200 feet of the well.
- Water treatment chemicals are not regulated by the DPH in regards to well siting. However, the University's contract operator will continue to be required to comply with the University's plan for waste minimization and disposal of hazardous materials.
- Finally, the distance between the firing range and the proposed Well E is similar to the distance from existing Well A, and Well E would be drawing water from deeper in the aquifer than Well A, such that it is unlikely that Well E would be affected by leftover lead shot. In addition, McLean and Bledsoe (1992) notes that lead is one of the least mobile metals in soil and reacts with clays, phosphates, sulfates, carbonates, hydroxides, and organic matter such that the solubility is quickly reduced. At pH values above 6, lead is either adsorbed on clay surfaces or forms lead carbonate. Given the sandy soil at the Fenton River wellfield, it is unlikely that the lead shot has percolated into the deeper aquifer.

The potential location for Well E would be located in an area with limited vehicular traffic such that routine drips and spills from passing traffic or traffic accidents would be minimal. In addition, the University utilizes sand instead of salt to provide winter access to this area. Therefore, potential impacts from traffic-related pollutant sources are expected to be minimal.

A certain amount of construction and demolition-related waste would be generated by the project. For example, approximately 4,000 feet of an old 10-inch diameter cast-iron water main leading up to the Main Campus would be replaced. Disposal of these wastes would be handled in accordance with applicable solid waste statutes and regulations.

6.17 OTHER PROJECT IMPACTS

6.17.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

The implementation of this alternative would not result in any unavoidable adverse environmental impacts.

6.17.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The development of the well and its connection to existing transmission systems would utilize nonrenewable resources during the construction and implementation (i.e., construction supplies, fuel, etc.). Since these resources cannot be reused, they are considered to be irreversibly and irretrievably committed. Specifically, the University would contract the following:

- Clearing
- Well drilling and development
- Access road construction
- Installation of well connection piping
- Installation of a new eight-inch transmission main to connect the new Well E to the existing clearwell at the Fenton River Wellfield

- Replacement of the old 10-inch diameter water main leading up Horse Barn Hill from the wellfield

6.17.3 CUMULATIVE IMPACTS

Cumulative impacts are those that result from the incremental impact of the proposed action when added to other past, present, or reasonably foreseeable future actions. Cumulative impacts associated with the alternative include the following:

- Clearing
- Well drilling and development
- Access road construction
- Installation of well connection piping
- Installation of a new eight-inch transmission main to connect the new Well E to the existing clearwell at the Fenton River Wellfield
- Replacement of the old 10-inch diameter water main leading up Horse Barn Hill from the wellfield

6.17.4 MITIGATION OPPORTUNITIES TO OFFSET ADVERSE ENVIRONMENTAL IMPACTS

The implementation of this alternative is not expected to have long-term adverse environmental impacts. Only temporary environmental impacts are anticipated as related to construction.

Direct wetland impacts are expected to be minimal, as the new well would be located at least 50 feet from wetland boundaries and at least 100 feet from the edges of vernal pools; and the transmission main connecting Well E to the clearwell would also be located those distances away from wetlands and vernal pools. The Fenton River Wellfield model would be utilized to determine the magnitude of drawdown in wetlands near Well E and manage withdrawals accordingly.

American kestrel (threatened) and Wood Turtle (special concern) are located within the vicinity. The recommended construction-related mitigation measures for reducing potential impacts to American kestrel include the following:

- Engaging a qualified person to conduct a field study to determine the presence of this species in the vicinity of potential project areas;
- If the species is found, establish a buffer around the nesting area to minimize disturbance; and
- If establishing a buffer is not possible, then work shall not be conducted during the nesting season (February through July) in the vicinity of this species.

The recommended mitigation measures for reducing potential impacts to Wood turtles include:

- Silt fencing shall be installed around the work area prior to construction to act as a barricade;
- After the fencing is installed, a sweep of the work area shall be conducted by qualified personnel to look for turtles;
- Workers should be advised of the potential presence of turtles and given descriptions of the species;

- Turtles discovered in the work area shall be moved, unharmed, to an area immediately outside of the fenced area and positioned in the same direction it was originally walking;
- No vehicles or heavy machinery shall be parted in any turtle habitat;
- Work conducted during early morning and evening hours shall occur with special care not to harm basking or foraging individuals;
- All silt fencing shall be removed after work is completed and soils are stable so that reptile and amphibian movement between uplands and wetlands is not restricted.

The use of air pollution devices on construction equipment and other forms of controls that reduce the impact from fugitive dust emissions would be utilized during construction to minimize impacts to air quality. The proper phasing of construction will further minimize the length of time that soil remains exposed to wind and water. Activities would be conducted in accordance with proper protocols and regulations, and no washings will be directed to storm drainage.

The Town of Mansfield is undergoing a detailed revision of its regulations and has proposed an overlay zone to restrict development in areas of public water supply. The proposed overlay zone will restrict development within potential pipeline areas and thus be consistent with State, regional, and local planning. This effort will include the following:

- Implementation of overlay zones in the Town of Mansfield to reduce future development density and creation of impervious surfaces along potential pipeline routes; and
- Application of low-impact design standards to mitigate impacts to stormwater runoff in new developments.

6.18 EVALUATION OF PROJECT COSTS

6.18.1 LAND ACQUISITION AND EASEMENT COSTS

The implementation of this alternative would not require any easements or land acquisition.

6.18.2 COSTS TO IMPROVE EXISTING INFRASTRUCTURE

Costs related to improving existing infrastructure are not anticipated. The new water main through Horse Barn Hill is considered a new component of infrastructure.

6.18.3 CONSTRUCTION COSTS

Source-Related Costs

Because a specific well site has not been selected, planning level cost estimates are used for planning purposes. Cost elements include:

- Drilling of test borings, completion of informal yield tests, and water quality testing to select permanent well sites.
- Drilling and development of the production well.
- Completion of 120-hour aquifer pumping test for diversion permitting (if more than 250 feet from the original well location).

- Completion of 72-hour yield test for proving safe yield and appropriate water quality (can be coincident with other testing).
- Completion of 120-hour aquifer pumping test for Level A mapping (can be coincident with other testing).
- Construction of pump house.
- Installation of pumps, discharge lines, and electrical service to the well pump.
- Installation of transmission pipes from well to clearwell
- Grading and improvements for new access road.
- Setting Well A to “emergency status”.

The probable source-related costs for installing Well E are presented in Table 6.18-1.

**TABLE 6.18-1
Estimates of Source-Related Cost for Well E**

Item	Probable Cost
Drilling of test borings, completion of informal yield tests, and water quality testing to select permanent well sites.	\$40,000
Drilling and development of production well (includes pump and discharge lines)	\$100,000
Completion of 120-hour aquifer pumping test for diversion permitting & Level A mapping	\$50,000
Completion of 72-hour yield test for proving safe yield and appropriate water quality (can be coincident with other testing)	\$20,000
Well house at wellhead (includes structures, meters, piping)	\$50,000
Installation of transmission pipes from well to clearwell	\$100,000
Grading and improvements for new access road	\$5,000
Totals	\$365,000

Pipeline and Associated Water Mains

This alternative assumes that a 12-inch diameter water main would be extended from North Hillside Road (after extension) to Mansfield Four Corners, and that the 10-inch diameter water main from the Fenton River Wellfield to the 5.4 million gallon (MG) reservoir would be replaced. In addition, the following water main components are assumed:

- Bends – one located per 1,000 feet of pipeline;
- Isolation valves – one located per mile of pipeline;
- Flush hydrants – one located per mile of pipeline;
- Air release – one located per mile of pipeline; and
- Fire hydrants – four included (on Route 44).

The cost to install the pipeline detailed above is estimated at \$1,952,000. If the University chose not to replace the 10-inch diameter water main to the 5.4 MG reservoir, the cost to install a new 12-inch water main from North Hillside Road to Mansfield Four Corners is estimated at \$331,500.

6.18.4 SUMMARY OF POTENTIAL MITIGATION ACTIVITIES AND COSTS

As noted above, several mitigation opportunities have been identified for this alternative to minimize or offset adverse environmental impacts. The following will have costs that are already incorporated into other components of the alternative described above:

- Coordination with various local departments, commissions, and committees regarding the proposed pipeline (design and regulatory costs);
- Locate new fire hydrants to not be immediately in front of historic properties (pipeline costs);
- Designs that hang pipe on bridges or include directional drilling to prevent direct wetland impacts (pipeline costs);
- Construction occurring in the summer whenever possible to minimize traffic impacts near the University (pipeline costs);
- Performing a biological survey for endangered, threatened, or special concern species during the design phase to establish buffers and construction timetables to minimize the impact to these species (design and regulatory costs);
- Performance of construction activities during daylight hours to minimize noise impacts (pipeline and other construction costs); and
- Continued adherence to the University's Wellfield Management Plan and water conservation policies, with potential incorporation of the new wells into the Wellfield Management Plan (internal University administrative costs).

Similarly, the zoning related work in the Town of Mansfield is funded and currently proceeding. Development of an overlay zone would be included in that effort. An allocation has been included specific to the overlay zone.

6.18.5 ANALYSIS OF PROBABLE CAPITAL COSTS

The costs described above are summarized in Table 6.18-2.

TABLE 6.18-2
Summary of Estimated Costs for Alternative #2

Item	Without Replacement of 10-inch Water Main	With Replacement of 10-inch Water Main
Wellfield investigation, development, and construction	\$365,000	\$365,000
Transmission pipelines	\$331,500	\$1,952,000
<i>Design/contingency (20% of above)</i>	\$139,300	\$463,400
Permitting and Other Approvals	\$52,875	\$52,875
Modification of Town of Mansfield land use regulations	\$10,000	\$10,000
Totals	\$898,675	\$2,843,275

Because this alternative does not provide additional water supply to the University and Mansfield, estimating a per-gallon cost of water produced is not applicable.

6.19 FINDING

Replacing the function of Well A with Well E would not allow additional water to be produced at the Fenton River Wellfield, nor would relocation result in a measurable benefit to instream flows. However, despite the fact that this alternative does not meet the purpose and need, the University may have the need to replace Well A in the future for operational flexibility or other reasons. Such a replacement is not expected not cause significant environmental impact.