10.0 EVALUATION OF NEW WELLFIELD(S) ALONG THE WILLIMANTIC RIVER

10.1 ASSESSMENT OF FEASIBILITY

Unlike an interconnection with an established supply source, the development of a new groundwater source cannot be evaluated with respect to existing available water. Instead, the ability to develop a particular yield from a new groundwater source is dependent upon available historical information from borings, monitoring wells, and site-specific studies. This data has been complied for each of four potential wellfields along the Willimantic River, two near Mansfield Depot (MD-1 and MD-3) and two near Eagleville Preserve (EP-4 and EP-5). Included in this assessment is recent work undertaken by the Town of Mansfield to analyze a number of potential groundwater sources along the Willimantic River. As summary of locations follows:

- Alternative #6A is potential wellfield MD-1, located on private property south of Route 44. Most of this property is currently used for agriculture.
- Alternative #6B is potential wellfield MD-3 located in River Park. The site is owned by the Town of Mansfield and is currently used for recreation.
- Alternative #6C is potential wellfield EP-4, located in the State-owned northern portion of Eagleville Preserve. This area is currently forested wetland.
- Alternative #6D is potential wellfield EP-5, located in the southern portion of Eagleville Preserve owned by the Town of Mansfield.

10.1.1 POTENTIAL WELLFIELDS NEAR MANSFIELD DEPOT (MD-1 & MD-3)

A number of historic and more recent publications have analyzed potential groundwater aquifers in the Mansfield Depot area. These are briefly summarized below.

1960s era USGS Water Resource Bulletin

The U.S. Geological Survey (USGS) report entitled *Water Resources Inventory of Connecticut, Part 2 – Shetucket River Basin* (1967) shows that the aquifer beneath the Willimantic River consists of coarse-grained stratified drift at the proposed well site (Plate B). This information was supported by the logs for two wells and two test holes along Route 44 in Mansfield Depot. One of the test holes was located on the parcel for MD-1, but no information was directly realized in the vicinity of MD-3 (Plate A). The mapped area is relatively wide and encompasses much of the river valley from the railroad tracks (to the northeast) southwest across the river in Coventry. The mapped saturated thickness at MD-1 reportedly exceeds 40 feet (Plate B), with a thicker area that exceeds 80 feet located immediately east of the parcel. The mapped saturated thickness at MD-3 reportedly exceeds 40 feet (Plate B).

Based on the mapping near each site, the average permeability of the deposits in the saturated section may range from 530 to 4,700 gallons per day per square foot (gpd/ft^2), equivalent to a

hydraulic conductivity range from 71 feet per day (ft/d) to 630 ft/d. Thick areas are believed capable of yielding more than 100 gpm to drilled screened wells (Plate B).

1978 Ground Water Availability Map

The 1978 *Ground Water Availability in Connecticut* map produced by the Connecticut Department of Energy and Environmental Protection (CT DEEP, formerly DEP) in cooperation with the USGS shows that the vicinity of the proposed well sites is underlain by coarse-grained stratified drift capable of yielding moderate to large amounts of water (50 to 2,000 gpm).

1986 Stratified Drift-Areas in Connecticut Map

The 1986 USGS *Ground-Water Yields for Selected Stratified-Drift Areas in Connecticut* map shows that the potential well sites are located in a stratified-drift area with a saturated thickness greater than 10 feet and thought to be capable of yielding moderate to large amounts of groundwater. The estimated long-term yield of the aquifer in this location is 3.5 million gallons per day (mgd) and assumes a distribution of approximately four wells per square mile of aquifer area (which stretches from Merrow to downstream of Route 275), including the Willimantic River Wellfield. Thus, the map suggests that an additional 1.5 mgd could be realized from the Willimantic River aquifer in the vicinity of MD-1 and MD-3.

2005 USGS Surficial Geology Mapping

The surficial geology at MD-1 is mapped on the 2005 *Quaternary Geologic Map of Connecticut* as floodplain alluvium overlying sand overlying fines. The depositional environment near MD-1 includes postglacial deposits from the Holocene epoch. The mapped area is bounded between the river and the next property located to the east at the terminus of Depot Road. The area surrounding the floodplain alluvium in Mansfield Depot and Coventry is mapped as sand and gravel overlying sand overlying fines ("Upper Willimantic River Deposits" resulting from a related series of sediment dammed ponds). The stratified drift deposits continue upstream and downstream along the river valley.

The surficial geology at MD-3 is mapped on the 2005 *Quaternary Geologic Map of Connecticut* as sand that formed stream terrace deposits. The depositional environment includes early postglacial deposits from the late Wisconsinan period and early Holocene epoch. The mapped area is bounded between the river and the railroad tracks and appears associated with the upper end of Eagleville Lake; the area north of the tracks is mapped as sand and gravel overlying sand overlying fines (Upper Willimantic River Deposits resulting from a related series of sediment dammed ponds), while the area near the Willimantic River is mapped as floodplain alluvium overlying sand overlying fines (post glacial, Holocene deposits). The stratified-drift deposits continue upstream and downstream along the river valley.

Floodplain alluvium is mapped at the existing Willimantic River Wellfield, and the depositional environments of the various areas are similar. However, the presence of fines at depth suggests that yields may be lower elsewhere along the river than they are at the Willimantic River Wellfield.

2008 Surficial Aquifer Potential Mapping

The 2008 *Surficial Aquifer Potential Map of Connecticut* compiled by the Connecticut Geological and Natural History Survey in cooperation with the CT DEEP shows that the proposed well sites are located in an area mapped as "Other Glacial Meltwater Deposits with lower potential yield." This suggests a relatively heterogeneous mix of stratified-drift deposits are located near the sites, with limited banding of coarse-grained, water-bearing materials. The data on this map was reprinted from the 1992 Surficial Materials map released by the USGS.

Department of Consumer Protection Private Well Logs

Well logs for private wells in Mansfield were obtained from the Connecticut Department of Consumer Protection for the period 1970 through 2010. While overburden stratigraphy on such logs is generally poor, the depths to bedrock on these logs can provide an excellent overview of bedrock elevations in the area. Logs found to be in the vicinity of the proposed well site were mapped in ArcGIS when reasonable accuracy was possible. Thirteen wells and test holes were mapped in the vicinity of the proposed well sites (including those mapped by the USGS in the 1960s-era *Water Resources Bulletin*).

The logs for private wells located on Route 44 and Depot Road upstream of the proposed well site demonstrate depths to bedrock that ranged from 20 feet to 120 feet, with greater depths realized on the hill adjacent to the large area of till mapped northeast of the railroad tracks in Mansfield Depot. Table 10.1-1 compares topographic elevations from the State of Connecticut LiDAR two-foot topographic map contours with the depths to bedrock at the five closest well logs to the proposed well site within the stratified drift. The comparison of topographic elevations and depths to bedrock allow for a rough estimate of bedrock elevation to be determined. Note that "Ms 9th" is the USGS test boring performed at MD-1.

Table 10.1-1
Mansfield Depot Boring Descriptions

Well ID	Location	Topographic Elevation	Depth to Bedrock	Bedrock Elevation	Stratigraphy
Ms 9th	Route 44 near Willimantic River	285 (depth to water 3.7')	51	234	Topsoil to 4', gravel to 10', medium sand to 34', then compact sand and gravel (till?)
62072	29 Middle Turnpike (Route 44)	309	119	190	Gravel, sand
3560	Route 44 (Old Post Office Near RR Depot)	322	35	287	Sandy topsoil to 10', then clay
43537	82 Depot Road	315	23	292	Hardpan
14630	E. Dunham Memorial Church (Depot Road)	314	106	208	Boulders and coarse gravel to 20', fine sand to 95 feet, then boulders and gravel

The topographic elevations of MD-1 and MD-3 are approximately 285 feet. Based on the available information, it can be expected that bedrock will be at an elevation no higher than 240 feet at each potential well site, and may be as deep as 190 feet in elevation. This will provide an approximate depth to bedrock range of 45 to 95 feet at each site. The normal river elevation in Eagleville Lake

is approximately 277 feet (as shown on the 1997 USGS Topographic Map). Assuming groundwater levels are slightly higher (280 feet) at the potential well sites, a saturated thickness of at least 40 feet is likely at the potential well sites. Note that Ms 9th showed till-like sand and gravel at elevations below 251 feet. Thus, the saturated thickness of higher-yielding stratified materials may be as little as 30 feet at potential well site MD-1.

Based on the above information, the aquifer at the MD-1 and MD-3 sites will likely have approximately 30 feet of saturated thickness of non-compact material consisting primarily of medium sand. The hydraulic conductivity estimates are high enough to suggest that well development is feasible, although yields may not be as high as at the Willimantic River Wellfield due to the potentially lower saturated thickness, lower hydraulic conductivity, and therefore a lower specific capacity. For example, a specific capacity of 0.35 to 3.1 gpm per foot is estimated using the Driscoll method[1] from a transmissivity of 530 to 4,700 gpd/ft^2. Assuming a 25-foot drawdown, the potential yield from one new well at either of these locations may not exceed 78 gpm. Without completion of recent site-specific investigations, neither site appears capable of supporting the yield required by this project.

Potential Pollution Sources

MD-1 is located on private property and for that reason, site-specific investigation of potential pollutant sources has not yet been performed. The following information pertains to surrounding land uses and likely groundwater quality near and surrounding this site:

- Groundwater quality beneath the site is classified as GA.
- The parcel is used for agriculture. The types of crop grown and the type of any potential fertilizers and pesticides that have been used at the site are currently unknown.
- The entire sanitary radius of the proposed well is confined within the parcel. Up to two wells could likely be sited on the parcel while maintaining this radius. This could also be performed while maintaining a 200 foot setback from the Willimantic River, preventing the need for a Ground Water Under the Direct Influence (GWUDI) of surface water study.
- No buildings or storm drainage are currently present on the site. No drywells are believed to be present.
- North of the site, a former sewage treatment plant and former mixed waste landfill associated with Mansfield Training School were once located on Spring Manor Farm. The groundwater quality beneath that site is classified as GB. The former treatment plant and landfill are located more than 2,000 feet south of the existing Willimantic River Wellfield (and outside of the Level A Aquifer Protection Area) and approximately 2,500 feet from the proposed well site. These contamination sources are no longer active. The mapped area potentially affected by the these historic uses extends to the Willimantic River but is contained 1,000 feet upstream of Route 44 (based on the *GAA-May Be Impaired* groundwater classification). Anecdotal evidence suggests that the Mansfield Training School may have also operated a waste incinerator in this area.
- A mill formerly occupied the north side of Route 44 just east of the Willimantic River. It is possible that pollutants related to the former mill activity could be in groundwater beneath the site. No information is available regarding this mill, but portions of the former mill race are visible downstream of Route 44 during the Willimantic River Study field investigations. In

[1] Driscoll, F.G., 1986, Groundwater and Wells, Second Edition

addition, a former pipe organ factory was located on the eastern side of the MD-1 parcel. Potential contaminants from this prior use could potentially be in the soil onsite.

- Surface water quality in the Willimantic River is rated Class B. The effluent from the University's Water Pollution Control Facility (WPCF) is discharged downstream of the site, and former upstream sewage treatment discharges that were located nearby have been discontinued. Effluent discharges into the river are not expected to cause any water quality concerns at the proposed well site.
- The environmental database maintained by Environmental Data Resources, Inc. (EDR) was reviewed for the vicinity of the proposed well site. A variety of small spills were noted in the EDR database on Route 32, Depot Road, Plains Road, and Route 44. These were mostly related to automobile accidents that spilled fuel oil on the highway. The majority of these incidents were listed as being cleaned.
- Sanitary sewer service is available on Route 32. The sewer line is connected to the UConn WPCF. The proposed well location is greater than 200 feet away from the nearest septic system or sewer line.
- There are few instances of contamination of the aquifer upstream of the site, and most of these are related to former Mansfield Training School activities that have been discontinued.

A potential new well at this site would likely be located in an area adjacent to Route 44 and heavy vehicular traffic. Storm drainage and treatment facilities may need to be installed along Route 44 to prevent such contaminants from washing onto the site.

The parcel on which MD-3 is located is owned by the Town of Mansfield. The following information pertains to surrounding land uses and likely groundwater quality near and surrounding this site:

- A site-specific investigation of potential pollutant sources was performed by the Town's consultant in 2011 that identified scattered metal, a television, and tires within the wooded area within the 200-foot radius of the proposed well site. Other debris were also noted on the site, including scattered drums of rail grease, tires, and solid waste debris reportedly carried inland by flooding of the river.
- This site was formerly the location of sand filtration beds associated with the former Mansfield Training School Sewage Treatment Plant. The proposed well is located on top of the area of the former beds. These have since been excavated and removed.
- Sanitary sewer service is available on Route 32 near the well site. The sewer line is connected to the University's Water Pollution Control Facility (WPCF). A potential well location is believed greater than 200 feet away from the nearest septic system or sewer line. The University operates a sewer lift station on the parcel immediately north of River Park on Plains Road. The station is at least 350 feet from MD-3. Heavy rains lead to the station historically overflowing one to two times per year. The sewage overflows were considered to be heavily diluted by rainwater; nonetheless, an overflow could flow down-gradient into the eastern portion of River Park if it were not contained by the raised railroad bed between the sites. Improvements conducted in 2011 and 2012 were made to reduce inflow and infiltration, including severing of roof leaders on older buildings suspected to be connected to the sanitary sewer, sealing of laterals that were never properly abandoned that formerly connected to buildings that are now demolished, and manhole repairs. No overflows have occurred since this work was conducted.

- According to the 2002 Mansfield *Water Supply Plan*, the Connecticut Department of Transportation (DOT) salt storage facility on Plains Road sits atop a former dumping area. Test pits encountered demolition debris, trash, cans, bottles, sewing scraps including needles and thread, lawnmower parts, ash, medical waste including needles, vials, and gloves, an empty paint can, and an empty pesticide application bottle. This may have been associated with the former Mansfield Training School since that entity owned the land prior to being transferred to the University.
- The Town of Mansfield has control of the entire 200-foot sanitary radius of the proposed well site.
- No buildings or storm drainage are currently present on the site. No drywells are believed to be present on the site. Infrastructure related to the former sewage treatment has been removed.
- Groundwater quality beneath the site is classified as GB based on the presence of the former Mansfield Training School Sewage Treatment Plant, from which the discharge infiltrated into sand beds. The Connecticut Department of Public Health (DPH) will not permit a new water supply well in a GB area unless the area is reclassified. Groundwater quality surrounding the site is mapped as GA, and the sewage treatment plant has been out of service since 1993.
- Northwest of the site, a former sewage treatment plant and former mixed waste landfill associated with Mansfield Training School were once located on Spring Manor Farm. The treatment plant and landfill were located more than 2,000 feet south of the existing Willimantic River Wellfield (and outside of the Level A Aquifer Protection Area) and approximately 4,000 feet upgradient of the proposed well site. A waste incinerator was also reportedly located in this area. These contamination sources are no longer active. The mapped area potentially affected by these sites extends to the Willimantic River but is contained 1,000 feet upstream of Route 44 (based on the *GAA-May Be Impaired* groundwater classification).
- A mill and a pipe organ factory formerly existed on Route 44 just east of the Willimantic River. It is possible that pollutants related to the former activity could be in groundwater beneath the site. No information was immediately available regarding these businesses, but portions of the former mill race was visible downstream of Route 44 during the Willimantic River Study field investigations.
- Surface water quality in the Willimantic River is rated Class B. The effluent from the University's Water Pollution Control Facility (WPCF) discharges downstream of the site. Former upstream sewage treatment discharges that were nearby have been discontinued. Effluent discharges into the river are not expected to cause water quality concerns at the proposed well site.
- The environmental database maintained by Environmental Data Resources, Inc. (EDR) was reviewed for the vicinity of the proposed well site. A variety of small spills were noted in the EDR database on Route 32, Depot Road, Plains Road, and Route 44. These were mostly related to automobile accidents which spilled fuel oil on the highway. The majority of these incidents were listed as being cleaned.
- A magnesium chloride tank is located approximately 500 feet northeast of the proposed well site adjacent to the salt storage shed.
- The proposed well location for MD-3 is 170 feet from the Willimantic River. Thus, a GWUDI study would be required. The GWUDI study requires weekly water samples and quarterly microscopic particulate analysis samples to be collected and analyzed for a period of one year, lengthening the amount of time required for the new well or wells to come online.

- Stormwater runoff from the Depot Campus discharges via an unnamed stream through the nearby Green Farm to the Willimantic River. A proposed animal health research facility on the Depot Campus could be a future source of contamination of surface and groundwater in the vicinity of MD-3. The Environmental Assessment for this project states that "*the proposed stormwater management system for the proposed project site would be designed to preserve the existing hydrologic conditions to the extent possible, including drainage patterns, runoff volume, temperature, ground water recharge, and runoff quality*". Thus, it is possible that previously unrealized contaminants could be released from this location into the drainage system and track downstream towards MD-3.

There are few instances of contamination of the aquifer upstream of the site, and most of these instances are related to former Mansfield Training School activities that have been discontinued. However, many contaminants have been identified onsite. The potential location for a new well at this location would be away from Plains Road such that routine drips and spills from passing traffic or traffic accidents would not be a concern. However, potential well site MD-3 is sited in a GB area related to the former sewage treatment facility. Unless the classification were to be amended, DPH is not likely to approve this site for potable supply. There is also concern about the extent of the nearby dumping area upstream on Plains Road.

Given the uncertainty with the GB rating and the nearby dumping area, this site is not believed to be a viable alternative.

10.1.2 POTENTIAL WELLFIELDS NEAR EAGLEVILLE PRESERVE (EP-4 & EP-5)

1960's era USGS Water Resource Bulletin

The USGS Report entitled *Water Resources Inventory of Connecticut, Part 2 – Shetucket River Basin* (1967) shows that the aquifer beneath the Willimantic River consists of coarse-grained stratified drift at the potential well sites (Plate B). However, the USGS map does not show any borings near the potential well sites (Plate A) except for one slightly upgradient in Coventry (located west of the southern end of Eagleville Lake); hence, much of this analysis may have been inferred from surficial materials. The mapped stratified drift area is relatively wide and encompasses much of the river valley to the east side of Route 32. The mapped saturated thickness at the potential well sites reportedly exceeds 40 feet (Plate B).

Based on USGS mapping, the average permeability of the deposits in the saturated section may range from 530 to 4,700 gpd/ft^2 (equivalent to a hydraulic conductivity range from 71 to 630 ft/d). Thick areas are believed capable of yielding more than 100 gallons per minute (gpm) to drilled screened wells (Plate B).

1978 Ground Water Availability Map

The 1978 *Ground Water Availability in Connecticut* map produced by the (then) Connecticut Department of Environmental Protection (DEP) in cooperation with the USGS shows that the vicinity of the potential well site is underlain by coarse-grained stratified drift capable of yielding moderate to large amounts of water (50 to 2,000 gpm).

1986 Stratified Drift-Areas in Connecticut Map

The 1986 USGS *Ground-Water Yields for Selected Stratified-Drift Areas in Connecticut* map shows that the potential well sites are located in a stratified drift area with a saturated thickness greater than 10 feet and thought to be capable of yielding moderate to large amounts of groundwater. The estimated long-term yield of the aquifer in this location is 2.2 mgd and assumes a distribution of approximately four wells per square mile of aquifer area (which stretches from Route 275 downstream to approximately Coventry Road).

2005 USGS Surficial Geology Mapping

The surficial geology at the potential well sites is mapped on the 2005 *Quaternary Geologic Map of Connecticut* as sand and gravel that formed stream terrace deposits. The depositional environment includes early postglacial deposits from the late Wisconsinan period and early Holocene epoch. The mapped area of deposits is bounded from the eastern side of the railroad tracks to west across the utility easement.

To the east, sand and gravel is mapped between the railroad tracks and Route 32. These deposits are the result of sediment-damned ponds that form the Lower Willimantic River Deposits. Such deposits extend on both sides of the river northward to the upper section of Eagleville Lake, and continue downstream as well.

A thin area of floodplain alluvium (alluvium overlying sand and gravel) is mapped adjacent to the Willimantic River. The depositional environment includes postglacial deposits from the Holocene epoch. The similarity of the mapping at EP-4 and EP-5 to the existing Willimantic River Wellfield implies that well yields may be similar to the wells at the Willimantic River Wellfield.

2008 Surficial Aquifer Potential Mapping

The 2008 *Surficial Aquifer Potential Map of Connecticut* compiled by the Connecticut Geological and Natural History Survey in cooperation with the DEP shows that the proposed well sites are located in an area mapped as "Other Glacial Meltwater Deposits with Lower Potential Yield." This suggests a relatively heterogeneous mix of stratified-drift deposits are located near the site, with limited banding of coarse-grained, water-bearing materials. The data on this map was reprinted from the 1992 Surficial Materials released by the USGS.

Department of Consumer Protection Private Well Logs

Well logs for private wells in Mansfield were obtained from the Connecticut Department of Consumer Protection for the period 1970 through 2010. While overburden stratigraphy on such logs is generally poor, the depths to bedrock on these logs can provide an excellent overview of bedrock elevations in the area. Well logs in the vicinity of the proposed well site were mapped in ArcGIS when reasonable accuracy was possible. Approximately 30 wells were mapped in the vicinity of the potential well sites (including those mapped by the USGS in the 1960s-era *Water Resources Bulletin*).

The logs for private wells located on Route 32 immediately east of the well sites had depths to bedrock that ranged from 40 feet to 65 feet, with depths increasing towards the south. Depths to bedrock on Old Mill Court, Eagle Court, and Route 275 in Eagleville ranged from 20 to 55 feet. Table 10.1-2 compares topographic elevations from the State of Connecticut LiDAR two-foot topographic map contours with the depths to bedrock at the ten closest well logs to the proposed well sites within the stratified drift. The comparison of topographic elevations and depths to bedrock allow for a rough estimate of bedrock elevation to be determined.

Table 10.1-2
Eagleville Boring Descriptions

Well ID	Location	Topographic Elevation	Depth to Bedrock	Bedrock Elevation	Stratigraphy
Cv 1	Ash Trail, Coventry	305	100	205	Coarse sand and gravel
122050	11 Old Mill Court	289	40	249	Gravel and hardpan
140249	12 Old Mill Court	291	16	275	Overburden
47408	2 Old Mill Court	289	20	269	Gravel and hardpan
114176	9 Old Mill Court	301	30	271	Sand and gravel
103341	10 Eagle Court	306	45	261	Gravel and boulders to 12 feet, then hardpan
194732	829 Stafford Road (East of EP-5)	295	38	247	Gravel 20 feet, sand to 35 feet, then cemented gravel
164636	Route 32 (East of EP-5)	289	50	239	Sand, coarse gravel
206271	795 Stafford Road (East of EP-5)	284	59	225	Overburden
20945	Route 32 (East of EP-5)	298	65	233	Gravel and boulders

The topographic elevation of the potential well site is approximately 279 feet at EP-5 and approximately 270 feet at EP-4 (both in NAVD 1988). The depth to water is unknown, but is likely less than 10 feet. Based on the available information, it can be expected that bedrock will be at an elevation no higher than 230 feet at the proposed well site, and may be as deep as 200 feet in elevation. This will provide a depth to bedrock of 40 to 70 feet at the proposed well sites, with a saturated thickness of approximately 30 to 60 feet.

Town of Mansfield Investigations

In November 2011, the Town of Mansfield retained consulting services to undertake water supply test well exploration in the vicinity of EP-5. Three 2.5-inch diameter test wells were installed at two locations on the site. These test wells were located in the woods to the west of the agricultural field. Table 10.1-3 presents a summary of the boring logs obtained.

Test wells TW-1-11 and TW-2-11 each produced only 4 gallons per minute (gpm) from the lower five feet of the aquifer. TW-2-11 was rescreened from 28 to 33 feet in depth and the pumping rate was found to be 33 gpm based on a short-term pumping test. Monitoring at TW-2A-11 revealed a drawdown of nine feet, providing an estimated specific capacity of 3.7 gpm/ft for the aquifer. Assuming a 20 foot useable drawdown, the estimated capacity of this well would be 74 gpm. Further testing was recommended on the parcel following investigations at other areas to determine the effect of pumping multiple wells from this area.

Table 10.1-3
2011 Eagleville Preserve Boring Descriptions

Well ID	Topographic Elevation	Depth to Bedrock	Bedrock Elevation	Stratigraphy
TW-1-11	280	67	213	Fine to coarse sand to 27 feet, very fine sand and fine sand to 53 feet, fine sand to 64 feet, then till likely
TW-2-11	275	64	211	Fine to coarse sand to 37 feet, very fine to fine sand to 50 feet, fine to coarse sand to 64 feet, then till likely
TW-2A-11	275	65	210	Same as TW-2-11

Current Proximal Investigations

Connecticut Water Company (CWC) has been performing field investigations for potential wellfield development immediately southwest of the proposed well site in Coventry, across the Willimantic River. CWC's investigations have revealed the following general information about the aquifer in Coventry:

- The aquifer material appears to be reasonable for wellfield development;
- Well sites are limited by floodplains;
- The bedrock underneath the site is dips steeply toward the river; and
- The deepest material is closest to the river.

This information is similar to what has been learned about the EP-4 and EP-5 site. CWC estimates that a yield of 0.2 mgd could potentially be obtained from the site being investigated.

Based on the above information, the aquifer at EP-4 and EP-5 site will likely have greater than 30 feet of saturated thickness. The hydraulic conductivity estimates are sufficiently high to suggest that well development is feasible, although yields may not be as high as at the Willimantic River Wellfield due to the reduced aquifer thickness. While the parcel at EP-5 could potentially support three wells, it is not likely that three wells in this area could reach the desired yield. A combination of three wells at EP-5 and two wells at MD-1 may create sufficient yield, although direct and indirect wetland impacts associated with the development of multiple wells will accumulate quickly for multiple wells at multiple sites.

Potential Pollution Sources

The Connecticut DPH requires that new well locations are located at least 200 feet from any potential pollution sources and at least 50 feet from any drains carrying surface water or a foundation drain. The following potential pollution sources have been identified that could impact each potential wellfield location.

- A site-specific investigation of potential pollutant sources was performed in 2011 that revealed scattered solid waste, metal, and tires within the wooded area approximately 200 feet to the northwest of EP-5.
- The EP-5 site appears to have been used for agricultural purposes since at least the 1950s based on 1951 aerial photography. It is likely that fertilizers have been applied on site for

over 50 years. Prior to purchase by the Town in 1995, the site was reportedly used as a motorcycle track (1980s), a broiler farm, and a pasture. Pesticides and herbicides may have been used onsite, although only manure has been used since 1995.

- The EP-4 site is currently wooded and wetlands. The northern portion of the site was formerly the storage area for raw materials used at the Eagleville Mill. Portions of the former mill race reportedly pass through the site. A state-owned salt storage shed was reportedly located on the site from the late 1950s to the early 1970s following the closure of the Eagleville Mill, although such a storage shed could not be seen on the 1970 aerial photograph of the area.
- One new well could be sited at EP-4 while maintaining a 200-foot sanitary radius, and up to three wells could be sited on the EP-5 parcel while maintaining a 200-foot sanitary radius.
- No buildings dry wells, or storm drainage are currently present on either parcel. Historical aerial photographs of the site suggest that no buildings have been present on the EP-5 site since 1934, while storage buildings may have been present on the northern part of the EP-4 parcel through the 1970s.
- North of the sites, the Eagleville Mill (formerly on Route 275 at the Eagleville Dam) produced cotton fabric from 1814 to 1931, and shoe lasts until the 1950s. It is possible that pollutants related to the former mill activity could be in groundwater beneath the sites.
- Surface water quality in the Willimantic River is rated Class B. The effluent from the University's WPCF discharges into the river downstream of Eagleville Dam (but upstream of Route 275) approximately 790 feet upstream of EP-4 and 1,500 feet north of EP-5, is not expected to cause any water quality concerns at the proposed well sites.
- Two contaminated wells have been recorded near the proposed well sites. The wells (if they still exist) were likely located on Route 32 east of the proposed well sites. The wells were contaminated with hydrocarbons from gasoline. It is not known if the wells were overburden (dug) or bedrock wells.
- An oil/chemical spill was reported on Route 32 that appears to be connected to the Eagleville Garage. The spill is described as a "service station gasoline storage tank leak". The spill is listed as inactive, suggesting that the tank was removed and replaced. Eagleville Garage is located 1,000 feet northeast of EP-4 and 1,400 feet northeast of EP-5.
- The environmental database maintained by Environmental Data Resources, Inc. was reviewed for the vicinity of the proposed well sites. A variety of small spills have been reported to have occurred on Route 32 and Route 275. These were mostly related to automobile accidents that spilled fuel oil or antifreeze on the highway. The majority of these incidents were listed as being cleaned. Route 32 is located 660 to 800 feet to the east of the proposed well sites.
- A residential heating oil tank is located approximately 650 feet to the east of EP-5. Groundwater flow would likely draw any associated potential pollution towards Dunham Brook, away from the proposed well site. Any such tanks near EP-4 are located more than 500 feet from the proposed well site, although ground water flow may potentially direct contamination towards EP-4.
- Sanitary sewer service is not available on Route 32 near the well sites. The proposed well locations are believed to be greater than 500 feet away from the nearest septic system associated with the homes along Route 32.
- While the potential well location at EP-4 would require a GWUDI study, three wells could be sited on the EP-5 parcel without requiring a GWUDI study.

- Test borings at EP-5 did not reveal the presence of contamination above detection limits for analyses required by the Connecticut DPH for a new Community water supply source.

Based on the above information, the aquifer surrounding the EP-4 and EP-5 site has several potential sources of contamination, including former gasoline spills and pollutants potentially related to the former mill activity (and potentially the reported former salt storage shed) upstream. If the gasoline leak at the service station and the gasoline contaminated wells are related, then the proposed well sites may be located in the flow path of the contamination. However, no gasoline-related contaminants were detected at EP-5 during testing in 2011.

The scattered potential contamination sources that lie within the 200-foot radius of EP-5 (e.g. solid waste, metal and tires) could be an indication that other materials may have been dumped and buried on site. In addition, surficial site debris near the proposed well site would need to be evaluated by a Connecticut licensed environmental professional (LEP) to determine any potential threat to groundwater. Given the size of the two sites, the well location could be easily moved to another location on the parcel that would comply with DPH well site regulations. However, previous land uses at the site (motorcycle track, various agricultural practices) may place the well in an area that has more contamination that the current well site.

10.1.3 SUMMARY OF FEASIBILITY

The combined potential yield from Wells MD-1, MD-3, EP-4, and EP-5 is uncertain, as is the quality of water that would be derived from them. Development of wellfields at both Mansfield Depot and Eagleville Preserve may not produce greater than 0.5 million gallons per day. For this reason, one or more wellfields along the Willimantic River is not believed to meet the project purpose and need.

It is possible that the University and/or the Town of Mansfield could pursue development of new wells in the future for operational flexibility or for other unforeseen reasons. For this reason, an evaluation of potential impact has been evaluated herein.

10.2 LAND USE AND ZONING

The four potential wellfield locations along the Willimantic River are currently utilized either for agricultural or open space as noted below:

- Well location MD-1 is currently utilized as an agricultural field.
- Well location MD-3 is currently utilized as a Town park with a recreation field (River Park).
- Well location EP-4 is currently forested and utilized as a Town park (Eagleville Preserve) although the land is owned by the State of Connecticut.
- Well location EP-5 is currently utilized as an agricultural field with surrounding woodlands utilized as a Town park.

Potential well locations MD-1 and MD-3 are located in Conservation Areas as denoted on the State *Conservation and Development Plan Locational Guide Map*, while potential well locations EP-4 and EP-5 are located on lands designated as existing preserved open space. The WinCOG regional plan notes that the four wellfield locations fall in either high priority Preservation Areas

or permanently protected open space. These land designations are typical for many public water system sources and are consistent with the need to protect future sources of water supply. The proposed overlay zone will restrict usage of water along any potential pipeline routes to maintain consistency with nearby State Plan designations.

Well locations MD-1 and EP-5 are currently utilized for agriculture. While the field at MD-1 is privately owned, the field at EP-5 was purchased specifically to preserve the prime farmland for agricultural purposes. The town has a land-use agreement with the Stearns Farm; potatoes and corn are currently being grown. The use of either of these sites for the development of new wells would potentially restrict or preclude further use of these sites for agriculture. Should either of these sites be utilized, other farmland in Mansfield may need to be protected to offset potential losses.

Regardless of the well location selected, the aquifer protection area (APA) regulations in Mansfield and Coventry would be affected by the presence of a new well. Level A APA mapping would need to be performed to delineate the area of contribution and recharge of the groundwater flowing to the well. Thus, additional areas of Coventry and Mansfield would be designated as APA areas and existing Aquifer Protection Agencies in each town would administer the APA regulations in these zones.

The creation of a new wellfield or wellfields along the Willimantic River could locally affect land use at the wellfield sites; however, significant impact of land use beyond those sites is not likely to occur, particularly in light of the low yields that are anticipated from these wells.

10.3 SOCIOECONOMICS

Development of one or more wells along the Willimantic River could potentially provide a source of potable water supply to the University and/or the Town of Mansfield. The amount of water available to service these communities would be dependent upon the yield of the new wellfield(s).

The total population, average household size, percentage of low-income populations, and percentage of minority populations in areas of Mansfield and the region could increase slightly as a result of additional development as a result of a publicly available supply of water. The extent to which that could occur following development of groundwater supplies adjacent to the Willimantic River would be less than for a supply that could serve the full projected demands, as evaluated in Alternatives 3, 4, and 5 (interconnections with CWC, Metropolitan District Commission, and Windham Water Works respectively).

Some acquisitions and easements would be necessary for this alternative. The wellfield locations would need to be purchased or otherwise obtained. In the case of MD-1, this property would need to be purchased from the current private owner. In the case of MD-3 and EP-5, either the land would need to be purchased or an agreement acceptable to the Connecticut DPH would need to be made in order to ensure control of the 200-foot sanitary radius of each well, and easements for infrastructure. A similar agreement would be needed for EP-4 to transfer the CT DEEP lands.

The only water main that would not be installed beneath a roadway would be at the new wellfields (state, town, or private property depending on wellfield), pipeline segment 59 (railroad

property), and pipeline segment 63 (Spring Manor Farm access road on University property). A utility easement would be needed from RailAmerica, Inc. to install a water main through this property (for MD-1 Options #6A-3, #6A-4, and #6A-5) as well as a permit or permits to install a water main beneath the railroad tracks that parallel Route 32 (all options with the exception of #6A-5).

While some land use acquisitions would be required to implement this alternative, significant socioeconomic impacts are not anticipated.

10.4 COMMUNITY FACILITIES AND SERVICES

The community facilities and services along the pipeline segments associated with the various new Willimantic River Wellfield alternatives are summarized in Table 10.4-1 below.

TABLE 10.4-1
Summary of Community Facilities and Services
by Pipeline Segment along Potential Willimantic River Wellfield Scenarios

Pipeline Segment	School?	Potential Benefit from Fire Protection?	Recreation Area?
3 (MD-1)	No	Residential & Commercial	No
4	No	Commercial	No
5	No	Residential	No
20	No	Commercial	No
21	Yes	Will be served by UConn	Proposed
41 (EP-5)	No	Residential & Commercial	Yes
42 (EP-4)	No	Residential	Yes
43	No	Residential	No
44	No	Residential & Commercial	No
45	Yes	Already served	Yes*
46	Yes	Already served	Yes
47	Yes	Already served	No
51	No	Residential	No
52	No	Residential & Commercial	No
53	No	Residential	No
54	Yes	Residential	No
55	No	Residential & Commercial	No
56 (MD-3)	No	Already served	Yes
57	No	Already served	No
58	No	Already served	No
59	No	Residential & Commercial	No
60	Yes	Already served	No
61	No	Already served	No
62	No	Already served	No
63	Yes	Already served	No
64	Yes	Already served	No

*Hiking trails only

10.4.1 EDUCATION

As shown in Table 10.3-1 above, a number of schools are located along potential pipeline segments associated with this alternative. These include the University and E. O. Smith High School, both of which are already served with public water by the University. The installation of a new water main would not provide the opportunity to provide water supply to adjacent facilities. As none of the pipelines will directly impact the Depot Campus, access to these educational facilities would only be temporarily impacted during the construction period for connection options from the Eagleville Preserve well locations that connect directly to the University system (Options #6C-3, #6C-4, #6D-3, and #6D-4). Performing construction in this area during the summer would be the best method of avoiding this impact.

10.4.2 PUBLIC SAFETY AND EMERGENCY SERVICES

New water mains associated with this alternative would not have sufficient water to support fire flows with a few exceptions. The Insurance Services Organization (ISO) target fire flow for a hydrant is 1,000 gpm for two hours. The amount of water from a single well or wellfield under this alternative would not generate sufficient flow to operate a fire hydrant to ISO standards. Therefore, only the options that connect directly to the University's distribution system (Option #6C-4 and #6D-4) and have connection to the University's ample storage supplies would have the capability of providing fire protection service to new areas.

Table 10.4-2 presents a comparison of the potential number of new hydrants that could be installed on the various routing scenarios. Routing scenarios #6D-4 and #6C-4 would provide a greater benefit in terms of the availability of fire protection water, and Eagleville would particularly benefit from the availability of fire protection water.

The construction period associated with this alternative would require the use of State and local police services to provide maintenance and protection of traffic.

TABLE 10.4-2
Potential Fire Protection Benefits from a New Wellfield along the Willimantic River

Routing Scenario	Distance (ft)*	Number of Hydrants
#6A (any)	1,540	4
#6B (any)	1,540	4
#6C-1, #6C-2, #6C-3	1,540	4
#6C-4	11,450	24
#6D-1, #6D-2, #6D-3	1,540	4
#6D-4	12,680	27

* Does not include North Hillside Road extension which would have hydrants installed as part of the utility work with that project, nor areas of existing water service.

10.4.3 PARKS AND RECREATION

Potential well locations MD-3, EP-4, and EP-5 are located within recreational areas (River Park and Eagleville Preserve). The construction of a new well in these areas could inhibit but would not likely eliminate existing recreational uses. In particular, the proposed location of MD-3 is currently used as a recreation field. Much of this field would be lost if River Park was converted to a wellfield. Passive uses in Eagleville Preserve would likely need to be rerouted.

Several parks and recreational facilities are located in Mansfield along some of the potential pipeline routes. These include hiking trails in the Moss Sanctuary on Route 275 and recreational facilities at the University Main Campus and E.O. Smith. Public water service is already available in these areas. Significant impacts to parks and recreation are not expected during the construction period, as construction would not take place immediately adjacent to the entrances to these recreation areas.

10.4.4 PUBLIC TRANSPORTATION

A temporary impact to public transportation is likely during construction due to traffic delays dependent on the amount of pipeline being installed along existing bus routes. In particular, traffic delays on Route 195 (option #6C-4 and #6D-4) would be notable. However, since the majority of the proposed pipelines are to be installed far from areas currently serviced by the University or Windham Regional Transit District (WRTD), only a minimal impact to public transportation is expected.

10.5 AESTHETIC AND CULTURAL RESOURCES

Aesthetic Resources

The entire Town of Mansfield is designated as a scenic resource in the 2006 *Plan of Conservation and Development.* Many of the proposed pipeline routes through Mansfield pass areas that are predominantly agricultural or residential in nature, with generally sparse development along much of the roads. Areas along Route 32 are particularly open with scenic views down to the Willimantic River. In other areas, trees grow right to the edge of the roadway, inhibiting long scenic views in most areas, instead providing a shady, tree-lined drive.

The development of a new wellfield at MD-3, EP-4, or EP-5 would have a local impact on aesthetics at the well sites to support the new construction. Construction of a traditional brick or concrete pumphouse and treatment/control building on the site would be necessary; however, the pumphouse could be designed with exterior features in keeping with the surrounding area.

As water mains would be installed within existing roadways or below ground, long-term impacts to aesthetic and visual resources are expected to be minimal. Coordination with the various related commissions and committees in the Town of Mansfield will be essential to a successful project.

Historic and Cultural Resources

The 2006 *Plan of Conservation and Development* further identifies areas of archaeological sensitivity, historic site areas, and prehistoric site area in Mansfield. Areas of sensitivity are located along nearly all of the potential pipeline segments excepting those on the Main Campus. Prehistoric site areas are identified east of Plains Road and along pipeline segments 5, 59, 60, and 63. The Mansfield Training School Memorial Grove is located adjacent to pipeline segment 58. The State Archaeologist, State Historic Preservation Officer, Mansfield Historic District Commission, and the Cemetery Committee would be consulted prior to beginning work in these areas.

Mansfield Four Corners is considered a historic village and is located at the terminus of each of the potential water main scenarios. While the center of this village is located at the intersection of Moulton Road and Daleville Road with Route 44, many of the commercial buildings in this village are located near the intersection of Route 44 and Route 195. These commercial buildings are dilapidated and/or vacant. To the extent development of a new wellfield would serve this area, development could occur. Coordination with the Planning and Zoning Commission will be necessary to ensure that new development and redevelopment in Mansfield Four Corners is consistent with the historic aspects of this village.

Other historic districts include Eagleville, Mansfield Depot and the former Mansfield Training School. The potential pipeline routes pass by several historical properties and sites as noted in the 2006 *Plan of Conservation and Development,* such as those on Route 44, Route 32, Route 275, and Shady Lane. The extension of public water service past these properties would not impact the historic nature of these properties.

The potential well locations are all located on land that was previously developed or near development:

- The parcel containing well location MD-1 formerly housed the Mansfield Organ Pipe Works who made parts for pipe organs out of wood and metal. This factory was located on the eastern side of the property and torn down after the 1970s;
- The parcel containing MD-3 formerly housed the sewage disposal beds for Mansfield Training School;
- The northern portion of the parcel containing EP-4 formerly was a holding area for raw materials at a nearby mill that closed in the 1950s, and was reportedly a DOT garage in the 1960s; and
- The parcel at EP-5 was utilized as a pasture, a broiler farm, and a motorcycle rally track prior to being purchased by the Town of Mansfield.

Many cultural resources are located in Mansfield along potential pipeline routes. These include facilities at the University and the Town's Community Center that are already served by public water service. One house of worship (the former Saint Joseph Church) is located in Eagleville. These cultural resources are not expected to be effected by this alternative.

In summary, no significant impacts to historic or cultural resources are anticipated in conjunction with development of one or more groundwater wells along the Willimantic River.

10.6 PUBLIC WATER SUPPLY

Development of a supplemental source of supply adjacent to the Willimantic River could provide an increment of supply to the University system or independently to development within the Town of Mansfield. Connection to the University's existing system would require numerous components.

A connection to the University's 16-inch diameter transmission main leading to the Main Campus would require a 180 psi static discharge pressure at the well for MD-1 and MD-3, increasing to 185 psi at EP-4 and EP-5. A connection to the University's distribution system along North Eagleville Road or South Eagleville Road would require a similar pressure to push water into the University system. The University's 2011 *Water Supply Plan* indicates that system pressures in the University system are typically in the range of 140 pounds per square inch (psi) to 175 psi, with the highest pressures typically being experienced at the central utility plant (CUP). These system pressures are much higher than the industry standard range of 35 psi to 125 psi. As such, individual pressure reducing devices may need to be utilized at any properties that connect to pipelines from new wells.

The potential connection routes associated with this alternative pass two Community water systems. Rosal Apartments is located near Mansfield Four Corners and would likely be served by a new water main. Its water demands are included in the Mansfield Four Corners demands. Knollwood Apartments on South Eagleville Road has coexisted for many years adjacent to the University system and is unlikely to interconnect. In addition, non-transient non-community (NTNC) and transient non-community (TNC) systems are also located along potential pipeline routes, including Mansfield Shopping Center on Route 44, the Public America in Mansfield Four Corners, and 603 Middle Turnpike (Market & Deli). Demand from each of these developments is included in potential Mansfield Four Corners demands. Finally, Pub 32 at 847 Stafford Road is located along pipeline segment 41 and could only be served if EP-5 was utilized.

10.7 OTHER PUBLIC UTILITIES AND SERVICES

10.7.1 SANITARY SEWER

The 2007 *Water and Wastewater Master Plan* concluded that the capacity of the University's WPCF is sufficient for future wastewater treatment. Average daily flows at the WPCF typically average 27% to 44% (0.81 mgd to 1.32 mgd) of its average day capacity, while peak flows can utilize up to 90% of the plant's peak hourly capacity as a result of inflow and infiltration to the system, independent of the number of users discharging to the system. The University continues to take measures to alleviate this condition. Based on the likely additional flows to the University's WPCF (assuming the majority of new water customers would discharge to the sanitary sewer), the facility is believed to have sufficient capacity.

The withdrawal of water from a new wellfield on the Willimantic River would be returned to the Willimantic River via the existing outflow pipe downstream of Eagleville Dam. Effluent discharges to the Willimantic River would increase at a rate similar to the pumping rate, since the new water would be primarily utilized in areas with sewer service. The capability of the Willimantic River to assimilate treated waste water is not expected to be significantly impacted.

10.7.2 STORMWATER SYSTEMS, BRIDGES, AND CULVERTS

A variety of bridges, cross culverts, and stormwater systems can be found along the potential pipeline segments associated with a new wellfield along the Willimantic River. Table 10.7-1 summarizes these watercourse crossings. Photographs of several of these crossings are presented in Appendix C.

TABLE 10.7-1
Summary of Stormwater Systems by Pipeline Segment
Associated with Potential New Wellfields along the Willimantic River

Pipeline Segment	Bridge	Storm Drainage Systems	Cross Culverts	Comment
3 (MD-1)	No	No	No	
4	No	No	Yes	Culvert associated with former mill.
5	No	No	None seen	
20	None	Yes	Yes	Nearby pedestrian bridge.
21	None	Future	Future	Future North Hillside Road extension.
41 (EP-5)	No	Yes	Yes	No development at wellfield.
42 (EP-4)	Railroad	Yes	None seen	No development at wellfield. Route passes under Railroad bridge at Route 275.
43	No	No	None seen	
44	No	Yes	Yes	
45	None	Yes	None seen	
46	None	Yes	None seen	
47	None	Yes	None seen	
51	Eagleville Brook	No	None seen	Would likely need to hang pipe on side of bridge.
52	Eagleville Brook	No	None seen	Would likely need to hang pipe on side of bridge.
53	No	No	None seen	
54	No	Yes	Yes	
55	Cedar Swamp Brook	No	Yes	Would likely need to hang pipe on side of bridge.
56 (MD-3)	No	Yes	None seen	
57	No	No	None seen	
58	No	Limited	None seen	One catch basin noted.
59	No	No	None seen	
60	No	No	None seen	
61	No	Limited	None seen	One catch basin noted.
62	No	No	None seen	
63	No	No	Yes	Farm road has small culverts.
64	No	No	None seen	

The potential pipeline routing associated with new wells at MD-1 or MD-3 would not result in any challenging crossings. EP-4 and EP-5 would have several challenges to connect to Spring Manor Farm or run along North Eagleville Road, including large culverts and bridges at Cedar

Swamp Brook, Eagleville Brook, and the unnamed stream from the Depot Campus. A pipe could be hung on the side of these bridges if enough clearance above the bridge is not available beneath the roadway, or directional drilling could occur beneath the riverbed. The height of the bridge relative to the base flood elevation could be an important factor. Potential pipeline segments leading along South Eagleville Road do not appear to have any major crossings.

Minor crossings exist along many of the pipeline routes and are generally small pipes that would need to be avoided during construction. If modifications to stormwater systems were necessary, they would be evaluated within the design phase.

New stormwater systems would be developed in concert with any new development served by a new supply.

10.7.3 ENERGY, ELECTRICITY, AND NATURAL GAS

A new wellfield or wellfields along the Willimantic River would result in the following additional energy demands over current levels:

- Additional energy demands for pumping;
- Additional energy demands at existing treatment facilities or new water treatment facilities;
- Additional energy demands in new buildings on the North Campus and the Depot Campus that would be serviced by the proposed water supply, as well as in Mansfield Four Corners;
- Additional energy demands in the form of vehicle fuel and additional office work (computers, etc.) due to an increased service area for operations and maintenance personnel; and
- Additional energy demands (electricity, fuel) from new development and redevelopment spurred by the presence of the water main.

Electrical Service

As noted above, incremental electrical demands would be realized to support this project. These include using electricity for treating additional water at treatment facilities, additional pumping station demands to direct water into the distribution system, and potentially increased electrical demands from additional personnel and equipment.

As the yield of a new well or wells has not been determined, energy demands cannot be estimated at this time. However for planning purposes, it is assumed that the creation of a new well along the Willimantic River would result in an increase in electrical usage of 25% over the existing usage at the Willimantic River Wellfield. Additional wells would result in additional increases in electrical demand.

Electrical service would also be extended into any new developments including those spurred by the presence of the water main. New University buildings would partially or fully be serviced with electricity from the CUP. As exact building uses are not known at this time, estimates of electrical service cannot be provided. However, it is assumed that Connecticut Light & Power has sufficient supply to provide electrical service to any related incremental increases and new development.

Natural Gas Service

Expansion of natural gas is expected to occur to new buildings in North Campus and the Depot Campus; new buildings in the vicinity of Mansfield Four Corners may also be serviced with natural gas. While an estimated amount of new usage of natural gas in these areas cannot be quantified at this time as buildings have not been designed, it is assumed for the purposes of this EIE that sufficient supply exists to serve these developments. In addition, natural gas usage to create electricity at the CUP may increase to support proposed University development.

Coordination with these utilities will be necessary to determine the depth of the gas pipelines during the design phase in order to avoid interference. Additional protective controls such as extra casing may be necessary in the vicinity of the gas pipelines. No direct impact to natural gas service or existing pipelines (other than additional usage and service area) is expected.

Other Energy Sources

Development of a new groundwater supply would have an incremental impact on the amount of fuel utilized for backup generation at pump stations. Construction-related traffic delays will also cause an incremental increase in fuel consumption during the construction period. In addition, the construction period will involve a direct consumption of fuel by equipment that cannot immediately be quantified. Indirect impact to these fuel sources would likely occur through increased demand in the project area following development and redevelopment activities.

10.7.4 TELECOMMUNICATIONS SERVICE

Expansion of telecommunications service is expected to occur to any new buildings developed as a result of the availability of water supply. In addition, telecommunications service would be extended to any new wellfield to connect the equipment to the University's SCADA and alarm systems. It is assumed for the purposes of this EIE that sufficient capability exists to serve these developments. For example, University Information Technology Services (UITS) has indicated that it will be able to service any new buildings on the North Campus and the Depot Campus without issue. Coordination with existing utilities will be necessary to determine the depth of any underground wires during the design phase in order to avoid interference. No direct impact to telecommunications providers (other than additional usage and service area) is expected.

10.8 TRAFFIC, PARKING, AND OTHER TRANSPORTATION

The construction of a new wellfield along the Willimantic River and associated pipelines may have several impacts related to parking, traffic, and other transportation. Table 10.8-1 presents the characteristics of roadways along potential pipeline segments associated with the new wellfield scenarios. The majority of these routes are well traveled roadways.

Based on the information in Table 10.8-1, the potential pipeline routes from MD-1 and MD-3 would encounter less traffic during the construction period than those at EP-4 and EP-5. This is because the overall route length from MD-1 and MD-3 to the potential connection point is both shorter and in general will encounter less traffic than those from EP-4 and EP-5. Options that

connect EP-4 and EP-5 to Spring Manor Farm would result in higher traffic impacts than those that utilize off-road areas, South Eagleville Road, or North Eagleville Road.

The installation of new pipelines would cause temporary traffic impacts along the heavily travelled corridors during the construction period. Work at the new wellfields could cause a minimal traffic impact as compared to the impacts associated with pipeline construction. Construction in most roadway areas would be constrained to one lane, resulting in alternating one-way traffic along most of the potential pipeline connection routes. These delays could also impact bus service in the area. State Police traffic protection would be required. Construction activities may also temporarily restrict access to businesses and homes. Bikeways and sidewalks in the vicinity of the University (such as along Route 44) may need to have portions temporarily closed during the construction period. In addition, performing construction work during the summer period would minimize the volume of traffic passing the construction area near the University.

TABLE 10.8-1
Traffic Characteristics along Potential
New Willimantic River Wellfield Pipeline Segments

Pipeline Segment	Distance (ft)	Road Type	Traffic Count	Speed Limit (mph)	Source
3	460	Future access	-	-	-
4	840	Arterial	6,900	30	2010 CT DOT
5	1,890	Arterial	6,900	30	2010 CT DOT
20	1,540	Arterial	9,000	40	2010 CT DOT
21	3,400	Future	-	N/A	-
41	2,550	Arterial	8,900	35	2010 CT DOT
42	1,320	Collector	2,500	25	2010 CT DOT
43	660	Collector	2,500	25	2010 CT DOT
44	7,930	Collector	5,200	35	2010 CT DOT
45	3,410	Arterial	6,500	30	2010 CT DOT
46	1,360	Arterial	12,400	30	2010 CT DOT
47	380	Collector	-	25	-
51	1,350	Local	-	25	-
52	1,100	Arterial	9,200	35	2010 CT DOT
53	500	Arterial	9,200	35	2010 CT DOT
54	13,400	Collector	8,100	25	2010 CT DOT
55	6,340	Arterial	9,200	40	2010 CT DOT
56	1,410	Local	-	25	-
57	1,970	Arterial	8,000	40	2010 CT DOT
58	630	Arterial	5,800	45	2010 CT DOT
59	630	Parking Lot	-	-	-
60	1,840	Local	-	25	-
61	1,100	Arterial	5,800	45	2010 CT DOT
62	2,960	Local	-	25	-
63	4,220	Farm Road	-	15	-
64	130	Local	-	25	-

The New England Central Railroad or its lands in western Mansfield would need to be crossed under each scenario. Drilling or jacking beneath the railroad would need to occur. Rail America, Inc. has indicated that a construction schedule to minimize railroad traffic impacts would be coordinated during its permitting process.

10.9 WETLAND RESOURCES

The construction and use of a new well and associated pipelines has the potential for direct wetland impacts due to the construction of new infrastructure as well as the potential for long-term impacts related to drawdown nearby the new supply sources. These are described in the following sections.

10.9.1 EXISTING WETLAND AREAS NEAR POTENTIAL WELLFIELD LOCATIONS

Installation of a new wellfield along the Willimantic River would occur near a variety of wetlands and watercourses. Refer to Figure 10.9-1 for a depiction of inland wetland soils and watercourses adjacent to potential pipeline segments.

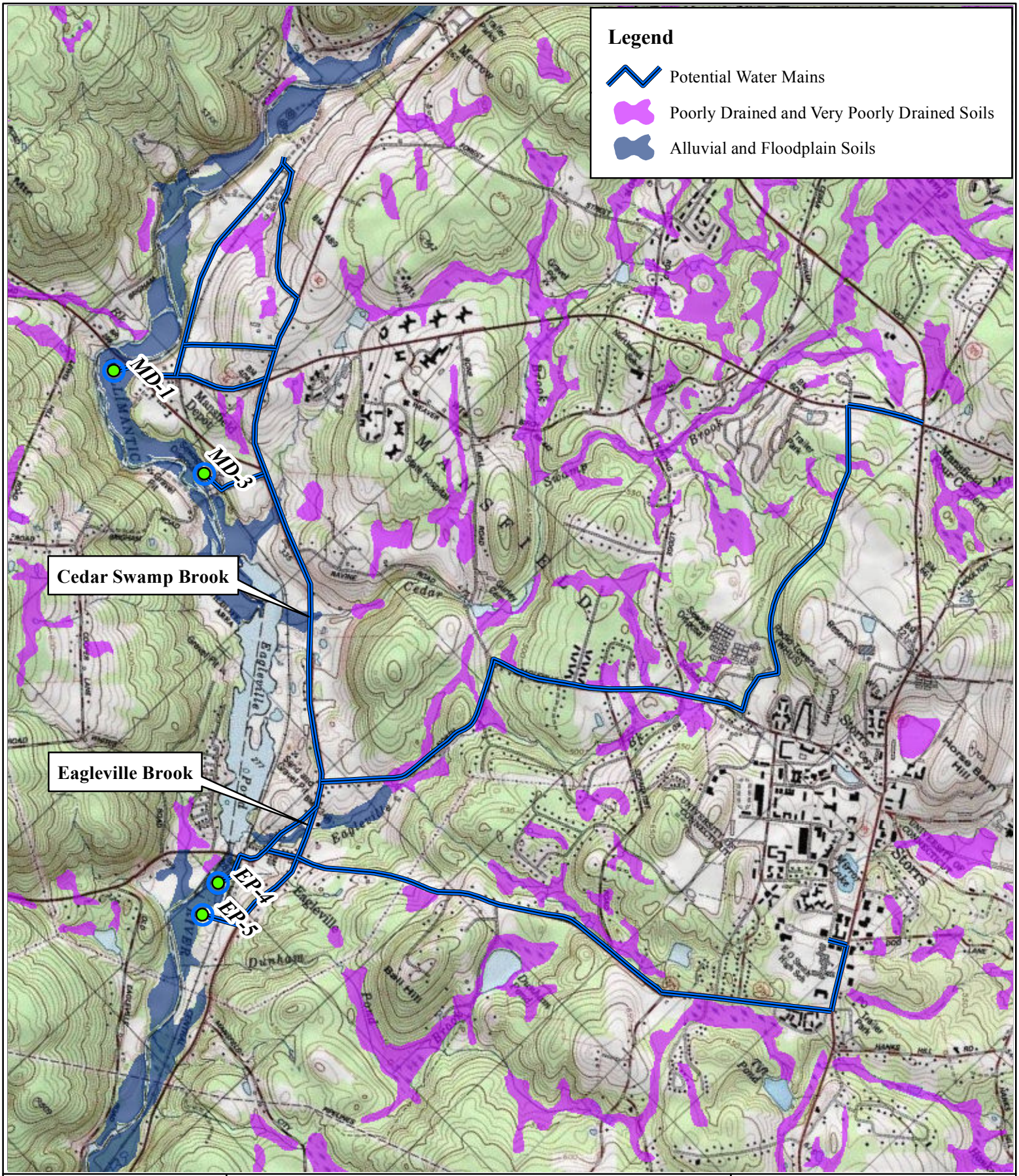
Potential Wellfield MD-1

Well Location MD-1 is located in an agricultural field within the floodplain of the Willimantic River. The potential well location is located very close to a wet meadow/emergent marsh depression (approximately 0.7 acres in size) that would likely qualify as a federal wetland. Hydrophytic vegetation within the depression includes buttonbush, silky dogwood, willow, blue vervain, woolgrass, soft rush, sensitive fern, lurid sedge, green bulrush, goldenrod, iron weed, boneset, joe-pye weed, and reed canary grass. The depression may support amphibian breeding, although it lacks valuable upland forested or meadow-type habitat adjacent to the wetland. Thus, the value of this particular wetland is lower than a similar wetland that has this bordering vegetation.

The ten-acre parcel that makes up this wellfield is sufficiently large to site two wells while maintaining a 200-foot sanitary radius on the property. While installing a well away from the wet meadow/emergent marsh depression may reduce the amount of direct wetland impacts, this area has the potential to be affected by drawdown associated with the new well or wells. In addition, a portion of this area may end up being filled to support access to the new pump houses above the 1% annual chance flood elevation.

Potential Wellfield MD-3

Well Location MD-3 is located just inside of the floodplain of the Willimantic River within a town recreation area. The floodplain wetlands along the Willimantic River consist of forested, scrub-shrub, and emergent marsh systems. Wetland vegetation includes red maple, yellow birch, pin oak, northern arrowwood, buttonbush, common winterberry, highbush blueberry, silky dogwood, steeplebush, speckled alder, purple loosestrife, broad-leafed cottontail, woolgrass, tussock sedge, soft rush, and other sedges and rushes. The proposed well location is located between two potential vernal pools: one is located to the east of Plains Road across from the entrance to River Park, while the second is located west of the soccer field. These pools are surrounded by valuable forested habitat.



SOURCE(S):
1997 USGS Topographic Map
SSURGO Soils Data from CT DEEP

Figure 10.9-1: Potential Wetlands along New Water Mains

LOCATION:
Mansfield, CT

University of Connecticut
Environmental Impact Evaluation

Map By: scottb
MMI#: 1958-59
MXD: H:\1958-59\GIS\Maps\Report\Figure10.9-1.mxd
1st Version: 9/14/2012
Revision: 9/14/2012
Scale: 1 inch = 2,500 feet

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The ten-acre parcel that makes up this wellfield may be sufficiently large to site two wells outside of wetlands while maintaining a 200-foot sanitary radius on the property. While direct impacts to the floodplain wetlands along the Willimantic River would likely be minimal, the drawdown associated with the new well or wells could impact the two potential vernal pools in the area. The extent to which this impact could occur would need to be evaluated through on-site testing. Numerous mitigation measures are available, if necessary, including construction of a new wetland along another section of this property or on other University or Town property or using wells minimally or only for peaking. In addition, riparian wetland impacts could be realized downstream to Eagleville Lake due to the reduction in instream flows. Additional analysis would need to be undertaken in consultation with CT DEEP and the United States Army Corps of Engineers (USACE) during the permitting processes.

Potential Wellfield EP-4

Well Location EP-4 is located within an extensive floodplain wetland complex associated with the Willimantic River. This complex includes backwater pools and several pocket wetlands as well as vernal pools that may support breeding amphibians. According to the Town of Mansfield, the area is heavily infested with non-native invasive species such as bittersweet, multiflora rose, winged euonymus (burning bush), barberry, and garlic mustard. A buttonbush swamp lies to the southeast of the potential well location. Floodplain trees include cottonwood, sycamore, elm, oaks, and maples. The nearby Willimantic River may also support turtles using the floodplain edges for nesting habitat, as well as a cold water fishery and associated recreational opportunities.

This nine-acre parcel is relatively narrow and the northern section is not sufficiently wide to support a well while maintaining a 200-foot sanitary radius on the property. As such, the southern portion has the only available space for a well. Installation of a new well and pumphouse on this parcel would require several acres of filling wetlands and vernal pools to elevate the location above the 1% annual chance floodplain. In addition, the potential pipeline route would need to be trenched through existing wetlands. In addition, riparian wetland impacts could be realized downstream to Eagleville Lake due to the reduction in instream flows.

Potential Wellfield EP-5

Well Location EP-5 is located in an upland agricultural area near the Willimantic River. A series of vernal pools lies nearby inside of a gated research area, serving as habitat for salamanders and frogs. Floodplain wetlands are associated with the riparian corridor adjacent to the Willimantic River. A grey dogwood swamp is located to the south of the potential well site and drains to Dunham Pond Brook. Dominant trees to the west of the agricultural field include mixed oaks, hickories, cottonwood, and maples with black cherry and black birch also present. The understory shrubs in the area are moderately thick and provide food and cover for local wildlife.

This 24-acre parcel is sufficiently large to support several wells well while maintaining a 200-foot sanitary radius on the property. Three wells could be easily located at the western edge of the existing fields. Two of these three wells would be located above the 1% annual chance floodplain such that grading in wetland areas would be minimal. The potential pipeline route would not need to be trenched through existing wetlands. However, the vernal pools, gray dogwood swamp, floodplain wetlands, Dunham Pond Brook, and the buttonbush swamp near EP-4 would all likely experience varying levels of drawdown associated with wellfield operation. Mitigation measures

similar to those described for EP-4 would be appropriate. Finally, riparian wetland impacts could be realized downstream to Eagleville Lake due to the reduction in instream flows.

10.9.2 EXISTING WETLAND AREAS ALONG POTENTIAL PIPELINE SEGMENTS

The potential pipeline segments from a new wellfield on the Willimantic River pass a variety of wetlands and watercourses. Refer to Figure 10.9-1 for a depiction of inland wetland soils and watercourses adjacent to potential pipeline segments. Table 10.9-1 summarizes the wetlands found along each pipeline segment potential pipeline segments associated with a new wellfield along the Willimantic River.

The wetlands presented above are described in more detail below.

- Pipeline Segments 3 & 4: This pipeline route includes well location MD-1 within an active cornfield south of Route 44. The cornfield is located within the floodplain of the Willimantic River and is classified by soil type as State wetlands. A wet meadow/emergent marsh depression is located within the center of the cornfield and had one to two feet of standing water present in November 2011. The depression may support amphibian breeding, although note that valuable upland forested or meadow-type habitat is lacking around the depression wetland. This depression would be classified as a federal wetland. Additional wetland areas do not appear to be located along Route 44 in this segment.

- Pipeline Segment 20: A forested wetland is conveyed under Route 44 between Rosal Apartments and the former Zenny's restaurant. The wetland flows from south to north through an 18-inch pipe.

- Pipeline Segment 21: The reader is directed to the Final Environmental Impact Statement (FEIS) for the Technology Park related to impacts to wetlands, vernal pools, and intermittent watercourses along this pipeline segment.

- Pipeline Segment 41: Well location EP-5 is at the edge of a cornfield in a dry, upland setting. A series of vernal pools is nearby inside of a gated "Recreation and Scientific Preserve." The area west of the well site appears to be an extensive forested floodplain wetland associated with the Willimantic River. The pipeline segment does not appear to cross or be adjacent to any wetland areas, although use of the well or wells would likely impact surrounding wetlands as described in Section 10.9.1.

- Pipeline Segment 42: Well location EP-4 is located in a difficult-to-access floodplain wetland complex consisting of backwater pools and several pocket wetlands. The potential well location is amid a complex of seasonal pools that might support breeding amphibians. The pipeline segment would need to cross this wetland complex towards Route 275. A culvert associated with the railroad crossing on Route 275 utilizes the former mill race to move water into the wetlands in Eagleville Preserve. As noted in Section 10.9.1, construction of a pipeline in this area would directly impact wetlands.

TABLE 10.9-1
Wetlands along Potential Pipeline Segments Associated with a New Willimantic River Wellfield

Pipeline Segment	Number of Adjacent Wetland Areas	Total Adjacent Wetland Distance (ft)	Comment
3 (MD-1)	1	450	Floodplain wetland; wet meadow / emergent marsh near potential well location
4	1	50	Floodplain wetland
5	0	0	-
20	1	50	Forested wetland
21	2	420	Intermittent watercourse / wetland, vernal pool
41 (EP-5)	1	0	Vernal pools / floodplain wetland
42 (EP-4)	1	785	Forested wetland associated with Eagleville Preserve, former mill race
43	0	0	-
44	2	100	Intermittent watercourse
45	1	180	Forested wetland draining to Tift Pond
46	0	0	-
47	0	0	-
51	1	50	Eagleville Brook
52	1	150	Eagleville Brook & forested wetland
53	0	0	-
54	7	1,980	Intermittent stream / emergent marsh; forested wetlands, Eagleville Brook
55	3	600	Intermittent stream, Cedar Swamp Brook, unnamed stream from Depot Campus
56 (MD-3)	1	200	Forested floodplain wetlands
57	0	0	-
58	0	0	-
59	0	0	-
60	1	25	Seeps
61	0	0	-
62	0	0	-
63	2	550	Willimantic River floodplain wetland, intermittent watercourse
64	0	0	-

- Pipeline Segment 44: This hillside stretch of Route 275 has two shallow culverts and no major stream crossings. A small, perhaps perennial watercourse that is not shown on USGS mapping is conveyed beneath the road from a forested wetland area to the southeast. East of Dunham Pond Road, an intermittent water courses is conveyed north to a perennial unnamed tributary to Eagleville Brook. The forested wetland associated with Eagleville Brook parallels the north side of Route 275 near Separatist Road, although it is not located immediately adjacent to the road.

- Pipeline Segment 45: A forested wetland is located south of Route 275 in the vicinity of Knollwood Apartments. This wetland drains to Tift Pond and eventually to Hanks Hill Brook. The Town of Mansfield has indicated that a vernal pool featuring frogs and salamanders is located within this wetland area.

- Pipeline Segments 51 & 52: Eagleville Brook is conveyed beneath Route 32 and Shady Lane flowing towards the southwest. A forested wetland is located on the southwestern side of Route 32, but extensive wetlands are not located near the Shady Lane crossing.

- Pipeline Segment 54: Several forested wetlands are located along North Eagleville Road associated with low-lying areas and Eagleville Brook. A relatively large emergent marsh wetland is located near the intersection of North Eagleville Road and Hunting Lodge Road associated with Eagleville Brook.

- Pipeline Segment 55: This relatively long segment of Route 32 includes three significant crossings. The first is a crossing from an intermittent stream associated with small upstream ponds. Portions of the pond appear to support an emergent marsh community with forested wetlands on the southwest side of Route 32. The second is the crossing of Cedar Swamp Brook which has limited associated wetlands. The third is the crossing of an unnamed perennial stream flowing from the southwestern part of the Depot Campus. This crossing has an emergent marsh/shrub wetland and farm field wetlands close to Route 32.

- Pipeline Segment 56: This pipeline route includes well location MD-3 in River Park. While wetlands are not present along the section of pipeline proposed for Plains Road, River Park includes floodplain wetlands associated with the Willimantic River and an upland forested riparian zone border that appears to consist of state and federal wetlands near the recreational fields with former wetland flagging still visible along the river. The floodplain wetlands consist of forested, scrub-shrub, and emergent marsh systems. Two potential vernal pools were observed nearby: The first is located east of Plains Road across from the entrance to River Park, and the second is located west of the existing recreational field relatively close to the proposed well site. These are also described in Section 10.9.1.

- Pipeline Segment 60: The unpaved section of Old Colony Road has an area of seeps at the toe of the road slope, but no extensive associated wetlands.

- Pipeline Segment 63: This segment utilizes an existing dirt road within Spring Manor Farm and a wooded area near the railroad tracks to connect to Route 44. The floodplain associated with the Willimantic River is near the southern part of the segment. This area appears to support an extensive backwater or emergent marsh wetland that may have previously supported a water race to provide power to mills in Mansfield Depot. An intermittent watercourse draining a forested / scrub shrub wetland east of the railroad tracks is conveyed beneath the farm road running southwest to the Willimantic River.

Pipeline segments associated with a potential new wellfield along the Willimantic River lie entirely beneath paved roadways with a few exceptions as noted above. Hanging pipes on the sides of culverts or bridges may be an option or directional drilling could be utilized to avoid wetlands. These activities will not result in a wetland impact but may still require wetland

permits. The use of best construction management practices for sedimentation, erosion, and debris controls would result in minimal impact to adjacent wetlands along the remainder of potential pipeline routes.

The above noted wetland areas were evaluated by a certified soil scientist and professional wetland scientist based on the presence of perennial streams, intermittent streams, and state wetland soils. Wetlands and vernal pools will need to be delineated along the selected pipeline scenario by a professional wetland scientist during the design phase.

A pumping test and numerical modeling would be required by the CT DEEP as part of any diversion permit application for a new wellfield. This modeling would help to quantify the potential level of impact of a new wellfield on nearby wetlands and watercourses and would likely drive the acceptable rates of withdrawal. New sources at these locations could likely be developed without significant wetland impact; however, the rate of withdrawal relative to the cost of the alternative would likely be a major consideration prior to developing such a source.

10.10 BIOLOGICAL ENVIRONMENT

Some clearing will likely be required under this alternative. This would be limited to road edges where pipelines and pressure reducing valves would be installed, as well as areas at potential well locations to support the pumphouse and associated infrastructure. Clearing would be minimized in order to preserve as much of the existing environment as possible. Potential well locations MD-1 and MD-3 would require the least amount of clearing, while EP-5 would require clearing of the forest edge, and EP-4 would require significant clearing and filling in wetlands.

The Natural Diversity Data Base (NDDB), Final Environmental Impact Statement (FEIS) for the Technology Park, and the 2002 Mansfield *Water Supply Plan* reference several state-listed species that have been identified along potential pipeline routes associated with this alternative. These include grasshopper sparrows, showy lady's slipper, vesper sparrows, American kestrels, dwarf huckleberry, northern spring salamanders, bobolinks, eastern hognose snakes, eastern meadowlarks, purple milkweed, one-sided pyrola (believed extirpated), savannah sparrows, southern bog lemmings, and wood turtles. Descriptions of these species were presented in Section 4.9. Qualified personnel would need to perform a biological survey along the proposed construction route to determine if these species are present and to set a construction timetable to avoid these species.

10.11 INLAND FISHERIES

The area investigated during the 2010 *Willimantic River Study* extended from upstream of the Willimantic River Wellfield downstream to Plains Road. This area includes potential wellfields MD-1 and MD-3, but does not include potential wellfields downstream of Eagleville Lake (EP-4 and EP-5). However, given the proximity of the river reach downstream of Eagleville Lake to the reaches upstream of Eagleville Lake, the fact that CT DEEP fisheries data from the Willimantic River downstream of Eagleville Lake was used in the study to determine existing fisheries demographics, and the fact that long-term streamflow data from the USGS gauge on the Willimantic River downstream of EP-5 in Coventry was utilized to create the streamflow dataset used in the analysis, extrapolation of the Willimantic River Study data to areas immediately

downstream of Eagleville Lake is believed appropriate for the level of analysis presented in this EIE. Note the following:

- A new wellfield constructed at MD-1 would manifest reduced streamflows between Route 44 and the upstream end of Eagleville Lake, as well as downstream of Eagleville Dam. As the water level in Eagleville Lake would remain relatively constant because of the height of the dam, no fisheries habitat impacts would manifest within the impoundment.

- A new wellfield constructed at MD-3 is just upstream of the backwater of Eagleville Lake. Thus, reduced streamflows and the resulting fisheries habitat impacts would manifest downstream of Eagleville Dam.

- A new wellfield constructed at EP-4 or EP-5 would both manifest reduced instream flows and corresponding fisheries habitat impacts downstream of Eagleville Lake dam. Both sites are downstream of the effluent discharge from the University's WPCF.

The 2010 *Willimantic River Study* provides an estimate of habitat usability measured in weighted usable area (WUA). Table 10.11-1 presents the WUA of fish habitat for natural (non-pumping) low-flow conditions on the Willimantic River as presented in the 2010 *Willimantic River Study*.

The percent of maximum WUA presented above in Table 10.10-1 is indicative of the change in the amount of useable fisheries habitat in the Willimantic River as compared to the maximum amount of habitat available.

A new withdrawal of 0.5 mgd to 1.0 mgd is equivalent to a withdrawal of 0.77 to 1.55 cfs from the river due to a reduction in groundwater flow that would reach the river and/or from induced infiltration from the river. This range is used, since new groundwater sources are not expected to yield greater rates. Table 10.11-2 presents the percentage reduction of WUA for the habitat stressor thresholds given a pumping rate of 0.5 mgd and 1.0 mgd. Common shiner was not considered in this analysis since it retains a relatively high percentage of WUA even at lower flows.

As shown in Table 10.11-2, an additional withdrawal of 0.77 cfs could result in a decrease in percentage of maximum WUA of 1% to 2% for brook trout, brown trout, and fallfish, while an additional withdrawal of 1.55 cfs could result in a decrease in percentage of maximum WUA of 3% to 4% for brook trout, 2% to 3% for brown trout, and 2% to 4% for fallfish. Note that since this reduction is based on a natural condition dataset, the potential reduction in WUA presented in Table 10.10-2 does not include existing withdrawals from the Willimantic River Wellfield. In other words, Table 10.11-2 presents the incremental impacts rather than cumulative impacts.

The existing withdrawals at the Willimantic River Wellfield can reach a maximum of 1.97 mgd, or 3.05 cfs as reported in the 2011 *Water Supply Plan*. This withdrawal rate is considered to have the potential to cause significant fisheries habitat impacts at very low flows. Table 10.11-3 presents the potential cumulative impact of pumping to WUA from the Willimantic River aquifer including the existing Willimantic River Wellfield *and* an additional wellfield or wellfields.

TABLE 10.11-1
Weighted Usable Area (ft²/1,000 ft) on the Willimantic River over a Restricted Range of Flows (5-30 cfs)

Simulated Discharge (cfs)	Brook Trout		Brown Trout		Fallfish		Adult Common Shiner		Juvenile Common Shiner	
	WUA	% Max WUA	WUA	% Max WUA	WUA	% Max WUA	WUA	% Max WUA	WUA	% Max WUA
5	4,529	15	3,971	17	4,747	25	13,636	63	2,548	100
6	5,085	16	4,261	18	5,107	27	14,301	66	2,187	86
7	5,639	18	4,544	19	5,459	29	14,915	69	1,888	74
8	6,198	20	4,824	20	5,801	31	15,458	71	1,632	64
9	6,758	22	5,101	21	6,138	33	15,949	73	1,433	56
10	7,323	23	5,379	23	6,475	34	16,400	76	1,272	50
11	7,894	25	5,659	24	6,813	36	16,810	77	1,143	45
12	8,467	27	5,938	25	7,152	38	17,196	79	1,040	41
13	9,048	29	6,221	26	7,483	40	17,559	81	949	37
14	9,636	31	6,513	27	7,799	41	17,900	82	878	34
15	10,233	33	6,807	29	8,099	43	18,224	84	814	32
16	10,828	35	7,106	30	8,396	45	18,522	85	759	30
17	11,409	37	7,405	31	8,687	46	18,798	87	719	28
18	11,981	38	7,704	32	8,966	48	19,057	88	687	27
19	12,549	40	8,007	34	9,237	49	19,298	89	663	26
20	13,114	42	8,314	35	9,503	50	19,518	90	644	25
21	13,680	44	8,623	36	9,773	52	19,722	91	628	25
22	14,253	46	8,935	37	10,043	53	19,913	92	614	24
23	14,809	47	9,250	39	10,310	55	20,091	93	603	24
24	15,354	49	9,565	40	10,579	56	20,258	93	592	23
25	15,898	51	9,882	41	10,845	58	20,416	94	583	23
26	16,426	53	10,202	43	11,112	59	20,562	95	574	23
27	16,935	54	10,523	44	11,375	60	20,699	95	566	22
28	17,433	56	10,841	45	11,635	62	20,825	96	557	22
29	17,913	57	11,165	47	11,893	63	20,941	96	550	22
30	18,382	59	11,492	48	12,149	64	21,046	97	544	21

Note: Rows with yellow shading denote the common (27 cfs), critical (15 cfs), rare (12 cfs), and extreme (7.8 cfs) discharges utilized as habitat management thresholds in the 2010 *Willimantic River Study*.

TABLE 10.11-2
Potential Reduction in WUA due to Groundwater Withdrawals at Threshold Discharges for Various Fish Species in the Willimantic River

Habitat Stressor Threshold	Discharge (cfs)	Brook Trout	Brown Trout	Fallfish
Withdrawal Rate of 0.5 mgd (0.77 cfs)				
Common	27	1%	1%	1%
Critical	15	2%	2%	2%
Rare	12	2%	1%	2%
Extreme	7.8	2%	1%	2%
Withdrawal Rate of 1.0 mgd (1.55 cfs)				
Common	27	3%	3%	2%
Critical	15	4%	3%	3%
Rare	12	4%	2%	4%
Extreme	7.8	4%	2%	4%

TABLE 10.11-3
Potential Cumulative Reduction in WUA due to Additional Groundwater Withdrawals at Threshold Discharges for Various Fish Species in the Willimantic River

Habitat Stressor Threshold	Discharge (cfs)	Brook Trout	Brown Trout	Fallfish
Withdrawal Rate of 2.47 mgd (3.82 cfs)				
Common	27	7%	5%	5%
Critical	15	8%	5%	7%
Rare	12	7%	5%	7%
Extreme	7.8	>5%	>3%	>6%
Withdrawal Rate of 2.97 mgd (4.60 cfs)				
Common	27	8%	7%	7%
Critical	15	10%	6%	9%
Rare	12	9%	6%	9%
Extreme	7.8	>5%	>3%	>6%

Results for the extreme threshold are limited by the information available in Table 10.10-1.

Based on the results in Table 10.11-3, an additional withdrawal of 0.77 cfs from a new wellfield could result in a cumulative overall decrease in percentage of maximum WUA of 7% to 8% for brook trout, 5% for brown trout, and 5% to 7% for fallfish. An additional withdrawal of 1.55 cfs from a new wellfield could result in a cumulative overall decrease in percentage of maximum WUA of 8% to 10% for brook trout, 6% to 7% for brown trout, and 7% to 9% for fallfish. These impacts would manifest downstream of Route 44 (if MD-1 was utilized) or downstream of Eagleville Dam. This analysis does not account for the proposed CWC wellfield in Coventry to be located across the river from EP-5 proposed to produce approximately 0.2 mgd (0.31 cfs).

The amount of habitat available for fallfish appears to be moderately impacted under lower natural flow conditions, while the amount of habitat available for brook trout and brown trout appears to be more significantly impacted under lower natural flow conditions.

Note that since the natural streamflow dataset utilized in the 2010 *Willimantic River Study* was partially based on a watershed correction ratio that transformed flows at the USGS gauging station in Coventry into typical flows at the Willimantic River Wellfield (Appendix B of the 2010 *Willimantic River Study*), additional discharge would be available in river reaches downstream of Eagleville Dam. This is because more drainage area is available for groundwater recharge and surface water input from streams such as Cedar Swamp Brook and Eagleville Brook. Thus, it is likely that the natural dataset used herein is conservatively low (less WUA) for the reach downstream of Eagleville Dam and that fisheries impacts to the Willimantic River would be somewhat mitigated by the availability of additional instream flow.

Overall, the incremental fisheries impact to the Willimantic River from any of the four potential wellfield locations appears to be slight, although it is recognized that the overall cumulative impact of pumping when including the Willimantic River Wellfield appears to be more significant. The actual level of impact to fisheries habitat would need to be determined during the diversion permit process based on proposed wellfield location and yield.

The use of groundwater from the Willimantic River corridor (basin #3100) in Mansfield would not constitute an interbasin transfer of water, although under existing conditions, withdrawals from the Willimantic River basin are partly utilized by the University in the Fenton River basin. The majority of flow is returned to the Willimantic River via the University WPCF, and this condition would continue in the future with a new wellfield located along the Willimantic River.

10.12 WATER QUALITY AND STORMWATER MANAGEMENT

10.12.1 SURFACE WATER RESOURCES

This alternative would withdraw additional water from the Willimantic River basin. The watershed draining to the wellfield locations includes over 100 square miles in Monson and Wales, Massachusetts, Stafford, Union, Ellington, Tolland, Willington, Vernon, Coventry, and Mansfield. The surface water in the Willimantic River is classified as B throughout its length, indicating that is suitable for fish and wildlife habitat, recreation, navigation, and industrial and agricultural water supply. This classification begins on Furnace Brook, one the river's major headwater tributaries in Stafford. The Willimantic River is listed as meeting the standard of designated use for aquatic life but not for recreation due to an unknown source of *E. Coli* bacteria. In addition, the river has a fish consumption advisory.

10.12.2 GROUNDWATER RESOURCES

Potential well locations MD-1, EP-4, and EP-5 along the Willimantic River are designated as areas of high ground water quality (Class GA) designated for existing private drinking water supplies or proposed public drinking water supplies. It is presumed that groundwater in such areas is at a minimum suitable for drinking or other domestic use without treatment. The

installation of a new well along the Willimantic River and associated water mains is consistent with this classification.

In addition, water withdrawn from one of these wellfields is expected to have similar quality to that already withdrawn from the Willimantic River Wellfield such that blending of treated water is not expected to present any challenges to the University.

Test borings and water quality sampling were performed at test wells located in the vicinity of EP-5. All water quality parameters met state and federal water quality standards; no volatile organics, pesticides, or iron was detected. Low-levels of manganese were detected. This confirms the GA designation in the vicinity of EP-5.

Potential well location MD-3 is designated as an area of reduced groundwater quality (Class GB) in a historically highly-urbanized area or an area of intense industrial activity and where public water supply service is available. Such groundwater may not be suitable for human consumption without treatment due to waste discharges, spills or leaks of chemicals, or land use impacts. In the case of MD-3, the area formerly contained rapid sand filtration beds that treated wastewater from Mansfield Training School. While the installation of water mains is appropriate through GB areas (such as along North Eagleville Road), the installation of a new supply source in a GB area is not consistent with that classification. In order to utilize MD-3 as a new source of supply, extensive testing would need to be performed to show that the groundwater in the area has improved to GA quality over the past two decades since the closure of this facility.

Several areas along potential pipeline routes are noted as having reduced groundwater quality. Areas of GA-Impaired water quality are located within Spring Manor Farm and poor ground water quality has also been characterized in Mansfield Four Corners. The installation of water mains into and through such areas is not expected to reduce water quality. Instead, the installation of water mains to Mansfield Four Corners would eliminate public health concerns related to the historical contamination in the area.

Homeowners located in Mansfield Depot and Eagleville currently utilize private wells to provide water supply to their properties. The installation of a new well along the Willimantic River and associated water mains is not expected to cause any impact to the water quantity available from those wells or the water quality within those wells. Most private wells are drilled into the underlying fractured bedrock aquifer which is not greatly influenced by pumping of the overlying stratified drift. 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.

10.12.3 STORMWATER MANAGEMENT

Impacts to stormwater quality are not expected. Best management practices would be utilized during the construction period such that construction debris and sediment are not directly released to stormwater systems. New stormwater systems would be developed in concert with any new University development and would need to meet the University's design standards. In addition, new stormwater systems would be created during new development projects. The impacts of these systems will be evaluated during local permitting processes.

10.13 FLOOD HAZARD POTENTIAL

The Willimantic River has an associated 1% annual chance floodplain and floodway mapped in the vicinity of the wellfield. Flood elevation information is located in the Town of Mansfield Flood Insurance Study (FIS). Based on information in the FIS, the 1981 Flood Insurance Rate Map (FIRM) , and the 1981 Flood Hazard and Flood Boundary Map, potential well locations MD-1, MD-3, and EP-4 appear to be within the 1% annual chance floodplain and likely the floodway of the Willimantic River. Well location EP-5 appears to be above the 1% annual chance floodplain but within the 0.2% annual chance floodplain. If more than two wells were pursued on this parcel, it is possible that at least one would be at a location currently below the 1% annual chance flood elevation. Stream channel encroachment lines (SCELs) are also located along the Willimantic River.

Given the location of the potential wells within and near the floodplain, mounding would need to occur to raise the elevation of the wellhead above the base flood elevation. Examples of this type of mounding are present at the existing Willimantic River Wellfield. Table 10.13-1 presents estimates for mounding based on ground surface and base flood elevations (BFEs). In each case, a mound would be 11 feet high with a 15-foot diameter plateau on the top for a well house, if desired. The volume of each mound would be approximately 300 cubic yards. Compensatory floodplain mitigation would likely need to be performed to offset the loss of floodplain storage. This would need to be identified and resolved through the permitting process. Each of the potential well sites is located sufficiently close to the SCEL boundary that it is possible that mounding could be required within the SCEL boundary.

TABLE 10.13-1
Grading Required for Well Mounds

Site	Ground Elevation (ft)	BFE (ft)	Required Height of Mound (ft)	Assumed Height of Mound (ft)	Volume of Fill Material (cy)
MD-1	283	293	>10	11	303
MD-3	285	291	>6	11	303
EP-4	265	275	>10	11	303

New well locations would need to comply with Connecticut DPH requirements for distance from annual high water marks. DPH requires that a new well be located at least 50 feet from the high water mark of nearby wetlands and watercourses. This distance would need to be confirmed in the field prior to the drilling of any test wells as it is part of the Well Site Application required by Connecticut DPH.

Potential pipeline routes that pass through floodplain areas will require regulatory review even if pipes are connected to bridges or drilled below-grade.

10.14 PHYSICAL ENVIRONMENT

10.14.1 TOPOGRAPHY

The topography of the four potential well locations in the vicinity of the Willimantic River is fairly flat but slope relatively quickly up to the Route 32 corridor. Potential well locations MD-1 and MD-3 are located at approximately 285 feet above sea level, while well site EP-5 is located at approximately 280 feet above sea level. Well location EP-4 is the lowest of the four sites and located at approximately 265 to 270 feet above sea level. The location for any new well or wells will 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. Because some well sites would need to be mounded to be above the base flood elevation, the adjacent topography would not be an issue.

The potential connection points to the University system for the four alternative well locations include the Willimantic River Wellfield Treatment Building (elevation 345), the 16-inch diameter water main to the Main Campus at the intersection of Spring Manor Lane and Route 32 (elevation 460), the 16-inch transmission main at North Hillside Road (elevation 665 feet), or the 12-inch diameter express main at Bolton Road (elevation 625 feet). As noted previously, a static pressure of 180 psi or more will be required to move water into the transmission system from the new well. As the hydraulic grade line in the Main Campus system is controlled by the High Head Storage Tanks in Towers and is greater than 710 feet, additional pressure may be needed to move water directly into the distribution system via a connection along South Eagleville Road.

10.14.2 SURFICIAL GEOLOGY

Surficial geology is discussed in detail in Section 10.1 associated with a review of potential well site yields.

10.14.3 BEDROCK GEOLOGY

The bedrock geology at well locations MD-1 and MD-3 is mapped as part of the Hebron Gneiss on the 1985 *Bedrock Geologic Map of Connecticut*. The bedrock geology is primarily schist and gneiss, and surrounding map units also consist of schist and gneiss. The bedrock tends to strike east to west and dip 25 degrees to the north in the vicinity of the project site.

The bedrock geology at the proposed well locations EP-4 and EP-5 is mapped as part of the Tatnic Hill Formation on the 1985 *Bedrock Geologic Map of Connecticut*. The bedrock geology is primarily schist and gneiss, and surrounding map units also consist of schist and gneiss. The bedrock tends to strike east to west and dip 10 degrees to the north in the vicinity of the project site.

This alternative would not rely on bedrock well sources. These wellfields withdraw water from the stratified drift aquifer and are located relatively far from surrounding residences such that water quality or water quantity impacts to private wells is not expected to be an issue.

Fault lines are mapped along potential pipeline segments associated with this alternative for the Eagleville wells that use a connection scenario via North Hillside Road. However, these fault lines is considered to be inactive.

10.15 AIR QUALITY AND NOISE

The construction of pumping and treatment/control buildings, new water mains and utility work, and other associated construction will not result in a degradation of air quality. New buildings associated with this alternative would have interior equipment and would not be significant generators of air pollution.

Temporary construction impacts to air quality in the vicinity of the new wellfield or wellfields are expected and unavoidable. For example, additional construction traffic will be realized near a wellfield during the development period resulting in an increase in vehicular emissions near the site. Overall, these emissions are expected to have a minimal impact on air quality.

In addition, other construction activities are expected to generate 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 use of air pollution devices on construction equipment and other forms of controls that reduce the impact from fugitive dust emissions will be utilized during this project 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 will be conducted in accordance with proper protocols and regulations, and no washings will be directed to storm drainage.

The implementation of a new wellfield alternative and associated new water mains and utility work would not result in any long-term noise impacts. New treatment facilities would be located either at the wellfield or tied into existing treatment at the Willimantic River Wellfield, with interior equipment that does not create significant noise at the street. While temporary impacts associated with the construction of new water mains would be realized along state and town roads, the noise generated by these construction activities would be minimal.

10.16 SOLID WASTE, HAZARDOUS MATERIALS, & POTENTIAL POLLUTION SOURCES

Regardless of the well location or locations chosen, some amount of construction and demolition-related waste will be generated by the project. Disposal of these wastes would be handled in accordance with applicable solid waste statues and regulations. Significant impacts are not anticipated.

10.17 OTHER PROJECT IMPACTS

10.17.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

Certain adverse impacts are unavoidable. These are predominantly in the category of short-term construction related impacts. The project will undergo a construction phase wherein additional equipment will be utilized at the site or sites. Mitigation measures have been identified with respect to associated short-term air and noise quality. However, a certain degree of additional truck and equipment use and access will be necessary during this time period, which is unavoidable. Potential soil erosion and sedimentation impacts have also been identified. These will be largely mitigated through proper construction management techniques.

The installation of a new well may result in loss of wetlands where filling and grading is required, and may cause incremental impacts to fisheries habitat in the Willimantic River that would be unavoidable if this alternative were implemented.

10.17.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The construction of a new wellfield and associated pipelines will utilize nonrenewable resources during the construction and implementation (i.e., construction supplies, fuel, personnel time, etc.). Since these resources cannot be reused, they are considered to be irreversibly and irretrievably committed. Specifically, these include the following actions:

- Clearing;
- Well drilling and development;
- Construction of new pump houses and treatment/control buildings;
- Installation of water mains to connect to the University and Mansfield; and
- Installation of associated infrastructure, individual pressure reducing valves, etc.

10.17.3 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:

- Additional withdrawals from the Willimantic River aquifer (and subsequently from the Willimantic River) through reduced groundwater discharge and induced infiltration;
- Loss of wetlands in the Willimantic River corridor due to grading and filling, with this loss increasing if multiple wells and well sites are developed;
- Loss of agricultural uses at sites MD-1 and EP-5;
- Loss of recreational opportunities at sites MD-3 and EP-4;
- Incremental energy demands;
- Incremental traffic density; and
- Potential additional development due to the presence of the water main, although this would be mitigated by the proposed overlay zone and the limitation on available water with this alternative.

10.17.4 MITIGATION OPPORTUNITIES TO OFFSET ADVERSE ENVIRONMENTAL IMPACTS

Several mitigation opportunities have been identified for this alternative to minimize or offset adverse environmental impacts. These include the following:

- Compensatory flood mitigation for filling in floodplains to construct mounds that elevate wellheads;
- Compensatory wetland mitigation for direct wetland impacts due to grading and filling;
- 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 relative to the threshold flows of the Willimantic River;
- Implementation of overlay zones and zoning regulation changes by the local land use commission in Mansfield to reduce future development density and creation of impervious surfaces along potential pipeline routes;
- Identification of alternate land for agricultural use to replace the loss of sites MD-1 and EP-5;
- Identification of alternate land for recreational use to replace the loss of sites MD-3 and EP-4;
- Coordination with various local departments, commissions, and committees regarding the proposed pipeline;
- Designs that hang pipe on bridges or include directional drilling to prevent direct wetland impacts;
- Construction occurring in the summer whenever possible to minimize traffic impacts near schools and the University;
- 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;
- Adherence to best management practices to mitigate impacts to stormwater runoff; and
- Performance of construction activities during daylight hours to minimize noise impacts.

10.18 EVALUATION OF PROJECT COSTS

10.18.1 LAND ACQUISITION AND EASEMENT COSTS

The implementation of this alternative will require the purchase or easement of land for a new well or wells. The cost for these items could range from minimal (transfer of land from the other State agencies or the Town of Mansfield) to thousands of dollars (for MD-1).

10.18.2 COSTS TO IMPROVE EXISTING INFRASTRUCTURE

Existing infrastructure will not need to be improved or replaced under this alternative.

10.18.3 CONSTRUCTION COSTS

Source-Related Costs

Because individual well sites have not been selected, rough cost estimates must be used for planning purposes. Elements of the cost estimates include:

- Cost of land to be acquired – approximately three acres is needed per well site to achieve full ownership of a 200-foot sanitary radius, although it is recognized that entire parcels will likely be acquired and assembled as needed.
- Drilling of test borings, completion of informal yield tests, and water quality testing to select permanent well sites.
- Drilling and development of production wells.
- Completion of 120-hour aquifer pumping test for diversion permitting.
- 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).
- Installation of pumps, discharge lines, and electrical service to well pumps.
- Installation of transmission pipes from wells to treatment building (if needed) or system.
- Grading and improvements for new access roads.
- Construction of treatment/control building or control building.

Cost estimates are summarized in Table 10.18-1 and include development of two wells per site (either one active well with one backup well, or two wells that operate lead-lag or in some other arrangement).

Pipeline and Associated Water Mains

The assumptions have been made relative to the cost of pipeline:

- Eight-inch transmission main
- 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
- Fire hydrants – none included

Table 10.18-2 lists the estimates for each potential pipeline scenario.

TABLE 10.18-1
Cost Estimates for a New Wellfield along the Willimantic River

Item	Estimated Costs			
	MD-1	**MD-3**	**EP-4**	**EP-5**
Cost of land	$1,000,000	$0[(1)]	$100,000[(2)]	$0(1)
Drilling of test borings, completion of informal yield tests, and water quality testing to select permanent well sites.	$75,000	$75,000	$75,000	$75,000
Drilling and development of two production wells (includes pumps and discharge lines)	$200,000	$200,000	$200,000	$200,000
Completion of 120-hour aquifer pumping test for diversion permitting & Level A mapping	$50,000	$50,000	$50,000	$50,000
Completion of 72-hour yield test for proving safe yield and appropriate water quality (can be coincident with other testing)	$20,000	$20,000	$20,000	$20,000
GWUDI testing ($50,000 per well)	$0	$100,000	$100,000	$0
SCEL/FEMA analysis (includes modeling)	$50,000	$50,000	$50,000	$0
Construct two 10-foot high mounds (each 303 cubic yards of fill material at $25/cy)	$15,000	$15,000	$15,000	$0
Compensatory flood mitigation (excavation of 606 cubic yards of fill material at $10/cy)	$6,000	$6,000	$6,000	$0
Compensatory wetland mitigation (replace wetlands lost to grading and filling)	$0	$0	$100,000	$0
Well houses at wellheads (includes structures, meters, piping) ($50,000 per well)	$100,000	$100,000	$100,000	$100,000
Installation of transmission pipes from wells to treatment/control building ($50,000 per well)	$100,000	$100,000	$100,000	$100,000
Construction of treatment/control building or control building (and contents)	$200,000	$200,000	$200,000	$200,000
Grading and improvements for new access roads	$10,000	$10,000	$10,000	$10,000
Totals	***$1,826,000***	***$926,000***	***$1,126,000***	***$755,000***

1. Assumed donation of land from Town
2. Assumed cost for easement from State of Connecticut

TABLE 10.18-2
Construction Cost Estimates for Potential Pipeline Scenarios

Potential Wellfield	Pipeline Scenario	Cost (million)
MD-1	#6A-1	$1,479,000
	#6A-2	$1,942,500
	#6A-3	$1,471,500
	#6A-4	$1,935,000
	#6A-5	$1,683,000
MD-3	#6B-1	$1,507,500
	#6B-2	$1,971,000
EP-4	#6C-1	$2,722,500
	#6C-2	$3,186,000
	#6C-3	$3,226,500
	#6C-4	$3,000,000
EP-5	#6D-1	$2,869,500
	#6D-2	$3,333,000
	#6D-3	$3,373,500
	#6D-4	$3,085,500

10.18.4 ANALYSIS OF ESTIMATED COSTS

The costs described above are summarized in Table 10.18-3. Supplies at MD-1 and EP-5 are most favorable, based on anticipated water quality and potential yield. The costs reported in Table 10.18-3 are reasonably additive, as the wells are not close together.

TABLE 10.18-3
Summary of Estimated Costs for Alternative #6

Item	Estimated Costs			
	MD-1	MD-3	EP-4	EP-5
Wellfield investigation, development, and construction	$1,826,000	$926,000	$1,126,000	$755,000
Transmission pipelines	$1,471,500	$1,507,500	$2,722,500	$2,869,500
Design/contingency (20% of above)	*$659,500*	*$486,700*	*$769,700*	*$724,900*
Permitting and Other Approvals	$150,000	$150,000	$150,000	$150,000
Legal agreements and services	$100,000	$100,000	$100,000	$100,000
Totals	**$4,207,000**	**$3,170,200**	**$4,868,200**	**$4,599,400**

Numerous mitigation opportunities have been identified for this alternative to minimize or offset adverse environmental impacts. Costs for compensatory flood mitigation for filling in floodplains to construct mounds that elevate wellheads and costs for compensatory wetland mitigation for direct wetland impacts due to grading and filling are included in Table 10.18-1 (and thus, in Table 10.18-3). Only site EP-5 is believed to be free of these potential costs.

Most of the mitigation opportunities listed in Section 10.17.4 will have costs that are inherently incorporated into components of the alternative. For example, coordination with local departments and commissions regarding the pipeline are typically incorporated into design and regulatory costs, as are designs that hang pipe on bridges or include directional drilling to prevent direct wetland impacts, and construction in the summer whenever possible to minimize traffic impacts near the University. Thus, much of the mitigation does not have a separable cost. On the other hand, implementation of overlay zones in Mansfield will have a moderate cost on the order of $10,000.

Identification of alternate land for agricultural use to replace the loss of sites MD-1 and EP-5 and identification of alternate land for recreational use to replace the loss of sites MD-3 and EP-4 will have a cost impact to the Town of Mansfield. The cost for land purchase can be minimized by selecting properties that are Town-owned, but this may not be an option. Furthermore, even if costs of land can be minimized, the preparation of land for agriculture or the establishment of recreational facilities can have an associated expense. These costs cannot be estimated without a selection of well site for development and an understanding of which land uses (agricultural or recreational) will be lost. However, this document recognizes that costs will be incurred by the Town of Mansfield.

10.19 FINDING

Development of one or more wells along the Willimantic River may cause adverse environmental impacts, although mitigation is possible to address these impacts. However, the yield and quality of water is uncertain. Development of wells at these locations will not meet the stated project purpose and need.