

ENVIRONMENTAL REPORT

AQUARION CANNONDALE WELL

WILTON, CONNECTICUT

PREPARED FOR:

AQUARION WATER COMPANY

December 2017

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INTRODUCTION

As part of a Water Diversion Permit application to the Connecticut Department of Energy and Environmental Protection (DEEP), LandTech has conducted an evaluation of natural resources at the Aquarion Water Company Cannondale Well Field on Cannon Road in Wilton, CT. The purpose of the natural resource survey was to obtain baseline data on existing natural resources in the vicinity of the existing wells and to assess potential impacts on wetlands and water resources associated with groundwater withdrawals.

The water diversion permit is for a proposed 1.0 mgd maximum groundwater withdrawal rate from one existing water supply well.

This study includes a compilation of natural resource information regarding the subject site from published sources as well as from field surveys.

NATURAL RESOURCE EVALUATION

Bedrock Geology

The well field is located within the Ratlum Mountain Schist bedrock unit. This unit consists of grey, medium-grained interlayered schist and granofels, composed of quartz, oligoclase, muscovite, biotite and garnet. Harrison Gneiss borders the schist to the east and west. It consists of interlayered dark- and light-gray, medium-grained, well-foliated gneiss, composed of andesine, quartz, hornblende, and biotite.

Surficial Geology / Soils

The surficial geology of the site consists of glacial outwash deposits and alluvial deposits. The glacial outwash consists of stratified drift composed mainly of interbedded sands and gravel. According to Leggette, Brashears and Graham (LBG), the geologic log for the production well indicates sand and fine gravel deposits to approximately 33 feet below grade overlying approximately 25 feet of medium sand, gravel and silt with the bottom 10 feet of the formation consisting of a medium sand and gravel mix. Additional details regarding the depth and overall extent of the stratified drift aquifer are included in the LBG report.

Post-glacial alluvial deposits are located along the Norwalk River.

The Natural Resources Conservation Service (NRCS) identifies the glacial outwash deposits as Haven and Enfield soils (Map Units 32A & 32B) and Ninigret and Tisbury soils (21A). The Haven series consists of very deep, well drained soils formed in loamy over sandy and gravelly outwash. The Enfield series consists of very deep, well drained loamy soils formed in a silty

mantle overlying glacial outwash. The Haven and Enfield soils are nearly level through moderately sloping soils on outwash plains, valley trains, terraces, and water-sorted moraine deposits.

The Ninigret series consists of very deep, moderately well drained soils formed in loamy over sandy and gravelly glacial outwash. The Tisbury series consists of very deep, moderately well drained loamy soils formed in silty eolian deposits overlying outwash. The Ninigret and Tisbury soils are nearly level to sloping soils on glaciofluvial landforms, typically in slight depressions and broad drainage ways.

NRCS identifies the site's alluvial soils as Pootatuck fine sandy loam (102) and Rippowam fine sandy loam (103). The Pootatuck series consists of very deep, moderately well drained loamy soils formed in alluvial sediments. The Rippowam series consists of very deep, poorly drained loamy soils formed in alluvial sediments. The Pootatuck and Wippowam soils are nearly level soils on floodplains subject to frequent to occasional flooding.

NRCS also identifies man-made soils within the project area as Udorthents-Urban land (306) complex and Udorthents, smoothed (308).

NRCS soils mapping is included in the Appendix B of this report.

Water Resources

The Cannondale well is situated within the Norwalk River watershed (DEEP# 7300). The projected zone of influence of the Cannondale Well Field encompasses portions of the Norwalk River, Goetzen Brook, and their associated floodplain wetlands.

Norwalk River

The Norwalk River flows north to south, east of Route 7, along the eastern edge of the aquifer approximately 150 feet east of the well field. The Norwalk River in the vicinity of the well field is a Class 3 Wild Trout Management Area. Existing populations of wild trout are enhanced through stocking of adults 9" in length or larger. There is a 9" minimum length harvest restriction. The large trout require deeper habitat to survive. Brown trout fry are also stocked between the Cannondale dam to the north and Wolfpit Road to the south.

According to the Adopted Water Quality Classifications, surface water quality of the Norwalk River is designated as Class B. This designation indicates that this is a fishable and swimmable surface water suitable for recreational use, fish and wildlife habitat, and agricultural and industrial supply.

At the northern end of the production wells zone of influence, the river is impounded by an earthen and masonry dam. In-filling upstream of the dam has created a shallow ponded environment. Between the dam and Cannon Road, the river abuts commercially developed land, including a stone retaining wall along the right bank, buildings, parking lots and lawn. This section of river is typically shallow, with a cobble, gravel and sand substrate and contains two small pools.

Between the Cannon Road and railroad embankment culverts, the Norwalk River abuts additional commercial land (right bank) and a narrow wooded buffer (left bank) between the

river and Pimpewaug Road. This section of river is typically shallow, with a deep pool upstream of the railroad embankment culvert.

South of the railroad embankment culvert, the river flows past the well field and through a relatively large forested floodplain wetland. Upstream of the Wilton YMCA driveway culvert, the river flows past ball fields, lawn and parking lots on YMCA property. The northern portion of this section of river is generally shallow and fast flowing over cobbles and gravel. The southern section is somewhat deeper with somewhat more gravel and sand substrate. There is a large pool downstream of the railroad embankment culvert and a second pool at a river bend north of the YMCA property.

Downstream of the Wilton YMCA, the river is confined within a channelized section of river behind commercial properties on Route 7. It is somewhat narrower than northern sections and is abutted on its right bank mainly by paved parking and storage areas. Numerous direct discharges of stormwater runoff exist.

Norwalk River Floodplain Wetlands

A relatively large area of forested floodplain wetland abuts the Norwalk River just south of the production well. The wetland is underlain by poorly drained loamy soils over sand and gravel outwash. It is characterized by a stand of 2nd growth hardwood trees dominated by red maple and white ash, and a well-developed shrub understory.

A Connecticut Department of Transportation (DOT) mitigation wetland lies southwest of the production well along the western edge of the floodplain forest, north of the Wilton YMCA, and adjacent to Route 7. The wetland was created within a work staging area around 2005 to compensate for offsite wetland impacts associated with the reconstruction of Route 7. According to application documents, the mitigation wetland was designed to complement the existing abutting wetlands, maximize edge habitat, and enhance wildlife usage through the use of native plantings. Small pools were incorporated into the design, near the interface of the existing wetlands to the east to create opportunities for vernal pools to develop.

Portions of the floodplain wetland (south and east of the DOT mitigation wetland) contain areas of seasonal shallow water that may support vernal pool species. The areas of seasonal shallow ponding contain pit and mound topography with dense shrub and emergent marsh vegetation.

YMCA Pond

An excavated pond lies west of the Norwalk River within the Wilton YMCA property. The pond is groundwater fed and is used for swimming. There are no bordering wetlands surrounding the pond.

Goetzen Brook

Goetzen Brook flows north to south, west of route 7 along the west side of well field's zone of influence (ZOI). It flows near the western contact of the till uplands and stratified drift of the Norwalk River valley. Goetzen Brook flows into the Norwalk River just north of the Wilton YMCA driveway culvert. According to the Adopted Water Quality Classifications, surface water quality of Goetzen Brook is designated as Class A. This designation indicates that this is a

uniformly good to excellent, natural quality surface water suitable for recreational use, health aquatic habitat, agricultural and industrial supply, and potential drinking water supply.

Goetzen Brook Wetlands

A shallow pond/emergent marsh wetland is located at the upstream end of Goetzen Brook, north of Olmstead Hill Road. The Brook flows through a narrow forested floodplain wetland, south of Olmstead Hill Road, between the base of the till uplands and recreational fields within Allens Meadow Park. There are two impoundments along the brook that form a shallow emergent marsh (former pond) and a larger ponded environment.

Endangered, Threatened and Species of Special Concern

The Connecticut Natural Diversity Database (NDDB) map data included in the December 2010 DEEP GIS data were reviewed to determine the presence of known or suspected state and federal endangered and threatened species and species of special concern. It was determined that an NDDB area encompasses a portion of the well's zone of influence northwest of the production well.

A request for additional review was sent to the DEEP in April 2011. The DEEP response (Appendix C) indicates that there are records for Whiteriver crayfish (*Procambarus acutus*) and the ground beetle (*Bembidion lacunarium*) in the vicinity. The response further states that it has been determined that the proposed well connection to the public water supply will not negatively impact these species.

IMPACT EVALUATION

Norwalk River

A 90-day aquifer test was conducted on the production well in 1984. Flows in the Norwalk River were monitored at four locations adjacent to the well field during the aquifer test. Another six day aquifer test was conducted on the production well in 2013. Flows in the Norwalk River were monitored at two locations, one upstream and one downstream of the well field during the 2013 aquifer test. Two piezometers were also installed adjacent to each other in the Norwalk River, east of the production well, to document the magnitude and direction of vertical flow between the aquifer and the river. Details regarding the two aquifer tests are included in the Aquifer Test Report prepared by LBG, dated December 2017.

Streamflow measurements collected during the 1984, 90-day aquifer test, under moderately low-flow conditions indicated that no more than 30 percent of the water pumped during the test was derived from induced infiltration from the Norwalk River. The report found that at a pumping rate of 1.0 mgd, the reduction in stream flow would not be more than 0.5 cubic feet per second (cfs).

The data obtained from the Norwalk River piezometers during the 2013 aquifer test documents that the Norwalk River adjacent to the well field was impacted by pumping of the production well. The piezometers located in the Norwalk River (PZ-1A and PZ-1B) each showed a reversal in flow gradient direction between the surface water and the aquifer water level from upward to

downward as the test progressed indicating induced infiltration from the Norwalk River. Both piezometers showed a clear declining trend in groundwater levels as soon as the production well began pumping and the water levels recovered after the cessation of pumping. After six days of continuous pumping, the drawdown in the groundwater level at PZ-1A and PZ-1B was 1.22 feet and 2.55 feet, respectively. Approximately 72 hours after the shutdown of the test, the groundwater levels in PZ-1A and PZ-1B recovered 0.98 feet and 2.16 feet, respectively.

According to LBG, based on the results of the aquifer tests at the requested diversion rate of 1.0 mgd, the estimated potential reduction of flow in the Norwalk River would be approximately 0.46 cfs or 208 gpm. The Norwalk River estimated flow durations (the percent of the time the flow in the river equals or exceeds the referenced value based on stream flow data from 1967 through 2017) in the vicinity of the well field (SG-1) calculated by LBG with and without the proposed water diversion are shown in Table 1.

Table 1. – Norwalk River Flow Statistics

	Percent of Time Daily Flow (cfs) Equals or Exceeds That Shown				
	10	30	50	80	90
Natural Conditions without Withdrawal	112	52	29	8.8	4.5
Pumping Conditions with Withdrawal	111.54	51.54	28.54	8.34	4.04

During periods of low flow (90% flow duration), induced infiltration associated with the 1.0 mgd withdrawal rate results in an 10% flow reduction in the Norwalk River near the well field from 4.5 cfs to 4.04 cfs.

In order to protect trout habitat in the vicinity of the well field, stream base flow must be maintained and the well withdrawals need to be incorporated into an overall water management plan to mitigate impacts during low flows. It will be necessary to maintain some deep water pools for adults, and riffle habitats for juveniles during low flow periods. The enhancement of trout habitat through the creation of additional habitat cover for all life stages of brown trout should also be considered.

Goetzen Brook

Two piezometers were installed and monitored within Goetzen Brook during the 2013 aquifer test. One piezometer (PZ-2) was located off Olmstead Hill Road near the reported NDDDB site identified as potential habitat for the white river crayfish. The other piezometer (PZ-3) was located near Route 7 southwest of the production well.

The two piezometers showed no discernible impact from the pumping. Throughout the test an upward vertical flow gradient was observed at both piezometers. Based on the aquifer test data, impacts to Goetzen Brook, its associated wetland habitats, and the whiter river crayfish from pumping of the production well at the requested water withdrawal rate are not expected.

Norwalk River Floodplain Wetlands and DOT Mitigation Wetlands

Two monitoring wells located within the large floodplain wetlands south of the production well were monitored during the 1984 aquifer pump test. Both monitoring wells (WN-80 & 82-4) showed reductions in groundwater levels during the pump test. After 3 days of pumping, drawdowns of 1.55 ft and 1.73 ft were observed in monitoring wells WN-80 and 82-4, respectively. After 90 days of pumping, drawdowns were 12.13 ft and 12.35 ft.

Additional monitoring of groundwater within the floodplain wetland and DOT mitigation wetland was conducted during the 2013 aquifer pump test. Five piezometers (PZ-3, PZ-4, PZ-5A, PZ-5B and PZ-6) were installed in the CT DOT mitigation wetland and the flood plain wetland located south and west of the well field. The piezometer data documents that at least a portion of the wetland was impacted by pumping during the aquifer test.

There was no discernible change in surface-water or groundwater levels at PZ-3 and PZ-4, that would suggest pumping related impact. There was no change in upward flow gradients between groundwater and surface water for both piezometers. Piezometer PZ-3 is located within the floodplain wetland at Goetzen Brook, south of the DOT mitigation wetland. Piezometer PZ-4 is located on the south side of the DOT mitigation wetland near its interface with the undisturbed floodplain wetland.

The piezometers located within the DOT mitigation wetland closest to the well field (PZ-5A, PZ-5B and PZ-6) each show immediate surface-water and groundwater responses to the start and succession of pumping at the well field. The hydrographs included in the LBG Aquifer Test report show that the groundwater and surface water at piezometers PZ-5A and PZ-5B declined approximately 2 feet during the pumping phase of the aquifer test and had recovered approximately 1 foot 72-hours after the pumping was terminated.

PZ-6 also shows an immediate surface-water and groundwater response to the start and cessation of pumping at the well field. The hydrograph shows that the groundwater at PZ-6 declined approximately 1.8 feet during the pumping phase of the test and recovered approximately 0.70 feet 72-hours after the shutdown of the test. The surface water near PZ-6 went dry approximately 27-hours after pumping started.

The impact to the piezometers located in the adjacent CT DOT mitigation wetland during the 2013 test is consistent with the impact observed during the 1984 test in the groundwater monitor well located in the vicinity of the CT DOT mitigation wetland (WN-80). After the first three days of the 1984 test, the drawdown in the groundwater level observed in WN-80 was 1.55 feet, similar to the drawdown observed in PZ-5 (1.48 feet) and PZ-6 (1.07 feet) after three days of pumping.

The hydrology supporting the DOT mitigation wetland and the larger Norwalk River floodplain wetland is largely groundwater based, with stormwater runoff and river overbank flows providing supplemental inputs. Areas of shallow ponding (vernal pools) within the wetlands likely support breeding amphibians during the spring breeding season. The DOT mitigation wetland was constructed mainly through earthwork that established grades at or near the groundwater level to provide seasonally saturated or ponded conditions. Planted trees and shrubs, as well as naturally colonized vegetation are largely hydrophytic, requiring seasonally saturated conditions.

In order to protect amphibian breeding habitat, water levels must be maintained during the late winter through spring breeding season. Seasonally saturated soil conditions also need to be maintained to preserve existing and created wetland habitats within the floodplain wetlands. Well withdrawals need to be incorporated into an overall water management plan to mitigate impacts to wetland water levels.

YMCA Pond

A small amount of groundwater drawdown was observed in a monitoring well (WN-66) located approximately 300 feet north of the YMCA pond during the 1984 pump test. After 3 days of pumping, a drawdown of 0.9 ft was observed. After 90 days of pumping, drawdown was 3.55 ft. Because of the distance between the production well and the pond (approximately 1,300 ft), and the small amount of drawdown observed after 3 days of pumping, impacts to the recreational pond are not expected.