Module 8: Hydrology
[§§77.405-407, 77.457, 77.521]

8.1 Chemical Analysis.

Provide the following data, in accordance with 8.2 for each point in the background sampling and monitoring program and report on Module 8.1(A) (separate form).

a) pH (field & laboratory)

b) Total Suspended Solids (mg/l)

c) Total Dissolved Solids (mg/l) or Specific Conductance ($\mu S/_{cm}$ at 25°C)

d) Field temperature at sample source (°C).

e) Provide the following in addition to a) through d) above, if requested by the Department. *

Total Alkalinity (mg/l)
Total Acidity (mg/l)
Total Iron (Fe) (mg/l)
Total Manganese (Mn) (mg/l)
Sulfates ($S0_4$) (mg/l)

*If the proposed noncoal minerals to be mined are located within the coal fields or other known acid producing areas or a watershed sensitive to mining impacts, additional parameters may be required by the Department. Contact the appropriate District Mining Office prior to beginning sampling to determine if these parameters are needed.

f) Flows of perennial streams above and below the operation and surface and underground mine discharges must be measured by approved methods. In addition, other flows from springs, streams, seeps or other discharge points in the representative monitoring program should be measured to reflect seasonal variations. (The Department may waive sampling points if there is a representative sampling of the requested points.) The elevations and flows of springs, seeps, and mine discharges are required.

The existing discharge is to an unnamed tributary to the Donegal Creek which is classified as a (TSF) Trout Stocked Fishery. The proposed 30-acre expansion has surface flows to a separate mapped stream located to the west which is also an unnamed tributary to the Donegal Creek, which is classified as a (CWF) Cold Water Fishery. The mapped stream located to the west of the 30-acre expansion area (BM-3 Upstream & BM-7 Downstream) has been modified and has been completely enclosed in 10-inch PVC pipe along its course between Heisey Quarry Road and Bossler Road. The NPDES Discharge was measured partially using an hour meter and calculating flow based on pump curves. We have installed a Seametrics EX253B-127 MAG Meter with a data logger on the 16-inch steel discharge line. Elevations of the impoundments were controlled using a Topcon RTK GPS to adjust aerial photography. Upstream (BM-5) and Downstream (BM-4) flow in the unnamed tributary to the Donegal Creek is measured using a float method or by manually gauging using a Global Water FP-111 flow meter.

g) Provide a description of the type of sample point (e.g. well, spring, etc.) and its relationship to the mine site (e.g. up-gradient, perched aquifer, down-gradient).

NPDES 001 is the active discharge located immediately east of the Scalehouse. This is the pumped discharge for the entire quarry operation. The proposed expansion will also discharge to this point when it is developed.

NPDES 002 did not flow during any of the background sampling. The pond that would discharge to this point is a retention pond and has no outlet structure.

BM-3 (this nomenclature matches previous applications) is an upstream point on the tributary located to the west of the expansion which is now completely piped. No measurement could be obtained because of the enclosed pipe. No discharge is proposed to this stream.

BM-4 (this nomenclature matches previous applications) is a downstream point on the east tributary which the quarry discharges. It is located just north of a culvert under Bossler Road east of the Swiegart Farm.

BM-5 (this nomenclature matches previous applications) is an upstream point on the tributary located to the east. It is located at a culvert under the south side of Market Street near a car dealer.

BM-7 is a downstream point on the tributary located to the west and could not be sampled since there is no flow due to the pipe enclosure. It is located near a culvert under Bossler Road under a power line. No discharge is proposed to this tributary.

MW-A (this nomenclature matches previous applications) is a monitoring well drilled in 1994 and is located across Heisey Quarry Road. This well is multi-level with three discrete zones. A Solinst pressure transducer has been installed to provide continuous water level readings in the middle zone.

MW-B (this nomenclature matched previous applications) is a monitoring well drilled in 1994 and is located just east of the scalehouse. A Solinst pressure transducer has been installed to provide continuous water level readings.

MW-C (this nomenclature matches previous applications) is a monitoring well drilled in 1994 which was mined through and destroyed. This well had two discrete zones.

MW-D (this nomenclature matches previous applications) is a monitoring well drilled in 1994 and is located along western property line and is accessed through Wenger's Feed Mill (Wenger Group) parking lot. This well is a multi-level well with three discrete zones, however the shallow zone is dry. A Solinst pressure transducer has been installed in the middle zone to provide continuous water level data.

MW-22-1 is a monitoring well drilled in 2022 near the pond at the asphalt plant. This well has a Solinst pressure transducer installed to provide continuous water level readings.

MW-22-2 is a monitoring well drilled in 2022 and is located at the southwest corner of the active pit. This well has a Solinst pressure transducer installed to measure continuous water level readings.

MW-22-3 is a monitoring well drilled in 2022 and is located at the southeast end of the overburden pile. This well has a Solinst pressure transducer installed to provide continuous water level readings.

MW-22-4 is a monitoring well drilled in 2022 and is located in the front yard of the Wogelmouth Farmhouse along Landis Road. A Solinst pressure transducer is installed to provided continuous water level data.

All drilling logs for each well have been attached.

h) Provide the name(s), address(es) and telephone number(s) of the individual(s) responsible for the collection and analysis of this data.

Chuck Brown and Rick Caranfa, Akens Engineering Associates, Inc., 219 East Main Street, Shiremanstown, PA 17011 717-975-9933 data collection, field analysis, and static water levels. ALS - Middletown conducted all Laboratory Analysis, 301 Fulling Mill Road, Middletown PA 17057-3500, 717-944-5541

i) Provide a description of the methodology used to collect and analyze this data.

The NPDES Discharge was measured partially using an hour meter and calculating flow based on pump curves. We have installed a Seametrics EX253B-127 MAG Meter with a data logger on the 16" steel discharge line. Elevations of the impoundments were controlled using a Topcon RTK GPS to adjust aerial photography. Upstream (BM-5) and Downstream (BM-4) flow in the unnamed tributary to the Donegal Creek were measured using a float method or by manually gauging using a Global Water FP-111 flow meter. For the monthly analysis Field pH, Conductivity, Total Dissolved Solids, and Temperature were analyzed using EX-Tech model EC500 ExStik II or Hanna Instruments HI9813-6 pH/EC/TDS/Temperature meter with CAL Check™, Range: pH 0.0 to 14.0 pH EC 0.00 to 4.00 mS/cm TDS 0 to 1999 ppm (mg/L). Both were calibrated for pH on regular basis with the calibration log maintained. The pH was calibrated with a Carolina Solutions or Apera Instruments one or three-point calibration using NIST Traceable solutions. The conductivity was also calibrated using Hanna Instruments three-point solution set. Manual static water level data was obtained using a Global Instruments WL650 Sonic Water Level Meter and a Solinst Model 101 P7 Water Level Meter with Laser Marked Tape, 200'. Continuous water level data was logged with Solinst Leveloggers Model 3001. Top of casings for the monitoring wells were surveyed using a Topcon RTK GPS system. Points were adjusted horizontally to NAD 83 South and Vertically to NAVD 88 using the OPUS - Online Positioning User Service. ALS - Middletown conducted all Laboratory Analysis, 301 Fulling Mill Road, Middletown PA 17057-3500, 717-944-5541

8.2 Background Sampling and Monitoring.

a) Background Sampling

Provide the results of the chemical analyses, as required by the Department, that characterize the water quality of sample points listed in 1) through 8). Background sampling points must have at least two (2) complete chemical analyses, at monthly intervals. All sampling points must be keyed to Exhibit 6.2 and identified in Module 8.1(A).

Note: *Include sample(s) from a low flow period.*

1) each stream that receives discharge, runoff or drainage from the operation.

BM-3, BM-4, BM-5, BM-7

2) streams, springs or wetlands that are representative of the surface and groundwater system of the general area.

BM-3, BM-4, BM-5, BM-7, NPDES 001

3) springs, seeps and wetlands within the permit area and springs, seeps and wetlands within 1000 feet of the permit area.

N/A

4) impoundments within the permit area and impoundments within 1000 feet of the permit area.

NPDES 001 & NPDES 002 (no discharge)

5) impoundments, impoundment discharges, and discharges from backfilled areas associated with previous or current underground or surface coal mines within the permit area and within 1000 feet of the permit area.

N/A

6) discharges within the permit area resulting from underground mines and discharges resulting from underground mines that are within the permit area but discharge outside the permit area.

None

7) any monitoring wells developed to determine the characteristics of the groundwater. (The Department may require additional monitoring wells.)

Static Water Level only - MW-A, MW-B, MW-D, MW 22-1, MW 22-2, MW 22-3, and MW 22-4

8) private water supplies and water supplies abandoned because of degradation or pollution from mining, within the permit area and within 1000 feet of the permit area. For each water supply sampled, provide the data required on the Private Water Supply Information Exhibit 8.2(A)(8) and indicate the source of the information (e.g. owner interview, survey by operator, P.E. etc.). (Provide driller logs if available.) (The Department may require additional water supply information on a case-by-case basis.)

The only private wells located within 1,000 feet of the expansion area are (PW-2) Sweigart Farm, (PW-1) Wolgemuth Farm, (PW-3) Agri-Source, and (PW-4) Wenger Group. Water supplies within the 1,000-foot permit setback line located to the north and northwest are within the public water supply service area of the Elizabethtown Water Authority as shown on the attached public water service area map downloaded from the eMapPA. We have included previously submitted Private Water Supply form for reference. We have completed an updated Exhibit 8.2(A)(8). We have attached a spreadsheet for tracking the private well owners. We have contacted all owners listed via USPS Certified Letters. Copies of those documents have been attached. We have also identified additional owners based on comments received at the zoning hearings for this project. We have sent USPS Certified letters to those owners as well. We sampled eleven private well owners that responded to the correspondence. We also attempted contact with key private well owners via telephone and direct home visits. We tracked all of this data via the attached spreadsheet.

b) Monitoring Program

Describe the proposed surface and groundwater monitoring plan that will be conducted. The monitoring plan shall include quantity and quality measurements of discharges from the operation; points that will show any effect of the discharge on the receiving stream; and points that will show any effect on the groundwater system. Unless otherwise approved by the District Mining Office prior to permit application submittal, monitoring points must have a minimum series of six (6) complete chemical analyses collected at monthly intervals and should include the month of August, September or October to reflect low flow conditions. A minimum of six (6) monthly samples should be submitted with the application and any additional samples while the application is in process.

Monthly sampling of NPDES permit for the NPDES 001 discharge point was sampled for the following: pH, Total Suspended Solids, Specific Conductance, Total Dissolved Solids, Acidity, and Alkalinity. Static Water Levels were monitored in MW-A, MW-B, MW-D, MW 22-1, MW 22-2, MW 22-3, and MW 22-4.

The proposed Monitoring Plan for this operation is as follows: No changes to the existing NPDES monitoring one additional point are being proposed and monitoring will be identical to the other two.

Static Water Levels once per month on MW-A, MW-B, MW-D MW 22-1, MW 22-2, MW 22-3, and MW 22-4. Once per quarter, sampling of the Upstream (BM-5) and Downstream (BM-4) on the unnamed tributary (UNT) to the Donegal Creek located to the east of the operation is conducted for flow, pH, Total Suspended Solids, Specific Conductance, Total Dissolved Solids, Acidity, and Total Alkalinity.

All monitoring points must be keyed to Exhibit 6.2. Monitoring plans must provide for collection and monitoring on a quarterly basis unless otherwise specified by the Department. All monitoring data must be compiled on Module 8.1(A) or equivalent facsimile. All monitoring points should be identified in the field with durable markers that can be maintained (wooden stakes, metal or plastic tags, etc.; not just plastic flagging).The following monitoring locations should be included in the monitoring program:

		Monitoring Points (Key to Exhibit 6.2)
1)	receiving streams above proposed discharge points	**BM-3, BM-5**
2)	receiving streams below proposed discharge points	**BM-7, BM-4**
3)	abandoned underground or surface mine discharges that are hydrologically connected and may be impacted by the proposed mining	**None**
4)	representative springs and seeps within the permit area and within 1000 feet of the permit area	**None**
5)	representative wetlands with **defined discharge points** within the permit area and wetlands within 1000 feet of the permit area that may be impacted by the proposed mining,	**None**
6)	water supplies	**None**
7)	cased boreholes/piezometers	**MW-A, MW-B, MW-D, MW 22-1, MW 22-2, MW 22-3, MW 22-4**
8)	point source discharges	**NPDES 001 NPDES 002**
9)	treatment pond discharges	**None**
10)	sedimentation pond discharges	**None**
11)	pit water during active mining (identify by mineral being mined)	**Same as NPDES 001**

12) each monitoring well developed to determine the characteristics of the groundwater **Wells were monitored for Static Water Level only since we have an active mine with Pit Sump. MW-A, MW-B, and MW-D have existed since 1994. MW 22-1, MW 22-2, MW 22-3, and MW 22-4 were all drilled in 2022 for this permit modification.**

Note: In cases where cased boreholes/piezometers or monitoring wells are not necessary, insert NA above and provide an explanation.

8.2(A)(8) PRIVATE WATER SUPPLY INFORMATION (key to Module 6.2)

Sample Point No	Owner	Type of Supply (Dug or Drilled Well, Spring)	Use	Surface Elevation (AMSL)	Depth of Casing	Diameter of Well	Static Water Elevation (AMSL) or Flow, Date of Measurement	Depth of Well	Type of Treatement If Any (iron filter, etc.)
PW-1	Wolgemuth	Drilled	Residential			6"			
PW-2	Sweigart								
PW-3	Graybill								
PW-4	Wengers Feed Mill Inc.								
PW-5	Ream								
PW-6	Ruhl								
PW-7	Kreider	Drilled							
PW-8	Foreman								
PW-9	Rheems Fire Co. #1	Drilled							
PW-10	Smith								

8.2(A)(8) PRIVATE WATER SUPPLY INFORMATION (key to Module 6.2)

Sample Point No	Owner	Type of Supply (Dug or Drilled Well, Spring)	Use	Surface Elevation (AMSL)	Depth of Casing	Diameter of Well	Static Water Elevation (AMSL) or Flow, Date of Measurement	Depth of Well	Type of Treatement If Any (iron filter, etc.)
PW-11	American Assn. Meat Processors								
PW-12	Kramer								
PW-13	Price	Drilled							
PW-14	Dohner								
PW-15	Spayd Properties								
PW-16	Daniel M Heisey Jr., Revocable Trust								
PW-17	Charles								
PW-18	Burke								
PW-19	Hernley								
PW-20	Tomosetti	Drilled 8/18/22	Residential	411	100	6"	5 GPM SWL 295.5 8/22	300'	

8.2(A)(8) PRIVATE WATER SUPPLY INFORMATION (key to Module 6.2)

Sample Point No	Owner	Type of Supply (Dug or Drilled Well, Spring)	Use	Surface Elevation (AMSL)	Depth of Casing	Diameter of Well	Static Water Elevation (AMSL) or Flow, Date of Measurement	Depth of Well	Type of Treatement If Any (iron filter, etc.)
PW-21	Miller	Drilled	Residential/Geothermal	410	Pump 74' Dump 91'	both 6"	Pump 60 GPM Dump 25 GPM 287.5 MSL	Pump 351 Dump 351	
PW-22	Haas	Drilled/Deepened 6/23	Residential	400	80'	6"	30 GPM	300	
PW-23	Abel	Drilled	Residential	392		6"	27.6 SWL w/sonic	275 pump @150'	

8.3 Characterization of Groundwater [§§ 77.405, 77.457 and 77.521]

Characterize the existing hydrologic balance of the permit and general areas. Cite all references and sources of information.

a) Identify all aquifers above the lowest mineral to be mined and the first aquifer below the lowest mineral to be mined. Include stratigraphic units, depths, and current use. Discuss the general uses of these aquifers in the area and known quality or quantity issues with these aquifers in relation to their uses.

The hydrologic setting of this quarry is predominantly in the (Oe) Epler Formation. The surface mine permit area is bordered on the north by the New Oxford Conglomerate, then the New Oxford Sandstone.

The setting at the Rheems Quarry is defined by an unnamed tributary to the Donegal Creek to the West which is a cold-water fishery (CWF) which has been altered by a pipe enclosure. There is an unnamed tributary to the Donegal Creek on the east which is a trout stocked fishery. The unnamed tributaries confluence together approximately 1.5 miles to south of the surface mine permit. The surface waters flow from north to south by the permit area. Groundwater is generally following topography and flows in and north to south direction towards the Donegal Creek. The current site has been operated previously as a surface mine for many years.

The Village of Rheems lies in a carbonate valley in northern Lancaster County, southeastern Pennsylvania, within the Lowland Section of the Piedmont Physiographic Province. Rheems is 2 miles east of Elizabethtown, shown on the 7 ½-minute quadrangle bearing that town's name. The quarry is a short distance west of the village, adjacent to Harrisburg Avenue in West Donegal Township.

The quarry exposes only the Lower Ordovician Epler Formation, an approximately 2,500-foot thick carbonate unit within the Beekmantown Group (Meisler and Becher, 1971) present throughout the entire Lebanon Valley nappe from Reading to Harrisburg.

The Epler is interbedded with limestone and dolomite. The limestone is mostly medium to medium-light gray (locally light pinkish gray) and weather to a light olive- gray or light gray. The finely crystalline beds contain very fine dark gray laminations.

The medium crystalline dolomite beds are medium gray in color, and weather to a yellowish gray. The dolomite is also laminated, and both lithologies tend to be medium to thick bedded. Chert, occurring as dark gray to black nodules, lenses, and stringers, is scattered throughout the Epler Formation.

The quarry highwalls provide excellent exposures of the mesoscale structures that comprise the local tectonic grain. The north and south highwalls approximately parallel the 0.75-azimuth trend of the folds and display the change along the grain; the east and west walls exhibit good cross sections of the structures.

The important faults present in this quarry occur in two orientations – parallel and transverse to the fold trends (Faill, 1983). Both types of faults, a steeply north-dipping parallel fault, and a steeply west-dipping transverse fault, are present at the south wall. They are both post folding because they offset parts of a fold. Another steeply west-dipping transverse fault along the southeast wall has an apparent offset of 6 feet down on the west, but its gently south-plunging slickenlines indicate strike-slip movement. This fault extends northward across the quarry to the northeast wall where the slickenlines plunge steeply (obliquely) to the northwest.

The Epler Formation is considered an excellent source of water. It is capable of producing an adequate water supply for industrial and municipal needs. Reported yields from the Epler Formation range from 3 to 1,800 gallons per minute (GPM) with a non-domestic median yield of 265 GPM. Specific Capacity values also vary greatly, but the median is around 9 GPM. As the case with the other carbonate rocks, the water is very hard with a median hardness of 291 mg/L. In addition, the unit has a high median specific conductance, which means that there is an abundance of dissolved solids.

The general uses of the aquifer in the area are domestic located to the north northeast and south of the quarry. There are agricultural uses located west and south of the quarry. The town of Rheems is located northeast which is served by public water supplies. There are two industrial users (Agrisource and the Wenger Group) of water located west of the existing quarry and will be just north and northwest of the proposed expansion.

We have contacted both users to obtain additional use information and details on the users wells. We received no response.

The quarry has operated at this site for many years with no water quality violations.

b) Describe the groundwater movement and the conditions that control and influence the groundwater system. Include the influence on quantity and quality from underground mines, industrial or municipal effects, fracture zones, faults, karst features and cave systems. Provide a groundwater contour map, if suitable.

Groundwater at this site is influenced by the following: the unnamed tributary to the Donegal Creek, pumping from the active sump, pumping from PW-1 and PW-2 which are agricultural uses, and PW-3 and PW-4 which are manufacturing processes. Public water supplies everything to the northeast and east. There are mapped faults and contact lines to the north and northeast. The 6.2 Environmental Resources Map illustrates the locations of these features. Empirical data was obtained while observing sump drawdown tests for the active pit sump the sump was allowed to fill approximately 10 feet, which took four weeks of pumping only the diesel pump at approximately 650 GPM. The pit sump was allowed to fill to the bottom of diesel pumps which is approximately 210 Above Mean Seal Level (AMSL). The current quarry floor elevation is 175 AMSL. The electric pumps were then engaged increasing the pumping rate to a peak rate of 2,500 GPM, dewatering the 10 feet in 10 days. Pumping has been occurring at this site since approximately the late 1980's. Monitoring of the wells and pumping have been reported since the 1990's. A groundwater contour map has been included in the application. The mapped faults and contacts have been shown on the Environmental Resources Map. See the attached Karst Supplement for the discussion on karst in the area.

c) Identify the effects any current or previous mining (including previous mining at this site) has had on the quantity and quality of the groundwater in the area, including impacts from diminution, increased turbidity, suspended solids or settleable solids. Include description of the source, rock unit involved and the reasons for the effect.

The current pit is approximately 32 acres. The active pit is excavated to a depth of approximately 175 AMSL. The existing maximum permitted depth is 126 AMSL. The proposed expansion is requesting the same ultimate permitted depth of 126 AMSL. We have many years of sampling data indicating compliance with the NPDES permit. The source rock is limestone/dolomite and generally does not have water quality issues for a noncoal quarry use.

8.4 Characterization of Surface Water [§§ 77.406 77.457 and 77.521]

a) Identify each stream receiving drainage from the proposed operation and the 25 Pa Code Chapter 93 projected water use classification.

Stream	***Classification***
UNT to Denegal Creek (West)	***Cold Water Fishery (CWF)***
UNT to Dongeal Creek (East) recieves NPDES	***Trout Stocked Fishery (TSF)***

b) Identify the effects which current or previous mining (including previous mining at this site) has had on the quantity and quality of the surface waters in this area, including impacts from increased turbidity, suspended solids or settleable solids. Include the source, rock unit involved, and reasons for the effect.

The aquifer is primarily located in the Ordovician - Epler Formation. This formation generally consists of Limestone, Dolomite, Shale, and Siltstone. The type of mineral mined, and the typical surface mine operation located at this site generally can affect the following water quality parameters: pH and Total Suspended Solids. The proposed expansion is located within an unnamed tributary to the Donegal Creek. This tributary is listed as impaired for aquatic life with siltation by agriculture and recreation with pathogens from an unknown source. There is a Total Maximum Daily Load (TMDL) study for this tributary which is the "Chiques Creek Alternative Restoration Plan" approved in 2019 (the plan referenced is listed as draft). The existing quarry and the proposed expansion are located in the Donegal Creek Watershed. The discharge from the proposed expansion will be to an unnamed tributary to the Donegal Creek where the existing NPDES discharge point is located. This tributary is impaired for aquatic life by AGRICULTURE - TOTAL SUSPENDED SOLIDS (TSS); AGRICULTURE - EUTROPHICATION and recreation with pathogens by and unknown source and is also part of the Chiques Creek Alternative Restoration Plan. The tributaries confluence approximately 1.5 miles south of the quarry operation near Donegal Springs. The existing quarry operation has not had a water quality violation as per a review of EFACTS dating back to 2008.

The Pierson Rheems Quarry has an existing NPDES permit to discharge an average monthly rate of 2.88 million gallons per day (MGD) to the UNT to the Donegal Creek.

We have attached the Streamstats for each tributary. The West UNT which is where the expansion is occurring lists a total contributing drainage area of 0.29 square miles, a mean annual flow of 0.266 cubic feet per second (CFS) or 119 GPM or 0.17 MGD. It lists the Q7-10 as 0.012 CFS or 5 GPM or 0.0072 MGD. The UNT to east where the NPDES discharge is located lists the contributing drainage area as 0.73 square miles, a mean annual flow of 0.78 CFS or 350 GPM or 0.504 MGD. It lists the Q7-10 as 0.0828 CFS or 37 GPM or 0.05328 MGD.

The proposed expansion is not expected to have any adverse effects on the streams. The current operation has been operating for decades with no impact. No changes to the NPDES permit are required at this time to add the 30-acre expansion.

c) Identify any current or previous land uses that may have significant impacts on surface water quantity and quality.

The current land use is surface mining and the expansion area is agricultural. The previous land use was mining for decades and agriculture in the expansion area. Located to the north of the operation is a mix of residential and light industrial uses and the Amtrak Railroad. Located directly east is Copes/Sudanos food processing facility. A warehouse is currently in the design stage to the east/southeast. Located to the West is Wenger Feed Mill. South and southwest is agricultural activities. A more detailed discussion of adjacent land use effects is located in the attached Karst Supplement.

8.5 Public Water Supply Information.

Provide the name, type, and location of all current public (community and non-community) surface water supplies that have intakes on the receiving stream within 10 miles downstream of the proposed permit area; public (community and non-community) water supplies (wells or springs) in or within one half mile of the proposed permit area; and public water supply wells for which any part of the permit area is within the Wellhead Protection Zone. Show the location of these supplies on Exhibit 6.1 or 6.2.

The Elizabethtown Water Authority has two wells located 1.7 miles away. Water supplies within the 1,000-foot permit setback line are within or will be within the Public Water Service area of the Elizabethtown Water Company.

8.6 Hydrologic Impact Assessment [§ 77.457 and 77.521]

a) Describe the groundwater hydrology in relation to the proposed mining operation (at maximum depth and lateral development) - i.e., - intercept regional water table, above regional water table, intercept perched water table, etc. State if and when groundwater will be intercepted (e.g., mining below the water table, installation of a production well for support or processing facilities). Include the depth to groundwater and the water table conditions present (artesian, regional, perched, etc.), the relationship to the mineral to be mined.

The existing operation already impacted the surrounding aquifer when the operation was pumping groundwater from 1980's through today. The proposed 30-acre expansion will have the same ultimate quarry depth as existing operation of 126 AMSL. We have included a groundwater contour map and graphs of continuous measurements of the monitoring wells plotted against rainfall. All these items provide a detail of the groundwater elevations. Visual observations of the existing active pit indicate no perched water tables and is confirmed in well drilling logs. We included in this application the well logs for reference. There is a formation contact between a sandstone conglomerate and the limestone (mined formation). The north face of the quarry is located very near the mapped contact line. This contact will limit impacts in the northerly direction.

b) Describe the probable hydrologic consequences of the proposed mining activities on the hydrologic system of the permit area and adjacent area both during the stages of and after the conclusion of operations. Describe the impact, during and after mining, on existing quantity and quality of the surface and groundwater as described in Sections 8.3 and 8.4.

A model is attached which predicts the hydrologic consequences of expansion which includes the impacts of the current mining activities. Empirical data was obtained while observing sump drawdown tests for the current operation and existing pit sump. Adding 18 acres of expanded pit is expected to have no additional consequences to northeast and east due to the existing pit sump at the proposed depth of the expansion area. Impacts to the north is limited by the formational contact line.

Empirical data is listed in 8.3b which shows the exact impacts on the surrounding aquifer from the existing operation.

In addition the area located to north and east is served by public water.

Historical water quality records indicate no impacts during or after mining is complete on water quality.

c) Is pumping of groundwater planned within the life of the operation. ☒ Yes ☐ No.

If yes, indicate the estimated gallons/day to be pumped for each stage of mining. Submit a science-based estimate of the zone of influence for each proposed stage of the operation. This may require a groundwater model to be developed using existing aquifer data as well as collecting new data, tracer tests or fracture trace analysis. Provide all documentation for the modeling. Use of groundwater modeling may be required to support the discussion of potential effects of groundwater withdrawal if the withdrawal has the potential to adversely impact water supplies, wetlands and other water resources and their affiliated uses, or if the withdrawal has the potential to cause or exacerbate sinkhole formation (See section 8.7). (Key groundwater elevations to cross-sections in 7.1 (c).)

We have prepared a groundwater model which is attached as a separate report. The empirical effects on the water table are listed in 8.3b which was obtained by monitoring the surrounding wells while the pit sump was dewatered.

NOTE: Operations in karst geology areas may be required to complete the *Karst Permitting Supplement* **(**5600-PM-BMP0456**)** in addition to supplying this information.

8.7. Water Supply Replacement [§§ 77.407 and 77.533]

a) Identify water supply sources that may be contaminated, diminished or interrupted by the mining operation and the means to restore or replace the affected supply. Include a demonstration that the quantity of the water supply will be sufficient to meet the needs of the water supply use. Note why other water supplies will not be affected.

PW-2, PW-3, and PW-18 which are within the zone of influence and have the potential to have water supply diminished by the proposed operation. PW-4, PW-20, PW-21, and PW-22 are all below the ultimate quarry depth. There are no predicted issues with contamination of surrounding wells based on decades of monitoring from the current operation.

b) Provide a specific capacity, step-drawdown, or other approved yield test for all water supplies that may be impacted by mining and for each proposed replacement supply source. Yield tests on other wells are at the discretion of the applicant or as requested by the Department. Provide specific capacity data on Module 8.6(A). Please refer to the guidance document, "Procedures for Establishing the Quantity of Water in Low-Yield Wells" (TGD # 563-2112-606) for methods.

Public Water serves the town of Rheems to the east. Replacement supplies for parcels located to the north shall be through public water supply extensions. Maximum predicted impacts are as follows:

PW-1 approx 25 feet - not expected to need replacement
PW-2 approx 100 feet
PW-3 approx 50 feet
PW-4 approx 70 feet - published well depth is significantly below quarry depth
PW-5 approx. 25 feet - not expected to need replacement
PW-7 approx. 25 feet - not expected to need replacement
PW-9 approx. 25 feet - not expected to need replacement
PW-14 approx. 25 feet - not expected to need replacement
PW-15 approx. 25 feet - not expected to need replacement
PW-16 approx. 25 feet - not expected to need replacement
PW-17 approx. 25 feet - not expected to need replacement
PW-18 approx 50 feet
PW-20 approx 100 feet - Already deepened to quarry depth
PW-21 approx 100 feet - Below quarry depth
PW-22 approx 100 feet - Already Deepened to quarry depth

The proposed replacement cost is approximately $11,000 per well based on actual replacement costs submitted for a 300 foot deep well. We have attached an invoice from a local well driller for reference. We are proposing a water replacement bond for 5 wells for an estimated water replacement bond of $55,000. The potential impacts, all listed above, will not occur until deepening to the next proposed lift.

c) Provide the existing operation and maintenance costs for each water supply that may be contaminated, diminished or interrupted by the mining operation and the projected operation and maintenance costs for the proposed replacement supply.

Operation and maintenance costs are not expected to be significantly different based on well replacement.

d) If the operation and maintenance costs for the proposed replacement water supply will be more than for the existing water supply, identify the provisions for compensating the water supply owner for the increased costs or provide the consent to Lesser Water Supply Agreement Form 5600-FM-BMP0110 for the increased operation/maintenance costs.