



TETRA TECH

PI TT-06-12-079

June 25, 2012

S. Stephen Platt
U.S. EPA Region III
Ground Water & Enforcement Branch (3WPP22)
1650 Arch Street
Philadelphia, PA 19103

**Subject: Underground Injection Control (UIC) Class IID Brine Disposal Well
Seneca Resources Corporation Well #38268 (API# 37-047-23835)
Highland Township, Elk County, Pennsylvania**

Dear Mr. Platt:

On behalf of Seneca Resources Corporation (Seneca), enclosed please find two copies of the subject UIC Class IID Well permit application prepared by Tetra Tech, Inc. (Tetra Tech).

Your prompt review of the application would be greatly appreciated. Should you have any questions or comments, please feel free to contact Guy Shirey of Seneca at (412) 548-2514 or me at (412) 921-4006. Thank you very much for your assistance.

Sincerely,

Dale E. Skoff, P.G.

Oil and Gas Hydrogeologic Services Manager

cc: Dave Rectenwald – EPA (1 copy)
Guy Shirey – Seneca (2 copies)

Tetra Tech

661 Andersen Drive, Pittsburgh, PA 15220-2700
Tel 412.921.7090 Fax 412.921.4040 www.tetrattech.com



TETRA TECH

**BRINE DISPOSAL WELL PERMIT APPLICATION
SENECA WELL # 38268
(API# 37-047-23835)**

**Seneca Resources Corporation
5800 Corporate Boulevard
Pittsburgh, PA 15237**

June 2012

complex world

CLEAR SOLUTIONS™



United States Environmental Protection Agency
**Underground Injection Control
 Permit Application**

*(Collected under the authority of the Safe Drinking
 Water Act, Sections 1421, 1422, 40 CFR 144)*

OMB No. 2040-0042

Approval Expires 11/30/2014

| | | | | |
|------------------|--|--|-----|---|
| I. EPA ID Number | | | | |
| U | | | | |
| | | | T/A | C |

*Read Attached Instructions Before Starting
 For Official Use Only*

| | | | | |
|---|------------------------------------|---------------|---------|--------------|
| Application approved mo day year | Date received mo day year | Permit Number | Well ID | FINDS Number |
| | | | | |

| | | | | |
|--|--------------------------------|--|--------------------------------|-------------------|
| II. Owner Name and Address | | III. Operator Name and Address | | |
| Owner Name Seneca Resources Corporation | | Owner Name Seneca Resources Corporation | | |
| Street Address 5800 Corporate Blvd. Suite 300 | Phone Number (412) 548-2500 | Street Address 5800 Corporate Blvd. Suite 300 | Phone Number (412) 548-2500 | |
| City Pittsburgh | State PA | City Pittsburgh | State PA | ZIP CODE 15237 |

| | | | |
|--|---|--|--|
| IV. Commercial Facility | V. Ownership | VI. Legal Contact | VII. SIC Codes |
| <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | <input checked="" type="checkbox"/> Private <input type="checkbox"/> Federal <input type="checkbox"/> Other | <input type="checkbox"/> Owner <input checked="" type="checkbox"/> Operator | 1389 - Oil and Gas Field services, Not elsewhere classified |

| | | |
|---------------------------------------|-----------------------------------|--------------------------------------|
| VIII. Well Status (Mark "X") | | <input type="checkbox"/> C. Proposed |
| <input type="checkbox"/> A. Operating | Date Started mo day year | |
| | | |

| | | | |
|---|----------------------------------|---|--------------------------|
| IX. Type of Permit Requested (Mark "X" and specify if required) | | X. Class and Type of Well (see reverse) | |
| <input checked="" type="checkbox"/> A. Individual | <input type="checkbox"/> B. Area | Number of Existing Wells 1 | Number of Proposed Wells |
| A. Class(es) (enter code(s)) | | Name(s) of field(s) or project(s) Seneca Well #38268 API # 37-047-23835 | |
| B. Type(s) (enter code(s)) | | D. Number of wells per type (if area permit) | |
| II | | | |

| | | | | | | | | | | | | | |
|---|-----|------|-----|-----|-----------|-----|-----|-------|---------|------------------------------|------|---|------|
| XI. Location of Well(s) or Approximate Center of Field or Project | | | | | | | | | | XII. Indian Lands (Mark 'X') | | | |
| Latitude | | | | | Longitude | | | | | Township and Range | | Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> | |
| Deg | Min | Sec | Deg | Min | Sec | Sec | Twp | Range | 1/4 Sec | Feet From | Line | Feet From | Line |
| 041 | 037 | 08.1 | 078 | 049 | 17.5 | | | | | | | | |

*(Complete the following questions on a separate sheet(s) and number accordingly; see instructions)
 For Classes I, II, III, (and other classes) complete and submit on a separate sheet(s) Attachments A-U (pp 2-6) as appropriate. Attach maps where
 required. List attachments by letter which are applicable and are included with your application.*

XIV. Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments
 and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true,
 accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and
 imprisonment. (Ref. 40 CFR 144.32)

| | | | |
|--|--|----------------------------------|--|
| A. Name and Title (Type or Print) | | B. Phone No. (Area Code and No.) | |
| Doug Kepler, Vice President, Environmental Engineering | | (814) 771-0281 | |
| C. Signature <i>DAICER</i> | | D. Date Signed <i>6/25/12</i> | |

Well Class and Type Codes

Class I

Wells used to inject waste below the deepest underground source of drinking water.

Type "I"

Nonhazardous industrial disposal well

"M"

Nonhazardous municipal disposal well

"W"

Hazardous waste disposal well injecting below USDWS

"X"

Other Class I wells (not included in Type "I," "M," or "W")

Class II

Oil and gas production and storage related injection wells.

Type "D"

Produced fluid disposal well

"R"

Enhanced recovery well

"H"

Hydrocarbon storage well (excluding natural gas)

"X"

Other Class II wells (not included in Type "D," "R," or "H")

Class III

Special process injection wells.

Type "G"

Solution mining well

"S"

Sulfur mining well by Frasch process

"U"

Uranium mining well (excluding solution mining of conventional mines)

"X"

Other Class III wells (not included in Type "G," "S," or "U")

Other Classes Wells not included in classes above.

Class V wells which may be permitted under §144.12.

Wells not currently classified as Class I, II, III, or V.

Attachments to Permit Application

Class

Attachments

I new well existing

A, B, C, D, F, H-S, U
A, B, C, D, F, H-U

II new well existing

A, B, C, E, G, H, M, Q, R; optional -I, J, K, O, P, U
A, E, G, H, M, Q, R, -U; optional -J, K, O, P, Q

III new well existing

A, B, C, D, F, H, I, J, K, M-S, U
A, B, C, D, F, H, J, K, M-U

Other Classes

To be specified by the permitting authority

INSTRUCTIONS - Underground Injection Control (UIC) Permit Application

Paperwork Reduction Act: The public reporting and record keeping burden for this collection of information is estimated to average 224 hours for a Class I hazardous well application, 110 hours for a Class I non-hazardous well application, 67 hours for a Class II well application, and 132 hours for a Class III well application. Burden means the total time, effort, or financial resource expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal Agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjusting the existing ways to comply with any previously applicable instructions and requirements; training personnel to be able to respond to the collection of information; search data sources; complete and review the collection of information; and, transmit or otherwise disclose information. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including the use of automated collection techniques to Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822), 1200 Pennsylvania Ave., NW, Washington, DC 20460. Include the OMB control number in any correspondence. Do not send the completed forms to this address.

This form must be completed by all owners or operators of Class I, II, and III injection wells and others who may be directed to apply for permit by the Director.

- I. **EPA ID NUMBER** - Fill in your EPA Identification Number. If you do not have a number, leave blank.
- II. **OWNER NAME AND ADDRESS** - Name of well, well field or company and address.
- III. **OPERATOR NAME AND ADDRESS** - Name and address of operator of well or well field.
- IV. **COMMERCIAL FACILITY** - Mark the appropriate box to indicate the type of facility.
- V. **OWNERSHIP** - Mark the appropriate box to indicate the type of ownership.
- VI. **LEGAL CONTACT** - Mark the appropriate box.
- VII. **SIC CODES** - List at least one and no more than four Standard Industrial Classification (SIC) Codes that best describe the nature of the business in order of priority.

VIII. **WELL STATUS** - Mark Box A if the well(s) were operating as injection wells on the effective date of the UIC Program for the State. Mark Box B if well(s) existed on the effective date of the UIC Program for the State but were not utilized for Injection. Box C should be marked if the application is for an underground injection project not constructed or not completed by the effective date of the UIC Program for the State.

IX. **TYPE OF PERMIT** - Mark "Individual" or "Area" to indicate the type of permit desired. Note that area permits are at the discretion of the Director and that wells covered by an area permit must be at one site, under the control of one person and do not inject hazardous waste. If an area permit is requested the number of wells to be included in the permit must be specified and the wells described and identified by location. If the area has a commonly used name, such as the "Jay Field," submit the name in the space provided. In the case of a project or field which crosses State lines, it may be possible to consider an area permit if EPA has jurisdiction in both States. Each such case will be considered individually, if the owner/operator elects to seek an area permit.

X. **CLASS AND TYPE OF WELL** - Enter in these two positions the Class and type of injection well for which a permit is requested. Use the most pertinent code selected from the list on the reverse side of the application. When selecting type X please explain in the space provided.

XI. **LOCATION OF WELL** - Enter the latitude and longitude of the existing or proposed well expressed in degrees, minutes, and seconds or the location by township, and range, and section, as required by 40 CFR Part 146. If an area permit is being requested, give the latitude and longitude of the approximate center of the area.

XII. **INDIAN LANDS** - Place an "X" in the box if any part of the facility is located on Indian lands.

XIII. **ATTACHMENTS** - Note that information requirements vary depending on the injection well class and status. Attachments for Class I, II, III are described on pages 4 and 5 of this document and listed by Class on page 2. Place EPA ID number in the upper right hand corner of each page of the Attachments.

XIV. **CERTIFICATION** - All permit applications (except Class II) must be signed by a responsible corporate officer for a corporation, by a general partner for a partnership, by the proprietor of a sole proprietorship, and by a principal executive or ranking elected official for a public agency. For Class II, the person described above should sign, or a representative duly authorized in writing.

INSTRUCTIONS - Attachments

Attachments to be submitted with permit application for Class I, II, III and other wells.

- A. AREA OF REVIEW METHODS** - Give the methods and, if appropriate, the calculations used to determine the size of the area of review (fixed radius or equation). The area of review shall be a fixed radius of 1/4 mile from the well bore unless the use of an equation is approved in advance by the Director.

- B. MAPS OF WELL/AREA AND AREA OF REVIEW** - Submit a topographic map, extending one mile beyond the property boundaries, showing the injection well(s) or project area for which a permit is sought and the applicable area of review. The map must show all intake and discharge structures and all hazardous waste treatment, storage, or disposal facilities. If the application is for an area permit, the map should show the distribution manifold (if applicable) applying injection fluid to all wells in the area, including all system monitoring points. Within the area of review, the map must show the following:

Class I

The number, or name, and location of all producing wells, injection wells, abandoned wells, dryholes, surface bodies of water, springs, mines (surface and subsurface), quarries, and other pertinent surface features, including residences and roads, and faults, if known or suspected. In addition, the map must identify those wells, springs, other surface water bodies, and drinking water wells located within one quarter mile of the facility property boundary. Only information of public record is required to be included in this map.

Class II

In addition to requirements for Class I, include pertinent information known to the applicant. This requirement does not apply to existing Class II wells:

Class III

In addition to requirements for Class I, include public water systems and pertinent information known to the applicant.

- C. CORRECTIVE ACTION PLAN AND WELL DATA** - Submit a tabulation of data reasonably available from public records or otherwise known to the applicant on all wells within the area of review, including those on the map required in B, which penetrate the proposed injection zone. Such data shall include the following:

Class I

A description of each well's types, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Director may require. In the case of new injection wells, include the corrective action proposed to be taken by the applicant under 40 CFR 144.55.

Class II

In addition to requirement for Class I, in the case of Class II wells operating over the fracture pressure of the injection formation, all known wells within the area of review which penetrate formations affected by the increase in pressure. This requirement does not apply to existing Class II wells.

Class III

In addition to requirements for Class I, the corrective action proposed under 40 CFR 144.55 for all Class III wells.

- D. MAPS AND CROSS SECTION OF USDWs** - Submit maps and cross sections indicating the vertical limits of all underground sources of drinking water within the area of review (both vertical and lateral limits for Class I), their position relative to the injection formation and the direction of water movement, where known, in every underground source of drinking water which may be affected by the proposed injection. (Does not apply to Class II wells.)

- E. NAME AND DEPTH OF USDWs (CLASS II)** - For Class II wells, submit geologic name, and depth to bottom of all underground sources of drinking water which may be affected by the injection.
- F. MAPS AND CROSS SECTIONS OF GEOLOGIC STRUCTURE OF AREA** - Submit maps and cross sections detailing the geologic structure of the local area (including the lithology of injection and confining intervals) and generalized maps and cross sections illustrating the regional geologic setting. (Does not apply to Class II wells.)
- G. GEOLOGICAL DATA ON INJECTION AND CONFINING ZONES (Class II)** - For Class II wells, submit appropriate geological data on the injection zone and confining zones including lithologic description, geological name, thickness, depth and fracture pressure.
- H. OPERATING DATA** - Submit the following proposed operating data for each well (including all those to be covered by area permits): (1) average and maximum daily rate and volume of the fluids to be injected; (2) average and maximum injection pressure; (3) nature of annulus fluid; (4) for Class I wells, source and analysis of the chemical, physical, radiological and biological characteristics, including density and corrosiveness, of injection fluids; (5) for Class II wells, source and analysis of the physical and chemical characteristics of the injection fluid; (6) for Class III wells, a qualitative analysis and ranges in concentrations of all constituents of injected fluids. If the information is proprietary, maximum concentrations only may be submitted, but all records must be retained.
- I. FORMATION TESTING PROGRAM** - Describe the proposed formation testing program. For Class I wells the program must be designed to obtain data on fluid pressure, temperature, fracture pressure, other physical, chemical, and radiological characteristics of the injection matrix and physical and chemical characteristics of the formation fluids. For Class II wells the testing program must be designed to obtain data on fluid pressure, estimated fracture pressure, physical and chemical characteristics of the injection zone. (Does not apply to existing Class II wells or projects.)
- For Class III wells the testing must be designed to obtain data on fluid pressure, fracture pressure, and physical and chemical characteristics of the formation fluids if the formation is naturally water bearing. Only fracture pressure is required if the program formation is not water bearing. (Does not apply to existing Class III wells or projects.)
- J. STIMULATION PROGRAM** - Outline any proposed stimulation program.
- K. INJECTION PROCEDURES** - Describe the proposed injection procedures including pump, surge, tank, etc.
- L. CONSTRUCTION PROCEDURES** - Discuss the construction procedures (according to §146.12 for Class I, §146.22 for Class II, and §146.32 for Class III) to be utilized. This should include details of the casing and cementing program, logging procedures, deviation checks, and the drilling, testing and coring program, and proposed annulus fluid. (Request and submission of justifying data must be made to use an alternative to packer for Class I.)
- M. CONSTRUCTION DETAILS** - Submit schematic or other appropriate drawings of the surface and subsurface construction details of the well.
- N. CHANGES IN INJECTED FLUID** - Discuss expected changes in pressure, native fluid displacement, and direction of movement of injection fluid. (Class III wells only.)
- O. PLANS FOR WELL FAILURES** - Outline contingency plans (proposed plans, if any, for Class II) to cope with all shut-ins or wells failures, so as to prevent migration of fluids into any USDW.
- P. MONITORING PROGRAM** - Discuss the planned monitoring program. This should be thorough, including maps showing the number and location of monitoring wells as appropriate and discussion of monitoring devices, sampling frequency, and parameters measured. If a manifold monitoring program is utilized, pursuant to §146.23(b)(5), describe the program and compare it to individual well monitoring.
- Q. PLUGGING AND ABANDONMENT PLAN** - Submit a plan for plugging and abandonment of the well including: (1) describe the type, number, and placement (including the elevation of the top and bottom) of plugs to be used; (2) describe the type, grade, and quantity of cement to be used; and (3) describe the method to be used to place plugs, including the method used to place the well in a state of static equilibrium prior to placement of the plugs. Also for a Class III well that underlies or is in an exempted aquifer, demonstrate adequate protection of USDWs. Submit this information on EPA Form 7520-14, Plugging and Abandonment Plan.

- R. NECESSARY RESOURCES** - Submit evidence such as a surety bond or financial statement to verify that the resources necessary to close, plug or abandon the well are available.
- S. AQUIFER EXEMPTIONS** - If an aquifer exemption is requested, submit data necessary to demonstrate that the aquifer meets the following criteria: (1) does not serve as a source of drinking water; (2) cannot now and will not in the future serve as a source of drinking water; and (3) the TDS content of the ground water is more than 3,000 and less than 10,000 mg/l and is not reasonably expected to supply a public water system. Data to demonstrate that the aquifer is expected to be mineral or hydrocarbon production, such as general description of the mining zone, analysis of the amenability of the mining zone to the proposed method, and time table for proposed development must also be included. For additional information on aquifer exemptions, see 40 CFR Sections 144.7 and 146.04.
- T. EXISTING EPA PERMITS** - List program and permit number of any existing EPA permits, for example, NPDES, PSD, RCRA, etc.
- U. DESCRIPTION OF BUSINESS** - Give a brief description of the nature of the business.

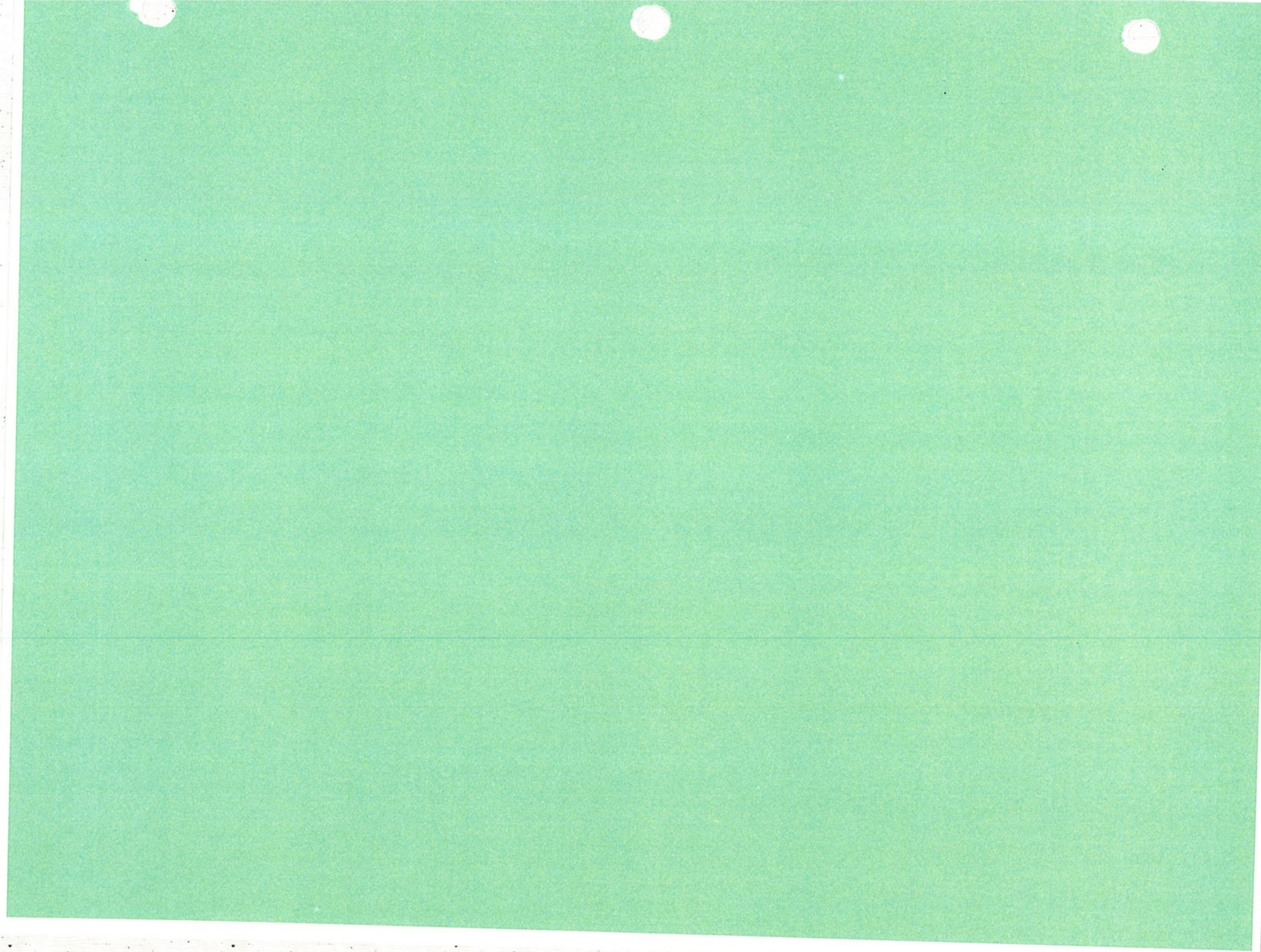


Table of Contents
Underground Injection Control (UIC) Class II Well Permit Application
Seneca
Well #38268
Highland Township, Elk County, PA

Section 1 – Area of Review Methods/Calculations

Section 2 – Maps of Well Area and Area of Review

Section 3 – Corrective Action Plan and Well Data

Section 4 – Name and Depth of USDWs

Section 5 – Geologic Data on Injection and Confining Zones

Section 6 – Operating Data

Section 7 – Well Construction Details

Section 8 – Monitoring Program

Section 9 – Plugging and Abandonment Plan

Section 10 – Necessary Resources

Section 11 – Plan for Well Failures

Appendices

Appendix A – Groundwater Well Records

Appendix B – Surrounding Landowner Information



TETRA TECH

21335 Signal Hill Plaza, Suite 100, Sterling, VA 20164 703-444-7000 703-444-1685 (FAX)

TECHNICAL MEMORANDUM - DRAFT

TO: Dale Skoff, Tetra Tech NUS
FROM: Jeffrey Benegar
DATE: June 14, 2012
RE: Area of Review/Zone of Endangerment Analysis for Potential Brine Disposal Injection Well #38268

EXECUTIVE SUMMARY

This technical memorandum (TM) summarizes the analytical modeling we have performed for the area of review/zone of endangerment analysis for potential brine disposal injection well #38268 for Seneca Resources. Well #38268 is located in Highland Township, Elk County, PA. Brine disposal via injection well would take place into the Elk 3 Sandstone. Our analysis is described in more detail below.

OVERVIEW AND METHODOLOGY

There are several methods proposed for calculating the zone of endangerment of an injection well. The most simplistic method is the use of a fixed radius, based on the type of injection well being permitted. Other methods involve calculation of the radius based on well and formation properties. The method used here is the graphical method first used by US EPA Region 6. It involves the calculation of the increase of pressure in the formation due to injection, then converting that pressure into equivalent feet of head. The increase in head in the formation due to injection is then compared to the equivalent head of the lowest most underground source of drinking water (USDW). When plotted graphically, the intersection of those two curves at some distance, r , determines the radius of the zone of endangerment.

The increase in pressure in the formation due to injection depends on the properties of the injection fluid and the formation, the rate of fluid injection, and the length of time of injection. The most common mathematical expression to describe this increase in pressure was developed by Matthews and Russell (1967). Matthews and Russell assume that, for a single well injecting into an infinite, homogeneous and isotropic, non-leaking formation, the increase in pressure (Δp) can be described as:

delta p = $162.6 Q\mu / kh * [\log(kt / \Phi\mu Cr^2) - 3.23]$ where:

delta p = pressure change (psi) at radius, r and time, t
Q = injection rate (barrels/day)
 μ = injectate viscosity (centipoise)
k = formation permeability (millidarcies)
h = formation thickness (feet)
t = time since injection began (hours)
C = compressibility (total, sum of water and rock compressibility) (psi^{-1})
r = radial distance from wellbore to point of investigation (feet)
 Φ = average formation porosity (decimal)

PARAMETERS USED IN THE ANALYSIS

The following parameters were used in the zone of endangerment analysis. The majority of the parameters are based on the analysis and results of the injection testing performed on well #38268 in March 2012 (Tetra Tech, 2012). The permeability value was based on the results from the injection testing analysis. For the depth to the lowest most USDW, a conservative estimate based on US EPA Region 3 guidance and review of site area hydrogeologic conditions was used (i.e., depth to USDW = 400 feet)

Input Parameters for Well #38268

Q = 3,000 barrels/day
t = 10 years = 87,600 hours
 μ = 0.9457 centipoise
k = 190 md
h = 49 feet
C = 7.6e-06 psi^{-1}
 Φ = 13.5%
Well radius = 0.29 feet
Specific gravity of injectate = 1.14
Surface elevation = 2040 feet
Depth to injection formation = 2354 feet
Base of lowest most USDW (elevation) = 1640 feet
Initial pressure at top of injection formation = 24 psi

RESULTS

The Matthews and Russell equation was solved for various distances from the wellbore based on the parameters listed above for permeability value determined from the injection test. The values of delta p were added to the existing pressure in the injection formation to obtain the total pressure in the formation. These values were then converted to feet of head of formation brine. The results are shown in Figure 1. The plot shows the calculated pressure surface within the injection formation, measured as feet of head of formation brine above the top of the injection formation. Also shown is the head of the

lowest most USDW. Where the two lines intersect, the radius of the zone of endangerment can be estimated. For the permeability value of $k = 190$ md, the increase in head due to injection would remain below the elevation of the lowest most USDW. This permeability value was obtained from injection testing analysis of well #38268.

CONCLUSIONS

Our analysis of the area of review/zone of endangerment for the proposed brine disposal injection wells is based on a methodology typically used by US EPA. For the permeability value of $k = 190$ md (obtained from injection testing analysis of well #38268), increase in head due to injection would remain below the elevation of the lowest most USDW. Based on the results, we believe the well is an excellent candidate for use as a brine disposal well.

In summary, the default area of review of a $\frac{1}{4}$ mile radius from the proposed injection well is applicable for this application.

Mr. Dale Skoff

4

6/25/2012

REFERENCES

Matthews, C.S., Russel, D.G., (1967) Pressure Buildup and Flow Tests in Wells, SPE Monograph Series, Volume 1, New York.

Tetra Tech, (2012) Injectivity Test Report, Seneca Resources Well #38268, Highland Township, Elk County, PA. May 2012.

FIGURES

Zone of Endangerment Plot - #38268 well

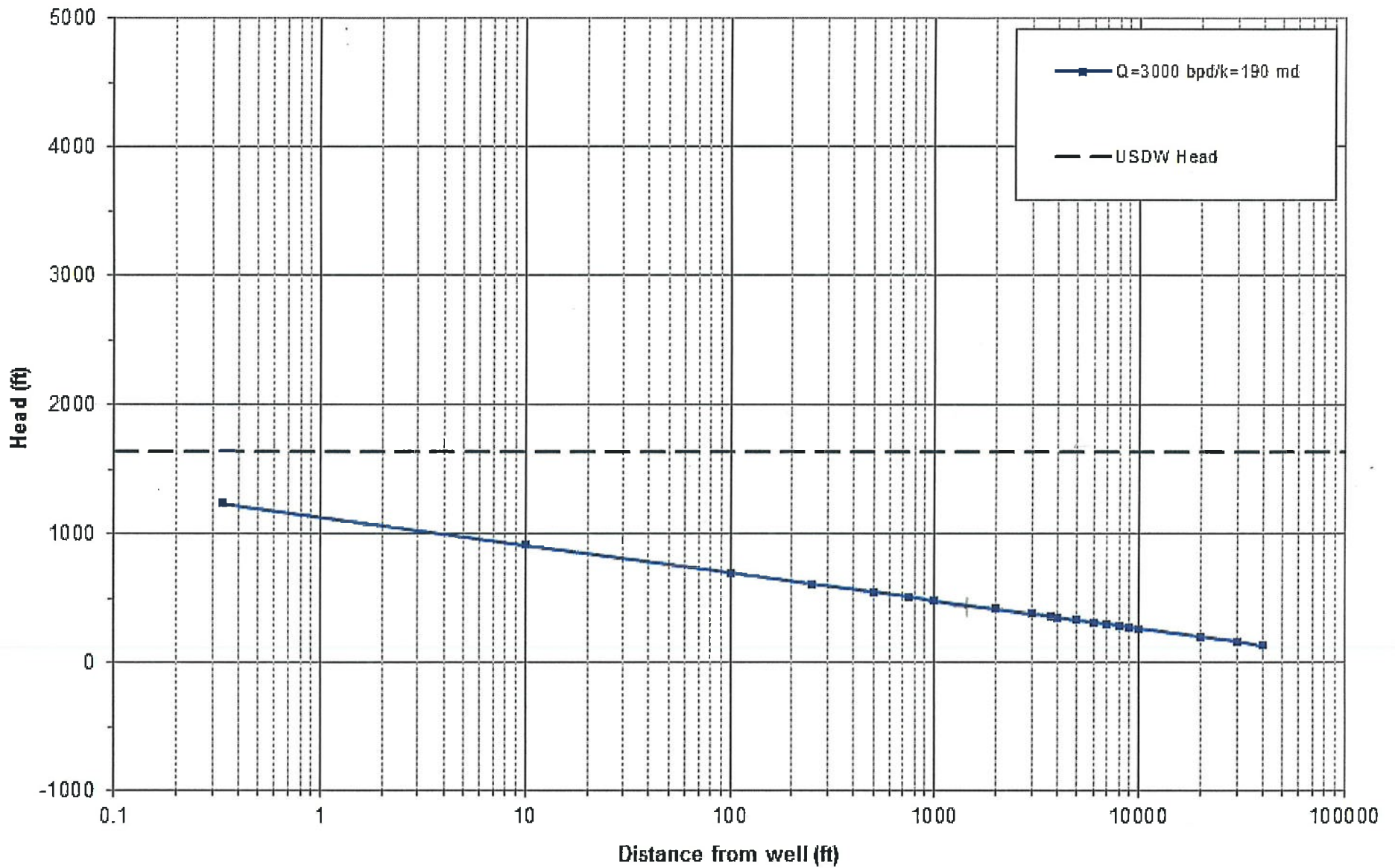


Figure 1. Feet of head of injection formation and USDW vs. distance from the well for #38268 well

Area of Review

According to publicly available records, including the Pennsylvania Geologic Survey's Ground Water Information System (PaGWIS) and the Pennsylvania Department of Environmental Protection's Drinking Water Reporting System (DWRS), there are no groundwater wells within the ¼ mile Area of Review for Seneca well #38268.

The only active oil and gas well located within ¼ mile of Seneca well #38268 is Seneca well #38281, which is located approximately 0.2 miles to the southwest. A plugged gas well, Seneca well #01328, is located approximately 0.2 miles southeast of the proposed injection well. This well is discussed in greater detail in the following section of this application.

According to records available through the DWRS, Highland Township maintains a public water supply consisting of two springs (one active and one inactive), two reserve water wells, and associated pumps, pipes, and storage tanks between 0.5 and 0.7 miles from Seneca well #38268 (proposed injection well). PaGWIS indicates that a private water well, owned by Randy Klalber, is located 0.8 miles from Seneca well #38268. There are no other identified intake or discharge structures; hazardous waste treatment, storage, or disposal facilities; mines; or quarries within one mile of Seneca well #38268. Information regarding water wells and springs within one mile of Seneca well #38268 is provided in Appendix A.

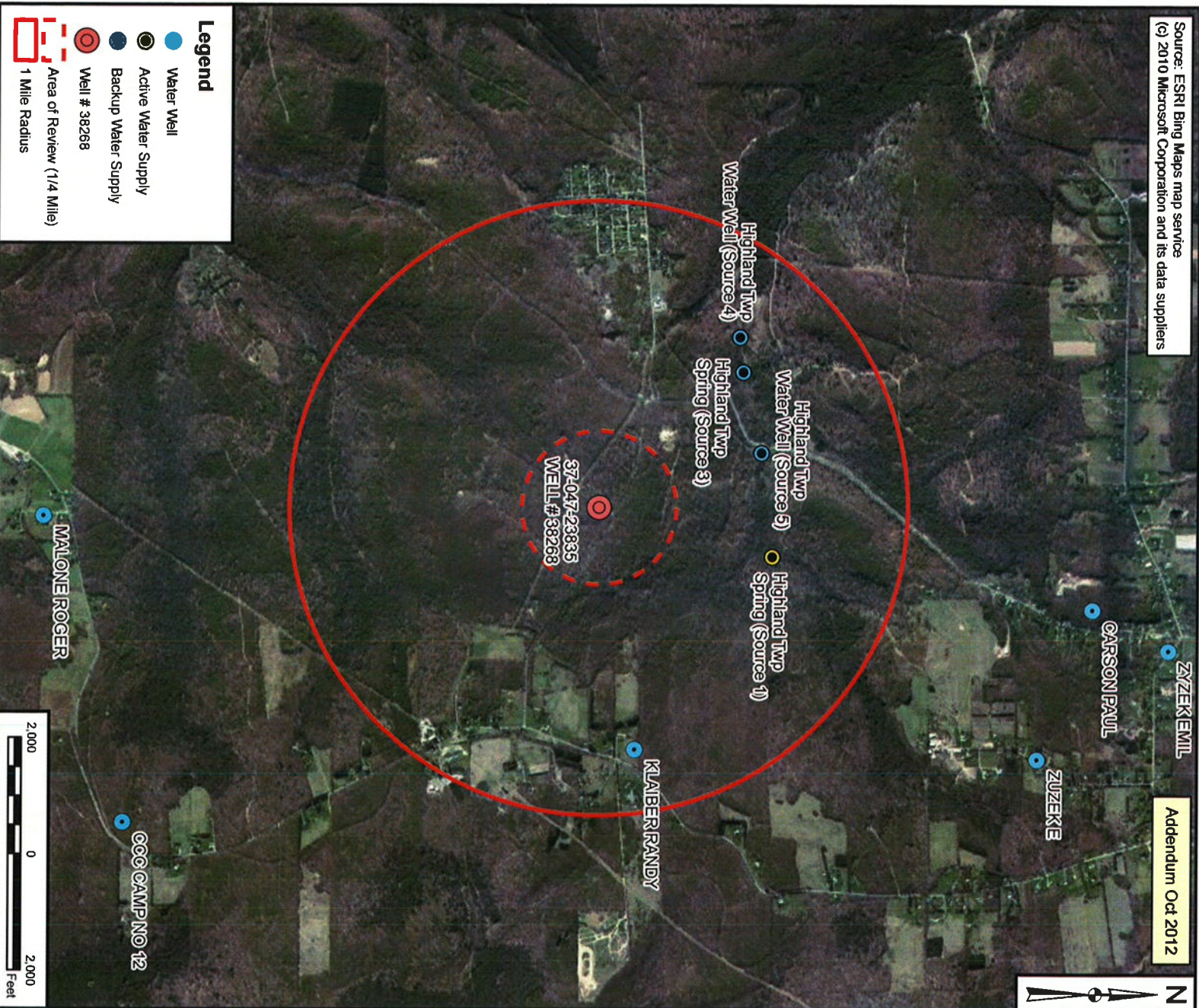
A High Quality – Cold Water Fishery (HQ-CWF) designated unnamed tributary (UNT) to the East Branch of Tronesta Creek is located approximately 0.5 miles east, a HQ-CWF designated unnamed tributary (UNT) to Wolf Run is located approximately 0.1 miles south, and a HQ-CWF designated unnamed tributary (UNT) to Wolf Run is located approximately 0.6 miles west of Seneca well #38268.

The names and addresses of residents located within ¼ mile of the proposed injection well are provided in Appendix B.

**AREA OF REVIEW MAPS
GROUNDWATER WELLS**

Source: ESRI Bing Maps map service
(c) 2010 Microsoft Corporation and its data suppliers

Addendum Oct 2012



- Legend**
- Water Well
 - Active Water Supply
 - Backup Water Supply
 - Well # 38268
 - Area of Review (1/4 Mile)
 - 1 Mile Radius



FIGURE 1
#38268 WELL LOCATION
WITH WATER WELL LOCATIONS

DRAWN BY: J. NOVAK 09/17/12
CHECKED BY: D. SKOFF 10/1/12
APPROVED BY:
CONTRACT NUMBER: 112C04078



ELK COUNTY, PENNSYLVANIA

| FIGURE NUMBER | REV |
|---------------|-----|
| 1 | 0 |

Source: ESRI USA Topo Maps map service
Copyright: © 2011 National Geographic Society, i-cubed

Addendum Oct 2012

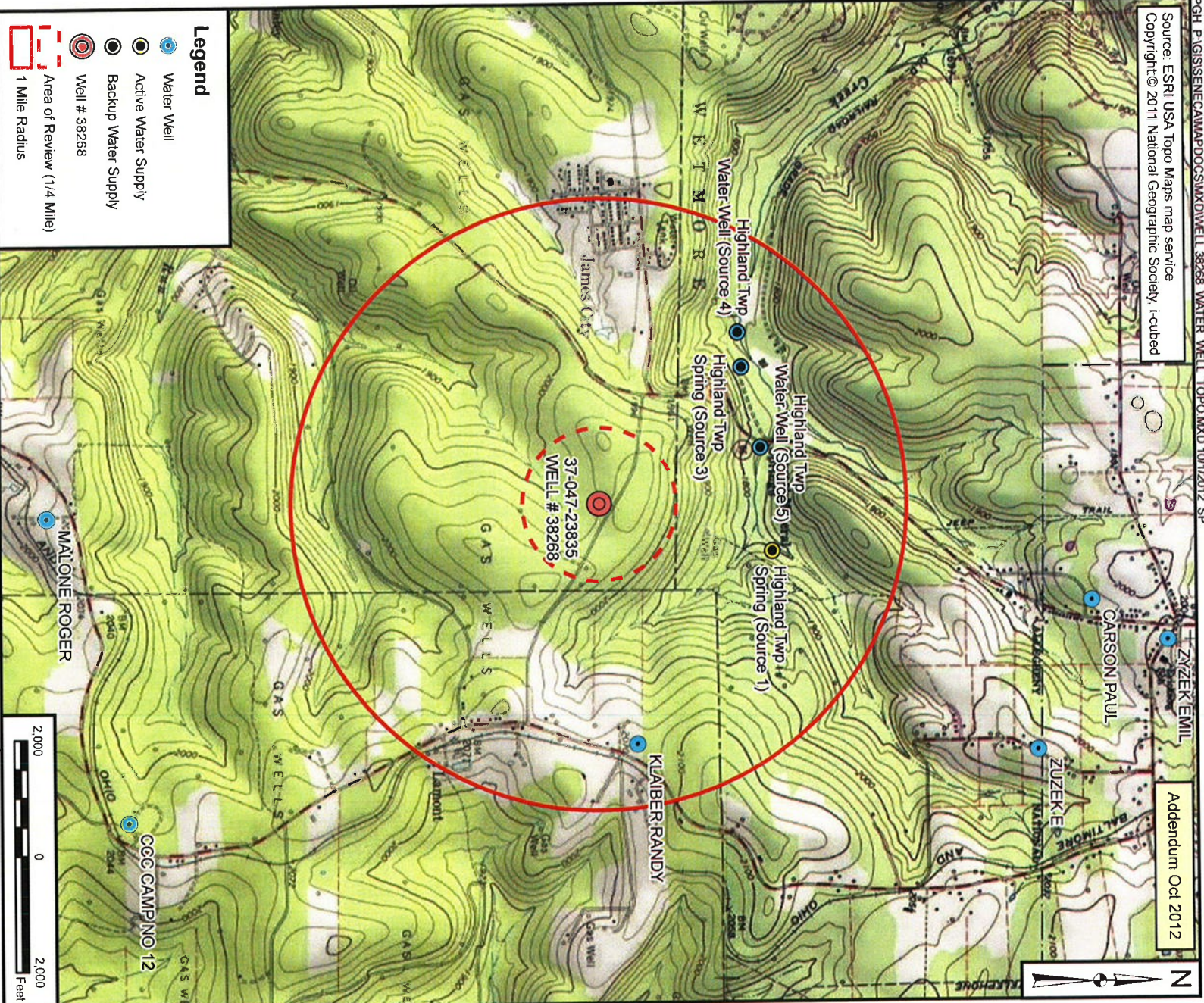


FIGURE 2
#38268 WELL LOCATION
WITH WATER WELL LOCATIONS



TETRA TECH

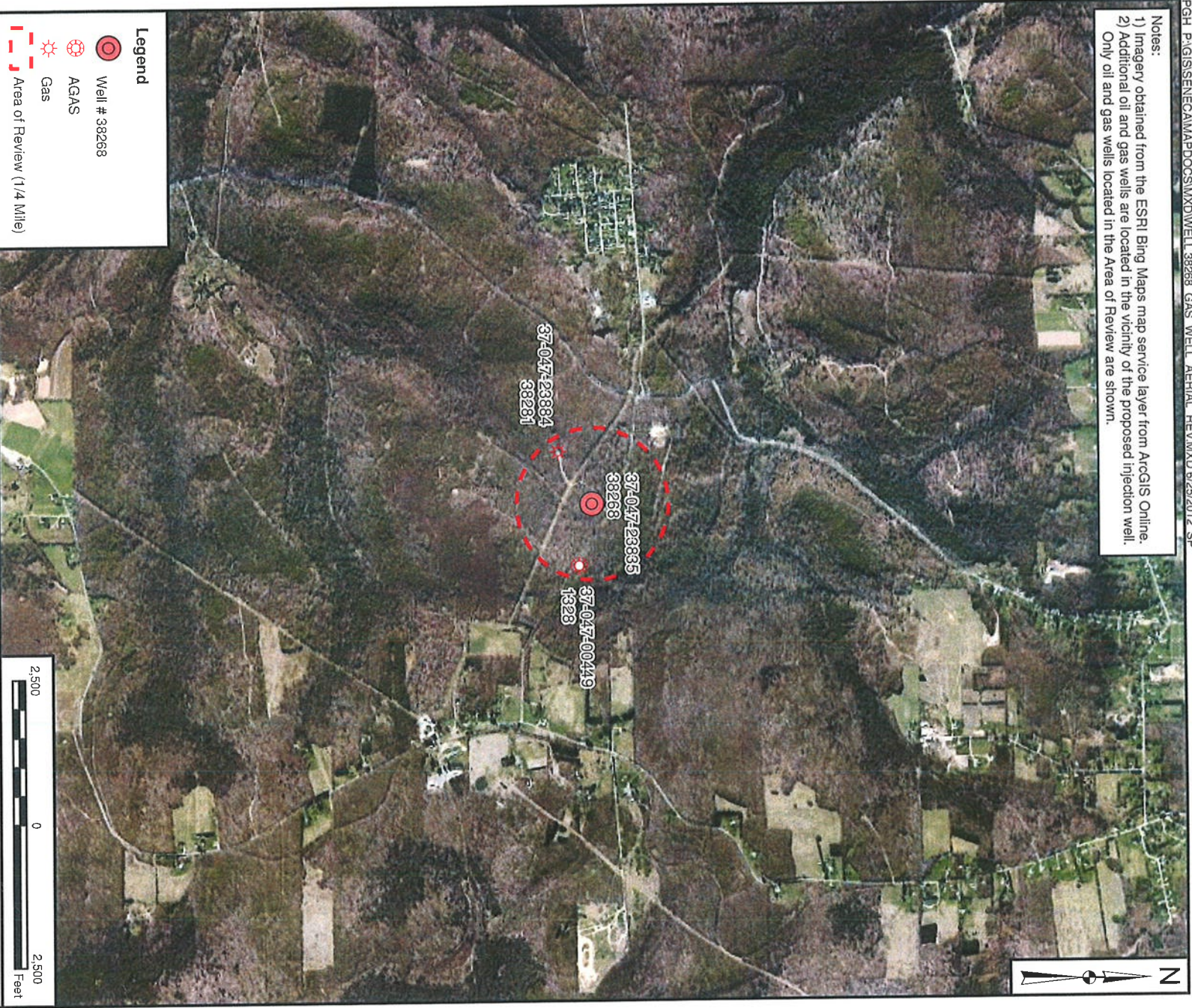
ELK COUNTY, PENNSYLVANIA

DRAWN BY: J. NOVAK 05/17/12
CHECKED BY: D. SKOFF 10/11/12
APPROVED BY:
CONTRACT NUMBER: 112C04078

| | | | |
|---------------|---|-----|---|
| FIGURE NUMBER | 2 | REV | 0 |
|---------------|---|-----|---|

**AREA OF REVIEW MAPS
OIL AND GAS WELLS**

Notes:
1) Imagery obtained from the ESRI Bing Maps map service layer from ArcGIS Online.
2) Additional oil and gas wells are located in the vicinity of the proposed injection well.
Only oil and gas wells located in the Area of Review are shown.



Legend

- Well # 38268
- AGAS
- Gas
- Area of Review (1/4 Mile)



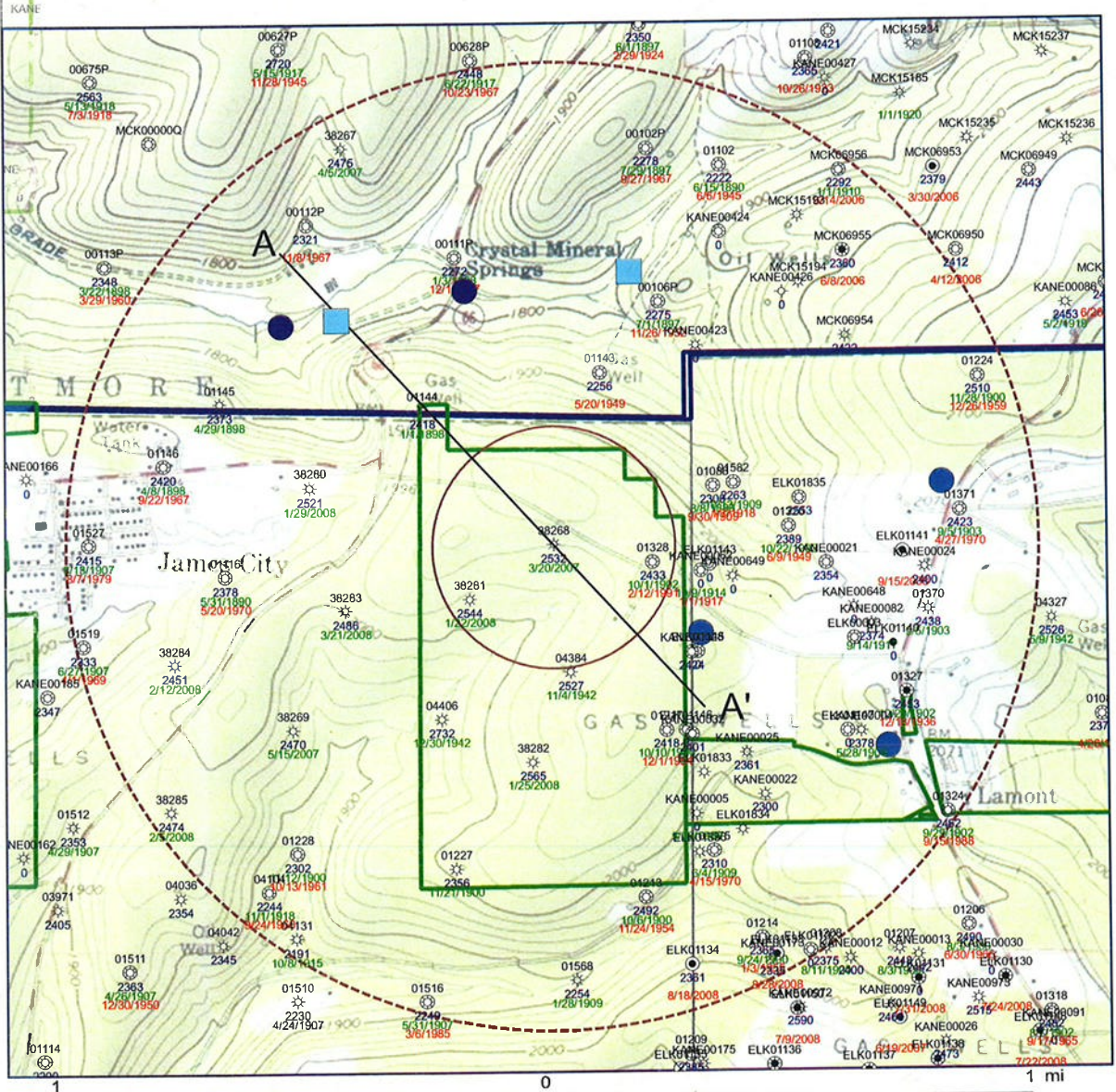
FIGURE 3
#38268 WELL LOCATION
WITH GAS WELL LOCATIONS



ELK COUNTY, PENNSYLVANIA

DRAWN BY: J. NOVAK 05/17/12
CHECKED BY: D. SKOFF 06/25/12
APPROVED BY:
CONTRACT NUMBER: 112C04078

| | | | |
|---------------|---|-----|---|
| FIGURE NUMBER | 3 | REV | 0 |
|---------------|---|-----|---|



Oil and Gas Wells

- Straight hole well
- Well Status
 - AGAS
 - AO&G
 - AOIL
 - D&A
 - GAS
 - OIL
 - UNK

Well ID
 Well Depth
 Spud Date
 Abandoned Date

- 1/4 Mile Area of Review
- One mile radius around well 38268

Private Water Wells

- Straight hole well
- Straight hole well

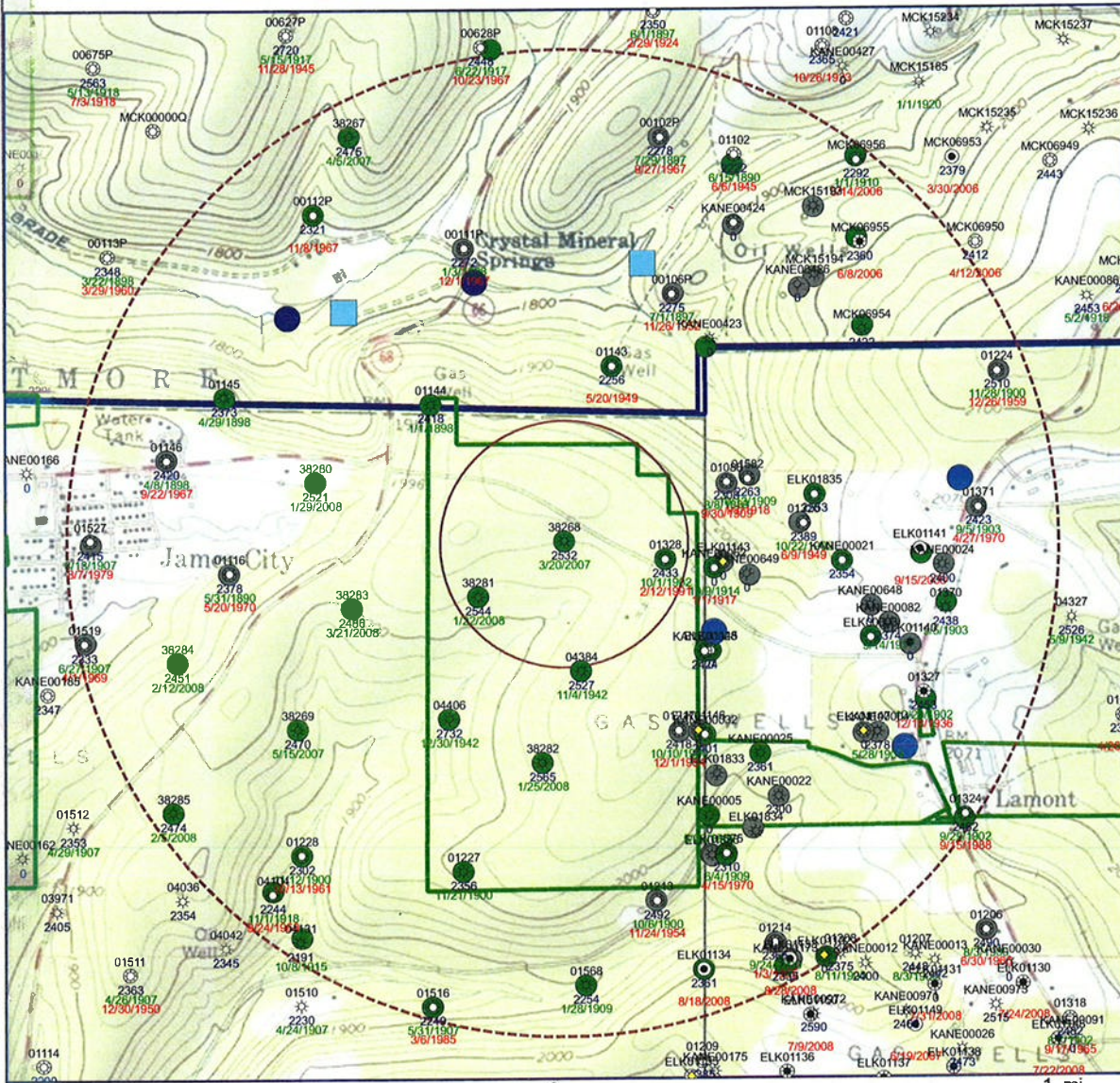
Highland Township Water Authority

- Point
- TYPE
- SPRING
 - WATER WELL

SENECA RESOURCES

Wells Within One Mile of Seneca Well #38268
 Elk County, Pennsylvania

| | |
|---------------------------------|----------------------------------|
| Author: Amanda Veazey | Date: December 6, 2012 |
| Scale: See Scale Bar | |



DEP Listed Orphan Wells

Straight hole well
 Straight hole well

Oil and Gas Wells

Straight hole well

Well Status

- AGAS
- AO&G
- AOIL
- D&A
- GAS
- OIL
- UNK

Private Water Wells

Straight hole well
 Straight hole well

Highland Township Water Authority

Point
 TYPE
 SPRING
 WATER WELL

Located Oil and Gas Wells

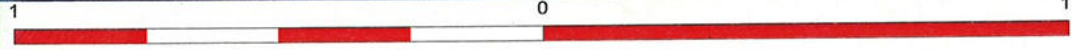
Point
 Point

No Well Found

Point
 Point

Well ID

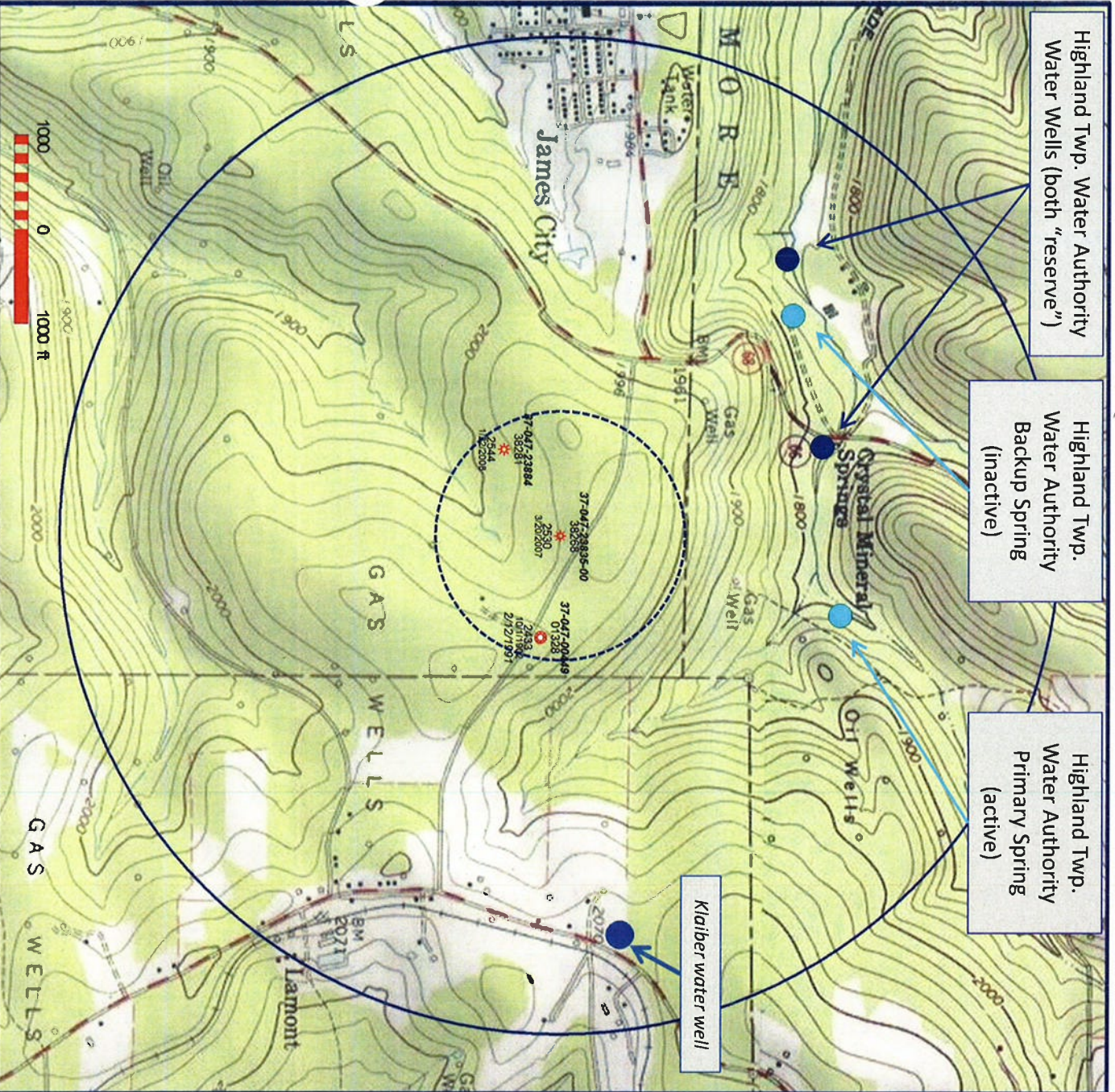
 Well Depth
 Spud Date
 Abandoned Date
 1/4 Mile Area of Review
 One mile radius around well 38268



SENECA RESOURCES

Wells Within One Mile of Seneca Well #38268
Elk County, Pennsylvania

| | |
|--------------------------|---------------------------|
| Author: Amanda Veazey | Date: December 6, 2012 |
| Scale: See Scale Bar | |



15 minute topographic quadrangle maps:
Kane, PA
James City, PA

Legend

Well Symbols

Well Status



| | |
|--|-------------------|
| | |
| Seneca Well 38368 Known Gas Wells within 1/4 mile Known Water Wells/Supplies within 1 mile | |
| Author: | Amanda Vezey |
| Date: | September 6, 2012 |
| Scale: | See Scale Bar |

**OIL AND GAS WELLS IN THE AOR
GROUNDWATER WELLS WITHIN 1 MILE**

| Proposed Injection and Monitoring Wells | | | | | | | | | |
|--|-----------------------------------|-------------------------------------|-----------|-----------------------|------------------|----------------------|-----------------------------|--|---|
| Operator | Cmpl Date | API | WellID | Elevation (ft msl) | Total Depth (ft) | Last Csg (in) | Csg Depth (ft) | Completion | Comments |
| SENECA RESOURCES CORP | 7/3/2007 | 37-047-23835 | 38268 | 2040 | 2530 | 7 | 553.2 | Notched & Frac'd: 2354-2403' | Subject of UIC Class IID permit application |
| SENECA RESOURCES CORP | 3/11/2008 | 37-047-23884 | 38281 | 2020 | 2544 | 7 | 602 | Notched & Frac'd: 2338-2390' | Monitoring Well |
| Other Existing /Former Oil and Gas Wells Within Area of Review (1/4 Mile Radius) | | | | | | | | | |
| Operator | CmplDate | API | WellID | Elevation | Total Depth (ft) | Last Csg (in) | Csg Depth (ft) | Completion | Comments |
| SENECA RESOURCES CORP | 11/21/1902 | N/A | 1328 | 2049 | 2433 | 6.25 | 460 | Shot with 100 qts. Nitroglycerin: 2370-2400' | Plugged and Abandoned Feb. 12, 1991 |
| Water Wells Within 1 Mile Radius | | | | | | | | | |
| PA Well ID | DateDrilled | Owner | WellDepth | Depth To Bedrock (ft) | Well Use | Borehole Bottom (ft) | Bore Hole Diameter (inches) | Casing Bottom (ft) | Casing Diameter |
| 100718 | 8/1/1987 | KLAIBER RANDY | 130 | 28 | WITHDRAWAL | | | | |
| DWRS6240006 Source 4 | | HIGHLAND TOWNSHIP WATER AUTHORITY | 206 | | MUNICIPAL BACKUP | 206 | 8 | 30 | 6 in., pump set at 170 ft |
| DWRS6240006 Source 5 | | HIGHLAND TOWNSHIP WATER AUTHORITY | 161 | | MUNICIPAL BACKUP | 161 | 8 | 28 | 6 in., pump set at 140 ft |
| Springs Within 1 Mile Radius | | | | | | | | | |
| PA ID | Owner | Comments | | | | | | | |
| DWRS6240006 Source 1 | HIGHLAND TOWNSHIP WATER AUTHORITY | Primary water supply for James City | | | | | | | |
| DWRS6240006 Source 3 | HIGHLAND TOWNSHIP WATER AUTHORITY | Backup water supply for James City | | | | | | | |