

IURC  
PETITIONER'S

EXHIBIT NO. 2  
1-27-21 AT  
DATE REPORTER

OFFICIAL  
EXHIBITS

FILED  
August 28, 2020  
INDIANA UTILITY  
REGULATORY COMMISSION

Petitioner's Exhibit No. 2

COLUMBUS CITY UTILITIES

INDIANA UTILITY REGULATORY COMMISSION

CAUSE NO. 45427

DIRECT TESTIMONY

OF

JAMES E. MCNULTY

SPONSORING ATTACHMENTS JM-1 AND JM-2

**Columbus City Utilities**

**Cause No. 45427**

**Direct Testimony of James E. McNulty**

1   **Q.    Please state your name, occupation, and business address.**

2    A.    My name is James E. McNulty. I am a Senior Project Manager with Strand  
3       Associates, Inc. My business address is 629 Washington Street, Columbus, IN  
4       47201.

5   **Q.    Please describe Strand Associates and its areas of expertise.**

6    A.    Strand Associates is a multidisciplinary engineering consulting firm specializing in  
7       civil and environmental engineering and science founded in 1946. Over the past 74  
8       years, we have provided services to communities throughout the State of Indiana  
9       including with respect to water treatment/supply and distribution projects. Our  
10       areas of expertise include site development, landscape architecture, transportation,  
11       survey, water supply, water treatment, wastewater treatment, water distribution,  
12       wastewater collection, and stormwater.

13   **Q.    Please summarize your educational background and professional experience?**

14   A.    I am a 1982 graduate of Hanover College with a B.A. Degree in Geology. I have  
15       been employed as a geologist and project manager in the environmental and water  
16       supply field for over 30 years. I have been employed by Strand Associates in  
17       Columbus, Indiana for 31 years from 1989 until the present. My work experience

1 includes projects for Columbus City Utilities ("CCU") developing water supply  
2 wells and evaluating water quality of the water supply.

3 **Q. Do you hold any professional licenses in the State of Indiana?**

4 A. Yes. I am a Licensed Professional Geologist in Indiana and have been since July  
5 1990.

6 **Q. Was your firm retained by CCU in connection with these proceedings?**

7 A. Yes.

8 **Q. Would you briefly describe the purposes for which you were retained and the**  
9 **nature and scope of the service which you are to provide?**

10 A. Yes. Strand Associates was retained by CCU to evaluate its existing water utility  
11 facilities and infrastructure and to identify its potential capital improvement needs  
12 over a 20-year planning period. Strand Associates prepared a Water and  
13 Wastewater Utility Master Plan for CCU documenting our evaluation in July 2018  
14 and partially amended in July 2020. The Master Plan and Master Plan amendment  
15 are included as confidential workpapers with my testimony. We have also  
16 conducted engineering studies to evaluate and support the specific projects CCU is  
17 proposing in this Cause to improve its water system. I am sponsoring two of these  
18 evaluations as Attachments JM-1 and JM-2 as part of my testimony. These studies  
19 discuss the various projects, present available alternatives for the projects and  
20 provide an explanation of the projects. I also contributed to the engineering studies  
21 related to the additional water well and raw water main projects in the 2018 Master

1 Plan CCU is proposing.

2 **Q. Were these attachments prepared by you or under your supervision?**

3 A. Yes.

4 **Q. What is the purpose of your direct testimony in this proceeding?**

5 A. My testimony discusses the relevant portions of the engineering studies and  
6 describes the proposed addition of four new groundwater well projects CCU intends  
7 to finance with the bonds to be issued in this Cause. I will also discuss the new plant  
8 scoping and design project, as well as the pilot testing project CCU is proposing in  
9 this Cause in connection with the construction of a new water treatment plant in the  
10 future.

11 **Q. Please described the new well projects CCU is proposing in this Cause.**

12 A. CCU is proposing to construct four new groundwater wells to replace lost capacity  
13 from it taking Wells 3A, 4, 14 and 15 out of service. The addition of the four new  
14 groundwater wells proposed in this Cause will increase the firm well capacity by  
15 an additional approximately 4.6 Million Gallons per Day ("MGD") for Water  
16 Treatment Plant #2 ("WTP #2").

17 **Q. Has raw water supply traditionally been an issue for CCU?**

18 A. Yes. A significant issue facing the water supply in Columbus is the raw water  
19 supply for WTP #2. WTP #2 has a firm water capacity of approximately 11.4 MGD  
20 without Wells 3A, 4, 14 and 15 in service, and the plant is rated for 20 MGD. CCU  
21 is currently constructing two new wells (18 and 19) to add approximately 2.3 MGD

1 to achieve approximately 13.7 MGD, but additional raw water capacity is needed.

2 The addition of the four new groundwater wells proposed in this Cause will increase  
3 the firm well capacity for WTP #2 to 18.3 MGD and should allow WTP #2 to  
4 accommodate a peak day demand of 15 MGD. However, additional raw water  
5 capacity is needed to supply the 25 MGD that a new water plant will need in order  
6 to meet the anticipated 20-year peak day demand of approximately 20 MGD.

7 **Q. Why did CCU determine to take Wells 3A, 4, 14 and 15 out of service?**

8 **A.** Detectable amounts of 1,4 dioxane were first detected in Wells 14 and 15 in 2013.  
9 While 1,4 dioxane is not a regulated contaminate in Indiana, for reasons discussed  
10 in the Direct Testimony of Scott Dompke, CCU made the decision in 2017 to take  
11 these wells out of service and to use them only as necessary and in combination  
12 with other wells. Wells 14 and 15 were constructed in 2007 and rated for over 1,000  
13 gallons per minute. Taking these wells out of service reduced raw water capacity  
14 by approximately 3 MGD. Further, CCU made the decision to remove Well 4 from  
15 service due to its age and condition. Well 4 was constructed in 1972, and the well  
16 has been out of service since 2011 due to a production rate of 250 gallons per minute  
17 after cleaning. Well 4 has essentially been abandoned by CCU. Well 3A was  
18 removed from service in June 2017 due to a positive test for E-coli. CCU conducted  
19 an investigation of Well 3A and discovered a hole in the casing which is believed  
20 to be the source of the bacterial contamination. CCU also reported the production  
21 in Well 3A was only 60 percent of the original capacity and, due to plugging of the  
22 well screen, it requires cleaning at six month intervals at a cost of between \$8,000

1 and \$11,000. Wells 3A and 4 are also located in the Bartholomew County  
2 Fairgrounds close to activities such as livestock facilities, a midway, and other fair  
3 activities. The location of these wells caused significant wellhead protection  
4 concerns for CCU and this factor, along with the other factors described in my  
5 testimony, led CCU to make the determination to abandon Wells 3A and 4.

6 **Q. Did Strand assist CCU in evaluating options for the well production issues?**

7 A. Yes. The Master Plan discussed the water supply issues and the construction of 8  
8 additional groundwater wells to supply WTP #2. The Master Plan was provided  
9 before CCU determined to remove Wells 14 and 15 from service in 2017. The  
10 Master Plan was amended in July 2020 to include the addition of 10 new  
11 groundwater wells over the 20-year planning period, in addition to the two new  
12 wells currently under construction (Wells 18 and 19). CCU asked Strand to further  
13 evaluate continuing operation of Well 3 (or 3A). Strand's evaluation of the  
14 advantages and disadvantages of continuing to operate Well 3A was provided in a  
15 letter to CCU dated October 31, 2018. This letter is included with my testimony as  
16 Attachment JM-1. Based on this evaluation, Strand suggested CCU abandon Well  
17 3A and replace the well with a new well in a different location (i.e. a location further  
18 away from the Bartholomew County fairgrounds). The additional well options were  
19 further studied and presented to CCU in a letter dated August 27, 2020. This letter  
20 is included with my testimony as Confidential Attachment JM-2. This study  
21 evaluated CCU's current water supply and presented three options for the location  
22 of the four additional wells proposed in this Cause. The study suggests the wells be

1 constructed in the existing South Wellfield at various sites. The final locations have  
2 not been determined at this time, and the well locations could be a combination of  
3 the locations presented in Options 2 and 3.

4 **Q. Given the 1,4 dioxane issue, is there any concern with constructing the new**  
5 **wells in the existing South Wellfield?**

6 A. No. As provided in the August 27, 2020 letter, the well sites proposed in Options 2  
7 and 3 are removed from the 1,4 dioxane limits. Unlike Option 1, Options 2 and 3  
8 provide well locations that are removed from the 1,4 dioxane issue, while allowing  
9 CCU access to the existing raw water main and power source, and also allowing  
10 CCU to use property that is currently owned by the City.

11 **Q. What is the anticipated cost of these 4 new wells?**

12 A. The 2020 Master Plan amendment presented an opinion of probable cost of  
13 approximately \$3,000,000 for the four new wells for WTP #2.

14 **Q. Is CCU proposing any other water treatment or supply projects in this Cause?**

15 A. Yes. CCU is proposing to conduct additional water treatment plant scoping and  
16 design, as well as pilot testing for a new water treatment plant CCU is proposing to  
17 build near the South Wellfield. This plant scoping/design and pilot testing will  
18 provide CCU with, among other things, data to be used as the base of design for the  
19 new water treatment plant.

20 **Q. Why is CCU proposing to build a new water treatment plant?**

21 A. First, it is important to note CCU is not proposing to build a new water treatment  
22 plant in this Cause. CCU is only seeking recovery in this Cause to evaluate the

1 project further and will make a determination at a future date to implement the new  
2 water treatment plant project. WTP #1 was last updated in 1976 and WTP #2 was  
3 expanded in 1992 to increase capacity to 20 MGD. Both water treatment plants  
4 were evaluated in the Master Plan and the plan presented two options for  
5 rehabilitation. Option 1 suggested a minimal rehabilitation of WTP #1 to extend its  
6 useful life, followed by rehabilitation of WTP #2 and construction of a new 12  
7 MGD water treatment plant to replace WTP #1. The opinion of probable cost of  
8 this option was approximately \$70,593,000 in 2017. Option 2 presented a full  
9 rehabilitation of WTP #1 followed by rehabilitation of WTP #2. The opinion of  
10 probable cost for Option 2 was approximately \$37,878,000 in 2017. The  
11 rehabilitation to WTP #1 was anticipated to be accomplished by 2024 to provide  
12 sufficient treatment capacity for when the capacity at WTP #2 was planned to be  
13 reduced during the rehabilitation.

14 **Q. Which Option has CCU determined to move forward with and to evaluate**  
15 **further in this Cause?**

16 A. CCU is not moving forward with either Option 1 or Option 2. The 2020 Master  
17 Plan amendment presents a third option which includes constructing a new water  
18 treatment plant (WTP #3) on a site north of the existing wastewater treatment plant.  
19 It was determined that Options 1 and 2 are no longer feasible options due to the  
20 limited capacity of WTP #1 (rated at 8 MGD). CCU needs more capacity than what  
21 WTP #1 can provide in order to supply the system demand during the rehabilitation  
22 of WTP #2. Because WTP #1 cannot provide this additional capacity, Option 3 was



1 explored as an alternative option to address CCU's water treatment needs. In this  
2 Option, both WTP #1 and WTP #2 would continue to operate while WTP #3 is  
3 constructed. Once WTP #3 is constructed and in operation, WTP #1 and #2 would  
4 be removed from service. WTP #3 would have a maximum day capacity of 25  
5 MGD, which is sufficient capacity to supply the system demand presented in the  
6 Master Plan currently being served by WTP #1 and #2.

7 **Q. What is CCU proposing to evaluate further in this Cause with the new plant**  
8 **scoping/design and pilot testing project?**

9 A. Option 3 proposed a pressure filter iron removal plant that would normally operate  
10 at less than 15 MGD but would be capable of producing up to 25 MGD for extreme  
11 peak days. Operating the filter in this fashion will require a pilot study of the filter  
12 flow rate for the Indiana Department of Environment Management. CCU is also  
13 planning to scope out and design the WTP #3 project and will use this evaluation  
14 as the basis of design for WTP #3 at a future date. The proposed project for WTP  
15 #3 includes the water plant, clear well storage, raw water main, finished water main,  
16 and improvements to the existing groundwater wells. As identified in the Master  
17 Plan amendment, the total cost of the scoping/design and pilot testing is anticipated  
18 to be \$2,650,000. As further identified in the Master Plan amendment, the opinion  
19 of probable cost for Option 3 is approximately \$50,600,000.

20 **Q. Are each of these projects reasonably necessary for the provision of reasonable**  
21 **and adequate service?**


22 A. Yes.

1   **Q.**     Does this conclude your direct testimony in this cause?

2   **A.**     Yes.

**VERIFICATION**

I, Jim McNulty, affirm under penalties of perjury that the foregoing representations are true and correct to the best of my knowledge, information and belief.

  
\_\_\_\_\_  
James E. McNulty

Date: August 25/2020



October 31, 2018

Mr. Scott Dompke P.E. Director  
Columbus City Utilities  
1111 McClure Road  
Columbus, IN 47201

Re: Fairgrounds Well No. 3 Abandonment

Dear Mr. Dompke:

At the request of Columbus City Utilities (CCU), Strand Associates, Inc.® (Strand) prepared a list of advantages and disadvantages of continuing to operate Well No. 3 in the Fairgrounds Well Field. This well experienced a well casing failure in 2017 that requires a decision regarding whether to expend resources to continue to operate and maintain the well. The advantages and disadvantages are as follows:

Advantages of Maintaining Well No. 3

1. The well is currently permitted and constructed.
2. The well can produce up to 600 gallons per minute (gpm) or 864,000 gallons per day when fully operational.
3. The well produced an estimated 271,870,000 gallons of water in 2015 or 744,849 gallons per day (about 500 gpm). This number is only estimated as there was no flow meter functional on the well.
4. The well casing was lined and a new concrete pad constructed in 2018 at a cost of about \$13,800.

Disadvantages of Maintaining Well No. 3

1. The well has been offline since June 16, 2017, after *E. coli* was detected at the well. An investigation of the well discovered a hole in the casing that was believed to be the source of the bacterial contamination. The well casing was repaired in 2018. Placing the well back into service will require overboard pumping for at least one day followed by two consecutive nondetect coliform bacteria tests and monthly testing for 12 consecutive months to meet Indiana Department of Environmental Management (IDEM) requirements. In 2018, the Total Coliform/*E.coli* testing results have been mixed. CCU has not been successful in obtaining two consecutive samples in a 24-hour period that were absent for total coliform.
2. The presence of total coliform bacteria in Well No. 3 as recently as August 13, 2018, raises the question of whether the well can be disinfected sufficiently to obtain the absence of Total Coliform/*E.coli* bacteria that is required by IDEM for placing the well into service and continuing use of the well. It is reasonable to assume that the well will be tested monthly for Total Coliform for the long term at a cost to CCU for laboratory testing and staff time for sample collection.

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In addition, there is the potential that a system false positive bacteria sample could bring Well No. 3 into question again. CCU should proceed to evaluate the ability of Water Plant No. 2 to achieve 4-Log disinfection. The cost to achieve the required compliance monitoring to demonstrate 4-Log disinfection could be in excess of \$300,000.00 for construction of plant improvements. Groundwater plants do not typically pursue the credit for 4-Log disinfection because of increased costs to operate and maintain a water plant while achieving compliance. CCU can expect increased costs for additional trained staff to manage the daily and monthly regulatory compliance requirements. A failure to achieve compliance with the increased regulatory requirements may include additional public notifications when not meeting compliance limits.

3. CCU staff report the well has a maximum production of 600 gpm that is about 60 percent of the original rated capacity of the well. This indicates significant plugging of the gravel pack or aquifer around the well.
4. CCU staff report the well must be cleaned and tested about once every six months at an estimated cost between \$8,000 and \$11,000 to maintain production over 400 gpm. CCU's well cleaning contractor reports that the well has a high iron level that quickly plugs the well screen. This is a high maintenance cost of \$0.58 per 1,000 gallons annually compared to Well No.17 that is cleaned one time every 12 months at a cost of \$0.021 per 1,000 gallons produced in 2015. Wells in good condition should require rehabilitation at one to three-year intervals if regularly maintained and pumped as designed. The wells at CCU require well maintenance frequently due in part to the excessive number of hours the wells must be in operation and past over pumping of the wells. The maintenance cost does not include cost of electricity, or cost of additional repairs to the pump, column pipe, bushings, or motor.
5. Well No. 3 was constructed in 1994 and is near the end of its useful life based on the age and frequent maintenance required to maintain production.
6. The CCU Water Utility Master Plan has identified older wells in the Fairgrounds Well Field to be abandoned and replaced based on age, condition, and locations that are vulnerable to contamination. The Water Utility Master Plan identified wells in the fairgrounds to be replaced with additional new well capacity in the Southern Well Field.
7. Well No. 3 is located at the Fairgrounds Well Field in the midway area for the county fair as well as other annual activities. The area around the well is vulnerable to surface activities resulting from the midway that include parking of travel trailers, food vendors, and fuel storage for generators within the 200-foot sanitary radius of the well that places this well at risk.
8. The site of Well No. 3 is such that it may not be possible to obtain a well site approval for a new well from IDEM because of the activities at the fairgrounds and the proximity to the Southern Indiana Railroad and County Road 200 S.
9. Well No. 3 is not equipped with a soft start on the motor.

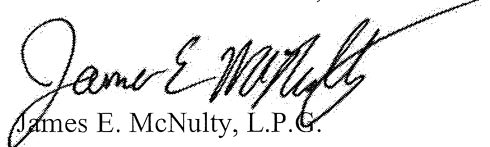
10. Well No. 3 will continue to require close monitoring to provide confidence in the water quality.

Based on these advantages and disadvantages Strand recommends planning to abandon Well No. 3 and replacing the well with a new well at a more suitable location. The well should remain available in the short term but not used unless there is an emergency that requires the water capacity. The raw water required for Water Treatment Plant (WTP) 2 is currently supplied by other wells in the southern well fields. CCU currently has Well No. 14 and Well No. 15 out of service due to dioxane detected at these wells. Well No. 16 and Well No. 17 are used only as necessary to potentially delay the migration of dioxane while studies and well field modeling related to the dioxane are completed. Well No. 16 and Well No. 17 remain available to provide capacity. In addition, WTP 1 has been producing water again since May 2018 to provide additional capacity to compensate for the capacity of Well No. 3. In the event that dioxane migration required removing Well No. 16 and/or Well No. 17 from service, or WTP 1 is taken out of service, the capacity of Well No. 3 may be necessary. Therefore, Well No. 3 should not be used but remain available until a new well for WTP 2 has been constructed and then abandoned at that time.

Let me know if there are any questions about this information and recommendations.

Sincerely,

STRAND ASSOCIATES, INC.®



James E. McNulty, L.P.C.



August 27, 2020

Mr. Scott Dompke, P.E., Director  
Columbus City Utilities  
1111 McClure Road  
Columbus, IN 47201

Re: Water Plant 2–Bond 1 Additional Well Options  
City of Columbus, Indiana (City)

Dear Mr. Dompke:

Columbus City Utilities (CCU) currently uses two water plants referred to as “Water Plant 1” in Lincoln Park and “Water Plant 2” south of the City on Sink Drive (in the county fairgrounds). These plants currently have a combined total well capacity of 23.6 million gallons per day (MGD) to meet the water system peak day demand that was near 15 MGD in 2019. However, the water system 20-year Master Plan is under revision to recommend that CCU rely on Water Plant 2 for water system capacity in the future to meet a projected demand of 20 MGD and abandon Water Plant 1 because of the cost of maintaining two water plants. The total well capacity to reliably supply 20 MGD to the system should be approximately 25 MGD to allow for wells out of service and water plant backwash requirements. Removing Water Plant 1 will result in the loss of 9.6 MGD of well capacity. In addition, CCU has removed Wells 14 and 15 from production at Water Plant 2 because of the presence of 1,4 Dioxane in these wells reducing well production another 2.8 MGD. This leaves the water utility with about 11.2 MGD of firm water production if Water Plant 1 is removed from production thus requiring an additional 13.8 MGD in new raw water supply to reliably serve the future water demand.

At the request of CCU, Strand Associates, Inc.® (Strand) has prepared this summary of options for additional wells at the Water Plant 2 well fields. The well fields that provide raw water to Water Plant 2 are known as the Fairgrounds, Marr-Glick, and South (Scheidt) well fields, but collectively referred to as the Water Plant 2 Well Field as presented in Figure 1. Currently an MCL for 1,4 Dioxane has not been established by the EPA. However, EPA risk assessments indicated a  $1 \times 10^{-6}$  cancer risk level at 0.35 ug/l.

CCU is currently planning to add two new Wells (18 and 19) at Water Plant 2 in 2020 and abandon two unproductive wells at the Fairgrounds well field. In addition, CCU plans to add four more wells in 2021 in conjunction with a 2020 bond issue. The presence of 1,4 Dioxane has removed two highly productive water supply wells (14 and 15) from the available well capacity and has raised questions regarding the area in the South (Scheidt) well field available for future well locations to meet the future demand of Water Plant 2. The loss of four wells and addition of six new wells provides a net gain of only two wells or approximately 2.3 MGD. The raw water capacity for Water Plant 2 is summarized in the following:

|  |           |
|--|-----------|
| Current Firm Well Capacity at Water Plant 2      | 14.0 MGD  |
| Wells 14 and 15 (Removed because of 1,4 Dioxane) | (2.8 MGD) |
| Well 3A (Abandoned)                              | (0.8 MGD) |
| New Well Capacity from Wells 18 and 19           | 2.3 MGD   |
| Future Well Capacity Anticipated in Bond Issue 1 | 4.6 MGD   |

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|   |                |
|---|----------------|
| Total Well Capacity after New Well Additions                | 17.3 MGD       |
| Future Well Capacity Required for 20 MGD Water Plant        | 25 MGD         |
| <b>Additional Well Capacity Required for 20-Year Demand</b> | <b>7.7 MGD</b> |

The addition of four new wells over the next few years in Bond Issue 1 should allow Water Plant 2 to meet a peak day demand of 15 MGD but will not provide capacity to supply 25 MGD that a new water plant will need to meet the anticipated 20-year peak day demand. The location of the four new wells for Bond Issue 1 and future well locations has been impacted by the presence of 1,4 Dioxane.

Figure 2 serves as a graphical representation of this data and the projected well production growth required over the next 20 years.

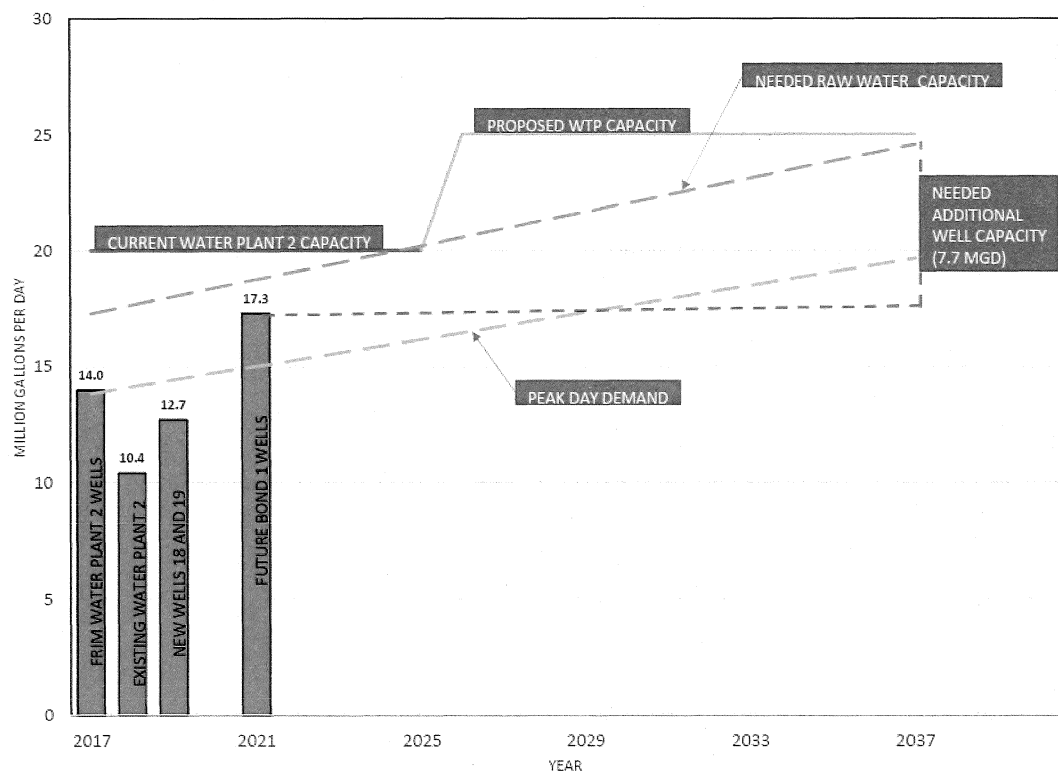


FIGURE 2: WATER PLANT 2 WELL CAPACITY AND WATER PLANT CAPACITY COMPARISON

Consequences of failure to develop additional well supply are:

- Water Plant 2 will not have sufficient raw water supply to meet current peak day demand.
- Water tank levels cannot be maintained resulting in low system pressure.
- The City will not have sufficient fire flow water supply.
- The City will not have water capacity for economic growth.



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- Indiana Department of Environmental Management (IDEM) could impose a connection ban on the system.
- CCU may have to pump Wells 14 and 15 for raw water supply or fire flow demand.
- Aging wells in the Fairgrounds will continue to operate at a high maintenance cost.

Strand has prepared three options for the location of the four additional wells anticipated for Bond Issue 1 in 2020 that could supply 4 to 5 MGD of additional water capacity needed to meet current peak day demand.

**Option 1—Four New Wells in the South (Scheidt) Well Field** (as located in Figure 3)

In Option 1, CCU would construct four new wells in the South (Scheidt) well field [REDACTED]. In 2008 this area was expected to be the next site for future wells because of land availability and access to the raw water main. Test wells were installed in 2008 in anticipation of the future wells, and the raw water main was sized to accommodate future wells in the area. The four wells would be expected to yield 1,000 gallons per minute (gpm) each or about 4.8 MGD.

The benefits of Option 1 are:

- Access to the existing raw water main
- Access to power
- Property is owned by CCU
- The aquifer yield has been well documented

The risks of Option 1 are:

- The well sites are in the area of Wells 14 and 15.

**Option 2—Four New Wells in the South (Scheidt) and Marr-Glick Well Fields** (as located in Figure 4)

In this option, [REDACTED]. These locations are at a greater distance outside of the area of previously detected 1,4 Dioxane.

The benefits of Option 2 are:

- Access to the existing raw water main
- Access to power
- Property is owned by CCU
- The aquifer yield has been well documented

The risks of Option 2 are:

- The well sites are in an area where a lower well yield is expected.
- Groundwater modeling reports the potential for 1,4 Dioxane to migrate to the west and contaminate Well 16 and potentially other pumping wells around Well 17.
- There is potential for chlorinated solvent compound contamination from historical activities in Garden City to impact new wells [REDACTED].
- CCU has detected nitrates in wells in the Fairgrounds and Marr-Glick.

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**Option 3—Four New Wells in the South (Scheidt) and Marr-Glick Well Fields (as located in Figure 5)**

In this option three new wells will be located [REDACTED]. These locations are at the greatest distance outside of the area of previously detected 1,4 Dioxane of the options evaluated.

The benefits to Option 3 are:

- Access to the existing raw water main
- Access to power
- Property is owned by CCU
- The well sites are all significantly removed from the 1,4 Dioxane limits.

The risks to Option 3 are:

- The well sites are in an area that has not been documented and a lower well yield is expected.
- There is potential for chlorinated solvent compound contamination from historical activities in Garden City [REDACTED].
- CCU has detected nitrates in wells in the Fairgrounds and Marr-Glick.
- A well site south of the WWTP would have to be removed in the event the WWTP is expanded.

The construction cost for each of these options is expected to be approximately \$3,000,000. Option 1 has the potential to supply the greatest amount of raw water from an area closer to the river that has greater potential well yield and higher aquifer recharge. Option 1 also has the greatest risk of 1,4 Dioxane migration west of the current limits. Option 3 provides well locations at the greatest distance from the 1,4 Dioxane, but also has risk of chlorinated solvent contamination migrating from Garden City. Implementing one of the options discussed leaves CCU short about 7.7 MGD for the 20-year Master Plan raw water capacity of 25 MGD. Placing Wells 14 and 15 back in service could add approximately 2.8 MGD to the raw water supply. An additional eight to ten new vertical wells or possibly a single horizontal collector well will be necessary to supply the additional 7.7 MGD. Additional water supply wells not specified in this letter, [REDACTED]. Without the ability to fully use the existing CCU property, [REDACTED].

There are a number of considerations that CCU should consider before making a decision regarding constructing a horizontal collector type well or multiple vertical wells. Assuming a well capacity of 10 MGD, CCU would need to construct one horizontal collector well or as many as eight vertical wells. A horizontal collector well would have the following advantages over vertical wells:

- One central caisson approximately 15 to 20 feet in diameter drilled to bedrock equipped with two or three pumps capable of pumping several thousand gallons per minute each thus reducing the construction footprint and raw water main construction costs.
- The cost for the electrical service and access road will be reduced because only one site is serviced.
- There is the potential for reduced maintenance costs due to fewer cleaning cycles.

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The risks of a collector well are:

- Well screens may become prematurely plugged resulting in reduced capacity and frequent well cleaning.
- The well would draw water from a small area that could be vulnerable to contamination.
- The number of available drilling contractors available to service the collector well are limited.
- Sufficient vertical well supply or a second collector well is required to maintain capacity during service of the collector well.

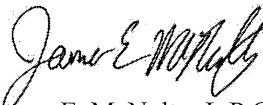
The information collected from test well [REDACTED] completed in 2019 has been discussed with Layne [REDACTED]. This location was selected because it is on property currently owned by CCU and is not in the area of Wells 14 and 15 in the South well field. Strand is currently in discussions with Layne regarding the suitability of the Marr-Glick area for a collector well and will follow up with a brief report when information is available. Horizontal collector wells are generally located adjacent to a river to induce recharge of the large quantity of water required for the well. Any proposed location of a collector well should be carefully studied and modeled to assist with the decision to construct a collector well. The evaluation process would require several months to complete. [REDACTED].

Strand recommends CCU proceed with Option 3 for future wells in 2020 bond issue unless CCU concludes that 1,4 Dioxane should not be considered in the decision process. [REDACTED]

If you have any questions regarding the recommended options presented, please contact Strand at (812) 372-9911.

Sincerely,

STRAND ASSOCIATES, INC.®

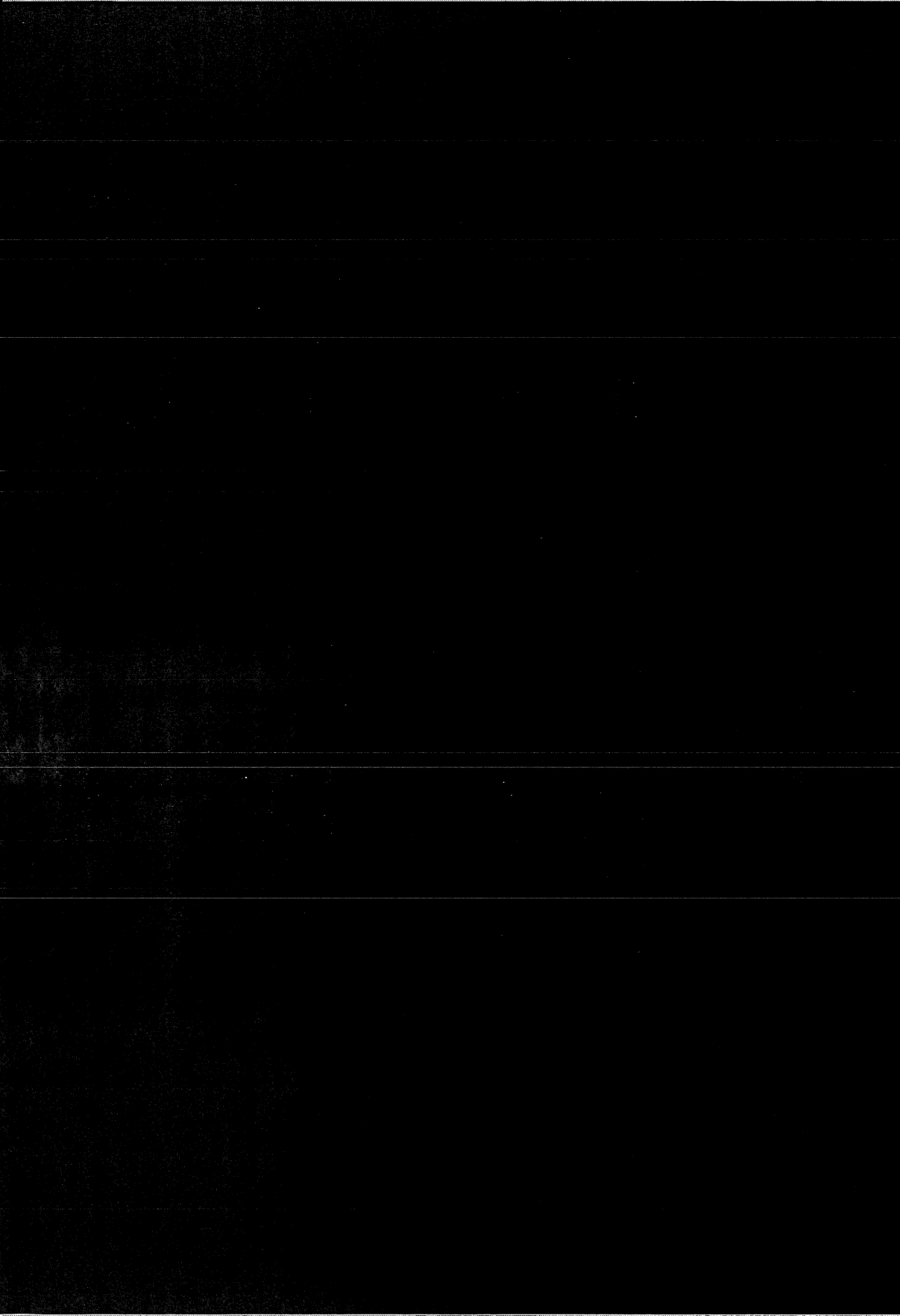


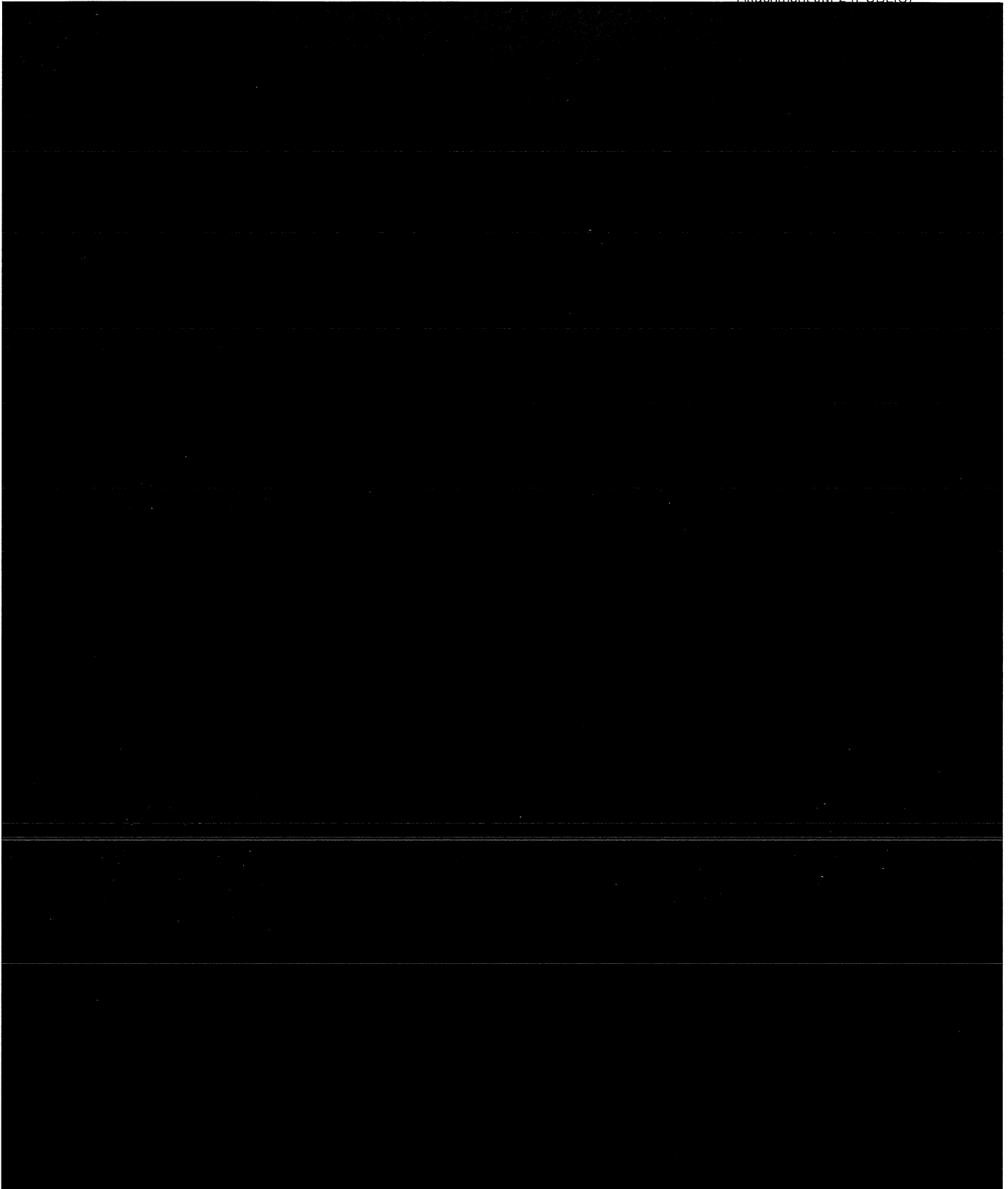
James E. McNulty, L.P.G.

1,4 - DIOXANE SAMPLING RESULTS  
MASTER FIGURE  
COLUMBUS CITY UTILITIES  
BARTHOLOMEW COUNTY, INDIANA



FIGURE 1  
4021.108





**POTENTIAL WELL LOCATIONS  
OPTION 1**

**COLUMBUS CITY UTILITIES, INDIANA  
COLUMBUS, IN**



**FIGURE 3  
4021.108**

Path: S:\COLL4000-4094\021118\Drawings\GIS\Option 2.mxd

User: Scott W

Date: 12/10/2019

Time: 9:26:04 AM

**POTENTIAL WELL LOCATIONS  
OPTION 2**

**COLUMBUS CITY UTILITIES, INDIANA  
COLUMBUS, IN**



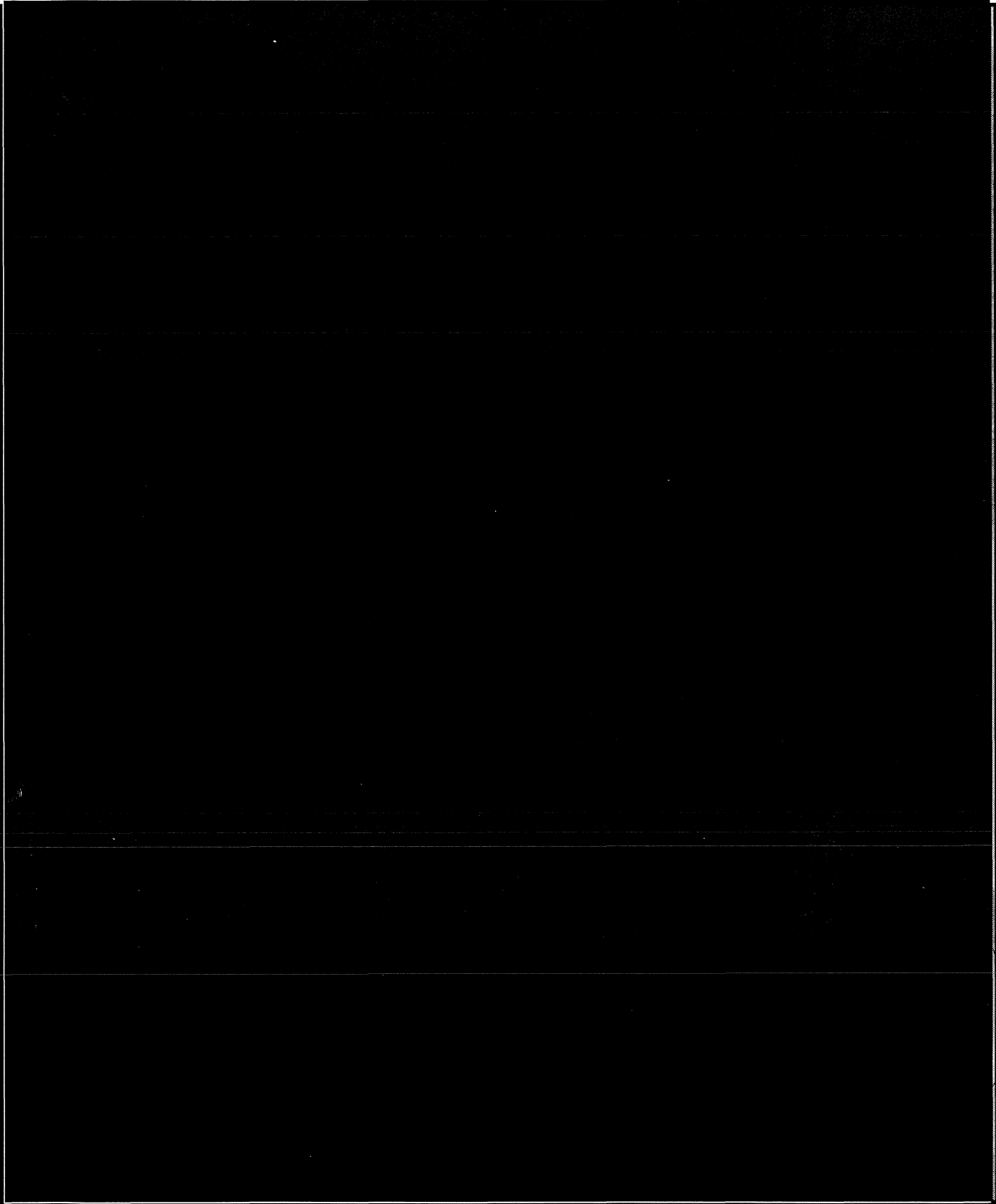
**FIGURE 4  
4021.108**

Path: S:\COL\M000-409\4021118\Drawings\GIS\Option 3.mxd

User: Scott W

Date: 12/10/2019

Time: 9:26:25 AM



**POTENTIAL WELL LOCATIONS  
OPTION 3**

**COLUMBUS CITY UTILITIES, INDIANA  
COLUMBUS, IN**



**FIGURE 5  
4021.108**

Path: S:\COLL4000-4099\4021\118\Drawings\GIS\Collector Well.mxd

User: ScottW

Date: 12/10/2019

Time: 9:19:37 AM

## POTENTIAL COLLECTOR WELL LOCATIONS

COLUMBUS CITY UTILITIES, INDIANA  
COLUMBUS, IN



FIGURE 6  
4021.108