STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

PETITION OF THE CITY OF EVANSVILLE, INDIANA, FOR AUTHORITY TO ISSUE BONDS, NOTES, OR OTHER OBLIGATIONS, FOR AUTHORITY TO INCREASE ITS RATES AND CHARGES FOR WATER SERVICE, AND FOR APPROVAL OF NEW SCHEDULES OF WATER RATES AND CHARGES.	**)))))))**	**CAUSE NO. 45545**

PUBLIC'S EXHIBIT NO. 4

TESTIMONY OF JAMES T. PARKS

ON BEHALF OF

THE INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR

SEPTEMBER 3, 2021

Respectfully submitted

INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR

Scott Franson, Attorney No. 27839-49
Deputy Consumer Counselor
Daniel M. Le Vay, Attorney No. 22184-49
Deputy Consumer Counselor
115 W. Washington St. Suite 1500 South
Indianapolis, IN 46204
Email: sfranson@oucc.in.gov
dlevay@oucc.in.gov

CERTIFICATE OF SERVICE

This is to certify that a copy of the ***Public's Exhibit No. 4, Testimony of James T. Parks*** has been served upon the following counsel of record in the captioned proceeding by electronic service on September 3, 2021.

Nicholas K. Kile
Hillary J. Close
Lauren M. Box
BARNES & THORNBURG LLP
11 South Meridian Street
Indianapolis, Indiana 46204
Email: nicholas.kile@btlaw.com
hillary.close@btlaw.com
lbox@btlaw.com

Scott Franson
Deputy Consumer Counselor

INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR
115 West Washington Street
Suite 1500 South
Indianapolis, IN 46204
infomgt@oucc.in.gov
317/232-2494 – Phone
317/232-5923 – Facsimile

TESTIMONY OF OUCC WITNESS JAMES T. PARKS
CAUSE NO. 45545
CITY OF EVANSVILLE

I. INTRODUCTION

Q: Please state your name and business address.

A: My name is James T. Parks, P.E., and my business address is 115 W. Washington Street, Suite 1500 South, Indianapolis, IN 46204.

Q: By whom are you employed and in what capacity?

A: I am employed by the Office of Utility Consumer Counselor ("OUCC") as a Utility Analyst II in the Water/Wastewater Division. My qualifications and experience are described in Appendix A.

Q: What is the purpose of your testimony?

A: My testimony evaluates the City of Evansville's ("Petitioner" or "Evansville") $269.2 million dollar capital improvement plan. I describe Evansville's water system and discuss how the proposed capital improvements will replace aging infrastructure. I explain why the OUCC generally considers the projects themselves appropriate as they replace the existing water treatment plant, aging water mains, and water mains in conflict with road projects. I explain that Petitioner is oversizing the new treatment plant by 25% because of unsupported aggressive water demand growth forecasts that are contradicted by Petitioner's overall declining use. I recommend Evansville size its new plant for 40 million gallons per day ("MGD") instead of the proposed 50 MGD.

I explain that Petitioner's selection of a new offsite treatment plant was made with a life cycle cost analysis that did not include all costs, especially the costs for a new residuals management system. I explain that Petitioner's consultant prepared detailed assembly level line-item cost estimates but assumed high levels of contingencies resulting in Petitioner's project cost estimates being overstated. I also recommend the Commission authorize approximately $3.5 million for relocation of the City garage to a new offsite location instead of Petitioner's requested $13.2 million.

Q: Please describe the review and analysis you conducted to prepare your testimony.

A: I reviewed Evansville's Petition and the testimonies of Lane T. Young, Executive Director, Evansville Water and Sewer Utility ("EWSU"), Douglas L. Baldessari, CPA, Baker Tilly Municipal Advisors, LLC ("BTMA"), Michael Labitzke, P.E, Director of the Program Management Office, EWSU, and Simon M. Breese, P. Eng. Vice President and National Technical Director, Water Treatment, Americas, AECOM. I reviewed Petitioner's Attachments, a late filed supplemental workpaper, and a revised Advanced Facility Plan for the new treatment plant including:

Attachment <u>DLB-1</u>	*Accounting Report on Proposed Improvement Project and Increase in Rates and Charges*, Baker Tilly US, LLP, April 20, 2021.
Attachment <u>ML-1</u>	*EWSU Water Master Plan*, HNTB Corp., Sept. 2016.
Attachment <u>ML-2</u>	*Water Main Replacement Scoping Reports* (33 water main projects), HNTB Corp., Dec. 2020, Revised Feb. 2021.
Attachment <u>ML-3</u>	*EWSU 2022 Rate Case Complete Project Listing.*
Attachment <u>ML-4</u>	*Booster Station Improvements Scoping Reports*, HNTB Corp., Dec. 2020, Revised Feb. 2021.
Attachment <u>ML-5</u>	*Facility Relocation Feasibility Assessment*, for the Evansville Street Maintenance Department &

Vanderburgh Levee Authority, VS Engineering, Inc., Dec. 15, 2020.

Attachment SMB-1 *Water Treatment Plant Advanced Facility Plan ("WTPAFP"), Alternatives Report*, AECOM, March 2021.

Supplemental Workpaper, *Preliminary Engineering Report – Water Treatment Plant*, VS Engineering, June 2021.

Water Treatment Plant Advanced Facility Plan, Alternatives Report, AECOM, April 23, 2021. (Obtained from Indiana Finance Authority ("IFA")).

I reviewed Petitioner's recent annual reports filed with the Indiana Utility Regulatory Commission ("Commission" or "IURC") and Monthly Reports of Operation ("MROs") filed with the Indiana Department of Environmental Management ("IDEM") to analyze Evansville's historical water usage, customer growth and water demand. I wrote discovery requests and reviewed Petitioner's responses. On July 21, 2021, OUCC Utility Analyst, Carl Seals, and I met with EWSU staff to discuss Petitioner's current operations and capital improvement plans and tour Evansville's existing filtration plant, the site for the proposed water treatment plant, and the Lincoln, Killian and Stallings Booster Stations.

I reviewed Petitioner's funding requests, project information and estimated costs from Cause Nos. 44760 (2016), 45073 (2018) and 45545 (2021). I also reviewed the October 2009 *Water Master Plan* and Drinking Water *Preliminary Engineering Reports* Petitioner submitted to the Indiana Finance Authority's Drinking Water State Revolving Fund ("DWSRF"). Finally, I compiled and attached various documents, which I refer to in my testimony. These attachments are listed in Appendix B.

II. DESCRIPTION OF THE EVANSVILLE WATER SYSTEM

Q: Please provide a brief description of the Evansville Water System and potential future demands.

A: Petitioner provides water utility service to approximately 63,473 residential, commercial, industrial, and public authority customers in and around the City of Evansville in Vanderburgh County and to three wholesale customers. Petitioner's customer base grew 4.7% in the last decade (2011-2020).[1] According to data from its Annual Reports to the IURC, reported water production (16.9 million gallon per day ("MGD") in 2020) and water sold (14.28 MGD on average in 2020) have been relatively flat for the past ten years (*See* Table 12, Appendix C).[2]

Evansville draws its water from the Ohio River and treats it at its surface water treatment plant which has a 60 MGD total capacity (all units in service) and a 42 MGD firm capacity.[3] Petitioner reports "Demand has been well below this capacity in recent years, with average day demands in mid to low 20 MGD range, and peak summer demands rarely exceeding 30 MGD."[4] Petitioner has three existing interconnected clearwells at the treatment plant totaling 8.5 million gallon ("MG") and 28.5 MG of water storage capacity in the distribution system, for a total finished water storage capacity of 37 MG. Evansville's distribution system consists of approximately 1,015 miles of water mains ranging from 1-inch

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[1] Customer growth averaged 0.46% annually from 2011 to 2020.
[2] In response to DR 15-11, Evansville stated the 2020 water produced and water sold volumes reported on its 2020 Annual Report do not appear to have been entered correctly.
[3] The firm rated capacity is based on the largest single unit being out of service under worst-case conditions (such as high raw turbidity and high system demand). For Evansville, the limiting treatment processes are mixing, flocculation, primary sedimentation, and secondary sedimentation. *See* Table 3.1 Water Treatment Plant Firm Capacities in Mr. Labitzke's case-in-chief testimony, Attachment ML-1 *Water Master Plan*, HNTB Corporation, September 2016, page 51 of 460.
[4] Mr. Breese case-in-chief testimony, page 6, lines 3-4.

up to 60-inch.[5] For a more detailed description of the Evansville water system, please refer to Appendix C.

III. WATER DEMAND FORECASTS AND DESIGN CAPACITIES

Q: Is Petitioner oversizing the new water treatment plant's capacity?

A: Yes. Based on my analysis of water produced reported to IDEM on the Monthly Reports of Operation ("MRO"), water sold data, and forecasted 2050 water demand data in the AECOM Advanced Facility Plan, Evansville has overstated 2020 water demand and future 2050 water demand. This overstatement causes the proposed treatment plant capacity to be oversized by 25%, which increases the project's construction costs. The oversizing is caused by several incorrect planning assumptions. Evansville's 2020 base year water demands by customer class are not based on actual volumes, overstated, and not supported by data. Evansville's high water demand growth projections for each customer class (i.e., residential, commercial, etc.) are also unsupported and contradicted by historical water usage trends. The high growth assumptions are also contradicted by Petitioner's overall declining water consumption.

OUCC population estimates show Petitioner's 2050 residential water demand projection does not align with Indiana Business Research Center ("IBRC") population projections. IBRC has forecasted Vanderburgh County will

[5] Attachment ML-1 *Water Master Plan*, HNTB Corporation, September 2016, Tables 2-1 and 2-2 pages 14 and 16 of 460.

add fewer than 9,000 people in the next 30 years.[6] Petitioner's consultant, AECOM, forecasts a 2050 residential usage of 12.91 MGD (for direct Evansville customers), equivalent to a 222,586 person-connected population that is unlikely to occur.[7] This connected population exceeds the IBRC's forecasted 2050 Vanderburgh County population by 29,198 people or 15%. Evansville does not serve all customers in Vanderburgh County.

Q: What are Petitioner's projected 2050 water demands?

A: For the year 2050, Petitioner is projecting an Average Day Demand of 36.4 MGD, and a Maximum Day Demand of 49.4 MGD. AECOM's 2050 projections start with assumed higher 2020 water demands by customer class (not actual) which are then multiplied by unsupported annual growth rates.

Q: Did Petitioner indicate the 2020 Water Demands were assumed volumes?

A: No. In my initial review of the Advanced Facility Plan, I understood the 2020 water demands listed in Table 3-7 were actual volumes. It was only from a review of water sold data that I realized AECOM assumed the 2020 volumes and that these assumed volumes were greater than the actual 2020 volumes.[8]

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[6] IBRC's current Vanderburgh County population growth projections to 2050 use the 2010 Census base year population to project the 2050 population at 193,388 people. Vanderburgh County's actual 2020 Census population at 180,136 was below the IBRC's 184,440 projected population. Updated population forecasts, using the lower 2020 Census count, are unavailable but are also expected to be adjusted lower.

[7] Calculated by the OUCC as 12,910,000 gallons per day residential usage divided by AECOM's 58 gallons per capita per day ("gpcd") water usage (AECOM *Advanced Facility Plan*, page 17) equals 222,586 people. AECOM did not provide an estimated 2050 population or residential customer count.

[8] Petitioner provided actual water demands for each customer class for 2014 to 2021 in response to OUCC Data Request 17-1.

Table 1 – AECOM Projected Average and Maximum Day Demand through 2050[9]

Demand Source	Assumed 2020 Demand (MGD)	Projected 2050 Demand (MGD)	Assumed Annual Increase (%)	Total % Increase 2020-2050
Average Residential	8.26	12.91	1.5%	56.3%
Average Commercial	5.00	9.05	2.0%	81.0%
Average Industrial	3.00	6.29	2.5%	109.7%
Average Wholesale	2.88	3.60	0.75%	25.0%
Average Public Authority	1.00	1.08	0.25%	8.0%
Avg. Leaks and Losses	3.50	3.25	-0.2%	-7.1%
Avg. Day Demand	23.6	36.4	1.5%	54.2%
Max. Day Demand	31.7	49.4	1.5%	55.8%
Max Day / Avg. Day	1.4	1.4		

Q: Are the 2020 water demands used by AECOM reasonable?

A: No. By using assumed demands AECOM overstates water demand for all customer classes. In contrast, non-revenue water (which AECOM calls leaks and losses) appears to be understated. In Table 2 I compare actual 2020 water demand to AECOM's assumed demand and show the percentage AECOM overstated demand.

To forecast future 2050 flows, AECOM started with assumed higher 2020 water demand volumes rather than actual volumes. In effect, AECOM created two future flow projections, one for 2020 and the second for 2050. Actual 2020 demand for each customer class is comparable to the four-year average actual

[9] The data source for the 2020 and 2050 water demands is Table 3-7 in the *Water Treatment Plant Advanced Facility Plan, Alternatives Report*, AECOM, April 23, 2021. This revised Advanced Facility Plan was submitted to the Indiana Finance Authority for SRF funding on April 30, 2021, but was not submitted with Petitioner's case-in-chief on May 10, 2021.

demand (2017 to 2020).[10] Despite overstated customer class usage ranging from 14% (commercial) to 35% (public authority), AECOM overstates 2020 average demand only by 5%. This is because AECOM uses a lower 3.50 MGD non-revenue water volume than the actual 6.13 MGD I calculated.[11] AECOM did not provide data supporting its assumed 2020 water usage by customer class nor how it determined the assumed 3.50 MGD leaks and losses volume.

Table 2 – Comparison of Actual 2020 Average Demand (MGD) to the AECOM Assumed 2020 Demand

	Actual 2020 Demand[12]		Assumed 2020 Demand AECOM	
Demand Source	**BG/Yr.**	**MGD**	**MGD**	**Percent Overstated**
Average Residential	2.43	6.64	8.26	24%
Average Commercial	1.60	4.38	5.00	14%
Average Industrial	0.90	2.45	3.00	22%
Average Wholesale	0.80	2.19	2.88	31%
Average Public Authority	0.27	0.74	1.00	35%
Avg. Leaks and Losses		6.13	3.50	-43%
Avg. Day Demand[13]		22.53	23.6	5%
Max. Day Demand		28.8	31.7	10%
Max Day / Avg. Day Ratio		1.28	1.4	

Q: Why is it important to use actual 2020 water demand data?

A: It is important because AECOM uses the 2020 demand data as the starting point

[10] OUCC analysis of water sold for all five customer classes shows the 2020 average water sold at 16.4 MGD is slightly below the four-year average (2017-2020) water sold of 17.18 MGD.

[11] Non-revenue water is equal to the 22.53 MGD annual average flow based on 2020 MRO data reported to IDEM minus the 16.4 MGD 2020 water sold data (total from each customer class) reported to the OUCC in response to DR 17-1 equals 6.13 MGD of non-revenue water.

[12] *Id.*

[13] Actual 2020 average day demand of 22.53 MGD and maximum day demand of 28.8 MGD were taken from Evansville's Monthly Reports of Operation ("MRO") submitted to IDEM.

for its 2050 flow projections. AECOM uses the 2050 flow projections as justification for the proposed 36.4 MGD average day and 50 MGD maximum day plant capacities. By using inflated 2020 water demands, all flow projections emanating from those demands are also overstated. This means AECOM's 2050 water demand and design capacity are both overstated. Due to the high cost of Evansville's proposed new plant and its ratepayer impact, it is critical the most accurate base year data be used.

Q: What annual percent increases in water demand for each customer class did AECOM project?

A: AECOM's unsupported annual growth projections are:

a. Initial City population of 118,000 people and a per capita demand of 70 gal/day/person, or 8.26 MGD (higher than the per capita estimate of 58 gal/day/person).[14, 15]
b. City population growth rate of 1.5% per year, maintaining the same per capita demand through 2050.
c. Initial commercial demand of 5.0 MGD and a growth rate of 2.0% per year.
d. Initial industrial demand of 3.0 MGD with flow increase of 2.5% per year.
e. Initial wholesale demand of 2.88 MGD with flow increase of 0.75% per year.
f. Initial public authority demand of 1 MGD and growth rate of 0.25% per year.

Q: Did AECOM or Petitioner provide support for its growth projections?

A: No. Petitioner was unable to explain the basis used to set these specific annual growth percentages and did not provide data or any study, report, or analyses to support its assumptions. In discovery, Petitioner provided narrative discussions

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[14] AECOM calculated the per capita water usage as follows: 2017 residential water sold volume of 2.5 BG/year divided by 365 days/year divided by Evansville's 2017 population of 117,500 people equals 58 gallons per capita per day ("gpcd"). The OUCC believes AECOM's per capita usage calculation is incorrect. The actual usage may be 50 gpcd based on a 2020 residential water sold volume of 2.43 BG/year divided by 366 days/year divided by Evansville's 2020 residential customers of 59,605 divided by 2.23 people per housing unit equals 50 gpcd.

[15] AECOM does not explain why it raised the 58 gpcd water usage by 21% to an assumed 70 gpcd.

that shed no light on how AECOM developed the assumed growth rates.[16] Because Petitioner and AECOM were unable to support the growth percentages, I recommend the growth projections not be relied on to set future 2050 water demands for the individual customer classes. If these growth percentages are relied on to set 2050 water demands, it will produce a larger than needed treatment plant.

Q: Is Petitioner's assumed 1.5% annual population growth rate reasonable?

A: No. It is overstated by nearly an order of magnitude. The source of the assumed 1.5% growth rate is in Section 3.1 Population Projections, of the WTPAFP, where AECOM misread the Vanderburgh Co. Comprehensive Plan's 7% growth rate as an <u>*annual, not a total*</u> rate.[17] AECOM described the annual rate as follows:

> The Comprehensive Plan included a section about future capacity needs of the WTP and recommended an <u>annual population growth rate of about 7% through 2035</u>. However, this is a very aggressive growth model and can yield an unnecessarily large facility. Based on the historical data summarized above, it is recommended to utilize a lower and more representative rate of population growth to not drastically oversize the facility. <u>This report considers an annual population growth rate of 1.5% through 2050 for future plant capacity</u>.[18]
>
> (Emphasis added by the OUCC)

AECOM presented no information, data sources or support of any kind to justify choosing a 1.5% annual population growth rate. AECOM recognized a 7% rate

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[16] *See* Attachment JTP-1 for Petitioner's responses to Data Requests 3-15 to 3-18 requesting support for the annual growth assumptions used by AECOM to estimate 2050 water demands for each customer class.

[17] *See* Attachment JTP-2 for excerpts on demographics and housing from the *Evansville-Vanderburgh County Comprehensive Plan, 2015-2035*, Evansville-Vanderburgh County Area Plan Commission, June 27, 2016. The 6.99% total population growth from 2010 to 2035 (AECOM refers to a 7% annual rate) (Attachment JTP-2, page 15 of 17) is based on the IBRC's population projection starting from 179,703 actual 2010 Vanderburgh County Census population to 192,271 people in 2035.

[18] *Water Treatment Plant Advanced Facility Plan, Alternatives Report*, AECOM, April 23, 2021, page 14.

was a problem but did not realize the real issue, namely that it was not an annual rate. Checking the 7% as an annual growth rate would have shown Vanderburgh County's 2010 Census population of 179,703 nearly doubling every ten years and growing by over 15-fold to 2,680,913 people by 2050.[19] Obviously, this is unrealistic and should have caused the Comprehensive Plan's demographics section to be reread followed by converting the 7% total growth rate to an *annual* growth rate and applying the annual growth rate to determine future water demands. Instead, AECOM cut back to "a lower and more representative rate of population growth *to not drastically oversize* the facility." (Emphasis added by the OUCC.)

However, AECOM's assumed 1.5% annual growth rate, albeit lower, is still incorrect, unsupported, and too aggressive. I calculate the annualized growth rate using the pre 2015 IBRC population forecast (based on 2010 Census data) should be only 0.27%.[20] AECOM's assumed 1.5% growth rate is over five times greater than the correctly calculated annual rate using the Comprehensive Plan's IBRC data (based on 2010 Census data). Recent 2020 Census data shows slower Evansville and Vanderburgh County growth than previously forecasted.[21]

Q: Using recent 2020 Census data for Vanderburgh County, what would be the annual population growth rate?

A: Recent 2020 Census data shows Vanderburgh Co. added just 433 people between

[19] Calculated by multiplying Vanderburgh County's 2010 Census population of 179,703 people times 1.0699 raised to the power of 40 yields 2,680,913 people in year 2050.

[20] Calculated using pre 2015 IBRC population projections based on Vanderburgh County's 2010 Census population of 179,703 people and a 2035 forecasted population of 192,271 people. The total growth rate is 6.99% over 25 years and the annualized growth rate is 0.27%.

[21] 2020 Census data shows Evansville lost 131 people (2010 population of 117,429 and a 2020 population of 117,298) and Vanderburgh County added 433 people (2010 population of 179,703 and a 2020 population of 180,136).

2010 (179,703 people) and 2020 (180,136 people). Keeping the IBRC's forecasted 2020 to 2050 growth rates, the annualized population growth rate is 0.16% as shown in Table 3.[22]

Table 3 – OUCC Adjustments for Vanderburgh Co. Population based on 2020 Census Data and OUCC Adjusted IBRC Forecasts to 2050

Year	Population Data Source	Census / IBRC Population	IBRC Percent Growth	OUCC Adjusted Population	IBRC Percent Growth
2010	US Census	179,703		179,703	
2020	IBRC forecast[23]	184,440	2.64%		
2020	US Census			180,136	0.24%
2030	IBRC forecast	189,441	2.71%	185,020	2.71%
2040	IBRC forecast	191,966	1.33%	187,486	1.33%
2050	IBRC forecast	193,388	0.74%	188,875	0.74%
Total population added		8,948		8,739	
Total 2020 to 2050 growth rate (%)			4.85%		4.85%
Annual growth rate 2020 to 2050 (%)			0.16%		0.16%

Q: What service area population are direct customers of Evansville?

A: None of Petitioner's witnesses provide the service area population. AECOM states "Water is currently delivered to over 62,000 customer accounts and serves a population of approximately 120,000 people."[24] AECOM's population figure is incorrect since it ignores Vanderburgh Co. residential customers outside City limits who are not customers of a wholesale customer. The Preliminary Design

[22] Calculated starting with Vanderburgh County's 2020 Census population of 180,136 people and a 2050 OUCC adjusted population of 188,875 people. The total growth rate is 4.85% over 30 years and the annualized growth rate is 0.16%.

[23] The unadjusted IBRC forecasted populations were derived from 2010 Census data. New IBRC population forecasts using 2020 Census data have not yet been made.

[24] *Water Treatment Plant Advanced Facility Plan, Alternatives Report*, AECOM, April 23, 2021, p. 13.

Summary in Petitioner's Supplemental Workpaper indicates a current City population of 118,000 and a 173,000 served population.[25]

Q: What is the future service area population for the 2050 Design Year?

A: Again, none of Petitioner's witnesses state the future population and AECOM does not report it in the Advanced Facility Plan. The Preliminary Design Summary lists 2050 City and total served populations of 184,400 and 253,300 people.[26] This represents a 66,400 City population gain and an 80,300 total served population gain.

Table 4 – Evansville's Projected Population Gains 2020 to 2050
PER - Preliminary Design Summary[27]

Year	Assumed City Population	Assumed Total Served Population
2050	184,400	253,300
2020	118,000	173,000
Population gain 2020 to 2050	66,400	80,300
2020 to 2050 total increase %	56%	46%
Assumed annual growth rate %	1.50%	1.28%

It appears VS Engineering calculated the 2050 populations assuming a 1.5% annual City growth rate and a 1.28% annual growth rate for total served population. Neither of these assumed growth rates are supported by data or IBRC population projections. The unsupported 1.5% annual population city growth rate matches the value used by AECOM.

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[25] Attachment E: DWSRF Loan Program Preliminary Design Summary in Petitioner's Supplemental Workpaper - *Preliminary Engineering Report, Water Treatment Plant*, VS Eng., June 2021, page 70 of 80.
[26] *Id*.
[27] *Id*.

Q: Are Petitioner's 2050 City and total served populations reasonable?

A: No. They are overstated and exceed the IBRC's 12,076-person total population gain for the four-county area (2020 to 2050) by 565%.[28] I compared Evansville's Preliminary Design Summary population to the IBRC's projected gains for Gibson, Posey, Vanderburgh, and Warrick Counties as shown in Table 5.

Table 5– Forecasted Population Gains by County 2020 to 2050
Indiana Business Research Center[29]

Year	Vanderburgh County	Gibson County	Posey County	Warrick County	Four-County Population
2010 Census	179,703	33,503	25,910	59,689	298,805
2020 Census	180,136	33,011	25,222	63,898	302,267
2020	184,440	34,077	25,053	63,818	307,388
2030	189,441	34,783	23,874	67,958	316,056
2040	191,966	34,898	21,979	70,261	319,104
2050	193,388	34,950	19,969	71,157	319,464
Gain 2020 to 2050	13,252	1,939	-5,253	7,259	12,076
2020 to 2050 gain assumed in Petitioner's Preliminary Design Summary					80,300
Population gain 2020 to 2050, percent overstated					565%

AECOM presented 1960 to 2010 population data for Evansville and Vanderburgh County showing long term declines for Evansville, a 2017 population of 117,500 people and an assumed initial 2020 population of 118,000 people that it used for its residential customer flow projections.[30] AECOM provides no other discussion

[28] The IBRC only makes long term population forecasts for Indiana Counties. There is no 2010 to 2050 IBRC population forecast for the City of Evansville.
[29] The IBRC forecasted populations for 2020 to 2050 were derived from 2010 Census data. New IBRC population forecasts using 2020 Census data have not yet been made.
[30] AECOM's inclusion of Evansville's total 118,000 population (within City limits) in the residential customer class is incorrect because Evansville directly serves residential customers outside City limits. Residential customers living in apartments are accounted for in the Commercial customer class.

about the residential population or future population other than to state "Section Three, Population Projections and Water Demand of the Advanced Facility Plan summarizes Evansville's anticipated population growth and draws upon historical usage patterns to formulate future projected demands."[31] AECOM assumed significant increases in water demand across all customer classes even though the historical water sold trend is negative. *See* Tables 1 and 6.

Q: Isn't Petitioner simultaneously requesting a declining usage adjustment and proposing to design the new treatment plant for increased demand?

A: Yes. AECOM projected increased demand based on inflated population growth projections and inflated demand growth for all customer classes. Historical water demands have declined for each customer class except the Wholesale customers as shown by Table 6 which also shows annual rainfall data.

Table 6 – Historical Water Demand by Customer Class (MGD)

Customer Types	2014	2015	2016	2017	2018	2019	2020
Residential	7.34	7.15	6.94	6.90	6.77	6.47	6.64
Commercial	5.07	5.32	5.00	5.07	4.93	4.77	4.38
Industrial	2.63	2.93	2.81	2.77	2.93	2.66	2.45
Wholesale	2.11	2.11	2.19	2.05	2.25	2.19	2.19
Public Authority	1.01	0.99	0.85	0.90	0.88	0.85	0.74
Water sold (MGD)	18.16	18.49	17.79	17.70	17.75	16.93	16.39
Water sold (BG/Yr.)	6.616	6.741	6.496	6.409	6.490	6.180	6.011
Rainfall (inches)[32]	52.68	58.65	43.20	35.80	56.24	61.22	60.61

Petitioner's witness Mr. Baldessari graphically showed the declining use for annual water sold on page 34 of his testimony, which I include as Figure 1.

[31] *Water Treatment Plant Advanced Facility Plan, Alternatives Report*, AECOM, April 23, 2021. *See* p. 3.
[32] Water demand on an annual basis appears to be relatively unaffected by rainfall totals.

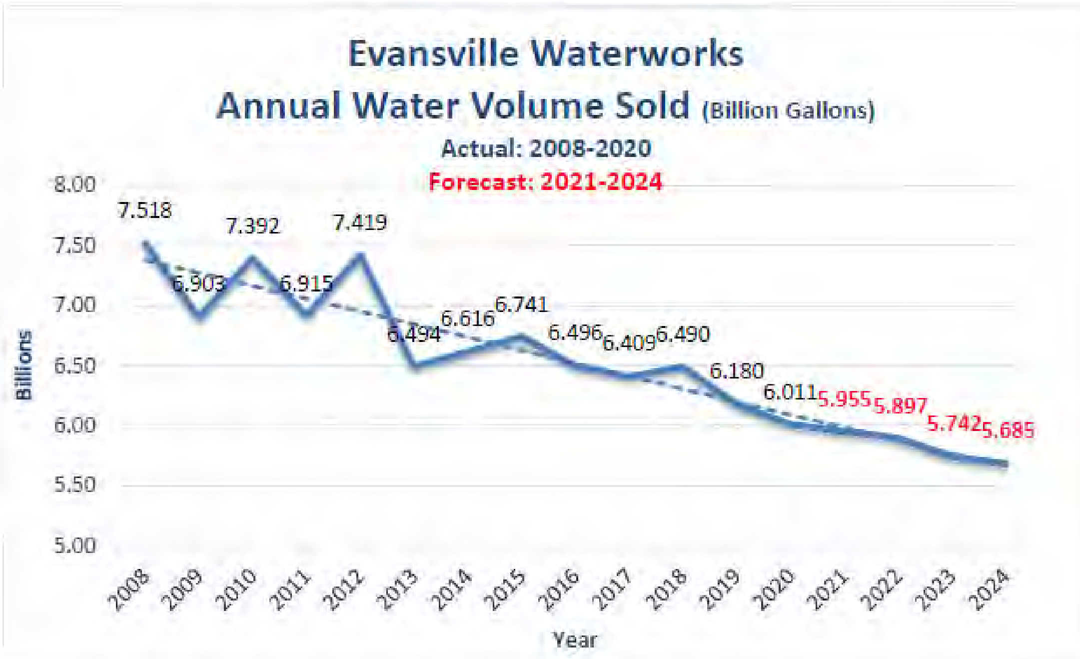

Figure 1 – Declining use graph (Mr. Baldessari's case-in-chief testimony, page 34)

Q: What did AECOM project for 2050 residential water demand?

A: AECOM projects residential demand will rise from 8.26 MGD in 2020 to 12.91 MGD in 2050. As I explained earlier, the 8.26 MGD demand for 2020 is a projected value, not actual, and is overstated by 24%. Actual 2020 residential water sold was only 6.64 MGD.

Q: Is AECOM's projected 2050 residential demand of 12.91 MGD reasonable?

A: No. AECOM's projection has a starting point (2020) that is 1.62 MGD higher than it should be. AECOM's projection also includes an inflated population growth projection. I estimate AECOM's projection is inflated by 85% (5.94 MGD overstated) and will not occur. I estimate residential demand will rise from 6.64

MGD in 2020 to approximately 7 MGD in 2050.[33] AECOM reported current water usage of 115 gallons per customer per day and 58 gallons per capita per day.[34] At these daily consumption rates, to reach the estimated 12.91 MGD residential demand in 2050, Evansville would have to add another 54,522 customers to its current 59,605 residential customers.[35] For AECOM's projections to be realistic Evansville's total residential customers would need to be 114,127 in 2050 or increase by 91 percent.

Q: Are AECOM's assumed 1.5% annual residential population growth rate and the 12.91 MGD forecasted 2050 residential demand justified?

Q: No. Evansville will not add another 54,522 residential customers over the next 30 years. As a check on how unlikely AECOM's projected growth is, I calculated the expected population from 54,522 new residential customers based on 2010 Census data for Evansville of 2.23 people per housing unit. The 54,522 new residential customers are equivalent to 121,584 people.[36] This far exceeds the Vanderburgh County population gain of 8,948 people forecasted by the IBRC. *See* Table 3.

Q: Are growth in the other customer classes similarly overstated?

A: Yes. AECOM's growth rates in the other customer classes also appear to be overstated. Petitioner did not provide support for any of its initial 2020 demand

[33] Based on an annual population growth rate of 0.16% for Vanderburgh County per the IBRC population forecast. *See* Table 3 for the annual population growth rate. The OUCC estimate of 2050 residential water demand is calculated as 1.0016 raised to the power of 30 times 6.64 MGD (2020 residential water sold) equals 6.97 MGD.

[34] *Water Treatment Plant Advanced Facility Plan, Alternatives Report*, AECOM, April 23, 2021. *See* Table 3-5 2017 Individual Category Daily Water Use, page 17.

[35] Calculated as 12.91 MGD (2050 projected residential) minus 6.64 MGD (2020 actual residential) equals 6.27 MGD residential demand growth. At AECOM's 115 gallons per day ("gpd") per customer usage, additional residential customers are 6.27 MGD times 1,000,000 divided by 115 gpd per customer equals 54,522 new residential customers.

[36] Calculated as 54,522 new residential customers times 2.23 people per housing unit (2010 Census housing data) equals 121,584 people.

volumes and annual growth rates. Also, the starting point for each customer class is overstated because AECOM did not use actual 2020 data.

Q: Did you prepare demand and annual growth rate estimates that could be used to establish the new plant's needed capacity?

Yes. I estimated 2050 water demands under two growth scenarios, which I summarize in Table 7. These estimates reflect actual 2020 water sold volumes and residential growth rates calculations based on IBRC population projections. In OUCC Growth Estimate 1, I assumed the commercial growth rate would mirror the residential growth rate and I lowered the industrial growth rate to 1.5% based on the negative demand trend. I matched the wholesale, public authority and leaks and losses growth rates assumed by AECOM. Under Growth Estimate 1, the new treatment plant should be sized for a maximum day demand of 34.5 MGD.

In OUCC Growth Estimate 2, I matched AECOM's assumed rates for the industrial, wholesale, public authority classes. I tripled the residential annual growth I calculated using IBRC data for Estimate 1 to 0.474% and used a 1.25% commercial rate. Commercial growth rates should track with the residential growth, but I conservatively gave more growth, over 2.5 times the residential rate, to the commercial class. Based on the more optimistic Growth Estimate 2, the new treatment plant should be sized for a maximum day demand of 39.7 MGD (rounded up to 40 MGD) and an average day demand of 28.4 MGD. For design, I recommend Evansville's new plant have a design maximum day capacity not to exceed 40 MGD. I compare the various AECOM assumed growth rates and water demand projections to actual 2020 water demands and Growth Estimates 1 and 2 in Table 7.

Table 7 – Comparison of Actual 2020 Demand (MGD), AECOM Assumed 2020 and 2050 Demands, and OUCC Projected Demands

Demand Source	Actual 2020 (MGD)	AECOM Assumed Demand		
		2020 (MGD)	% Annual Growth	2050 (MGD)
Average Residential	6.64	8.26	1.5%	12.91
Average Commercial	4.38	5.00	2.0%	9.05
Average Industrial	2.45	3.00	2.5%	6.29
Average Wholesale	2.19	2.88	0.75%	3.60
Average Public Authority	0.74	1.00	0.25%	1.08
Avg. Leaks and Losses	6.13	3.50	-0.25%	3.25
Avg. Day Demand[37]	22.53	23.6		36.4
Max. Day Demand	28.8	31.7		49.4
Max Day / Avg. Day	1.28	1.34		1.36
2050 Forecasts – OUCC Projections[38]				
	OUCC Growth Est. 1		**OUCC Growth Est. 2**	
Demand Source	**% Annual Growth Estimate**	**2050 Est. Demand (MGD)**	**% Annual Growth High Est.**	**2050 High Demand (MGD)**[39]
Average Residential	0.16%	6.96	0.474%	7.65
Average Commercial	0.16%	4.59	1.25%	6.36
Average Industrial	1.5%	3.83	2.5%	5.14
Average Wholesale	0.75%	2.74	0.75%	2.74
Average Public Authority	0.25%	0.80	0.25%	0.80
Avg. Leaks and Losses	-0.25%	5.69	-0.25%	5.69
Avg. Day Demand		24.6		28.4
Max. Day Demand		34.5		39.7
Max Day / Avg. Day		1.4		1.4

1 I compare AECOM's water demand to OUCC Growth Estimates 1 and 2 in

[37] Actual 2020 average day demand of 22.53 MGD and maximum day demand of 28.8 MGD were taken from Evansville's Monthly Reports of Operation ("MRO") submitted to IDEM.
[38] Values shown in red text are different than values used by AECOM in its demand projections.
[39] The high demand estimate is for population growth nearly three times (0.474% annual growth vs. 0.16%) above the OUCC's best estimate based to meet IBRC's population projections (based on 2010 Census data) which have not yet been updated to reflect actual lower population growth using 2020 Census data.

Figure 2. I also show historical water sold from 1996 to 2020 and Evansville's projected 2021 to 2024 declining use. The graph visually depicts AECOM's overstated water demand assumptions that if followed will lead to construction of an oversized 50 MGD treatment plant instead of the OUCC's recommended 40 MGD plant.

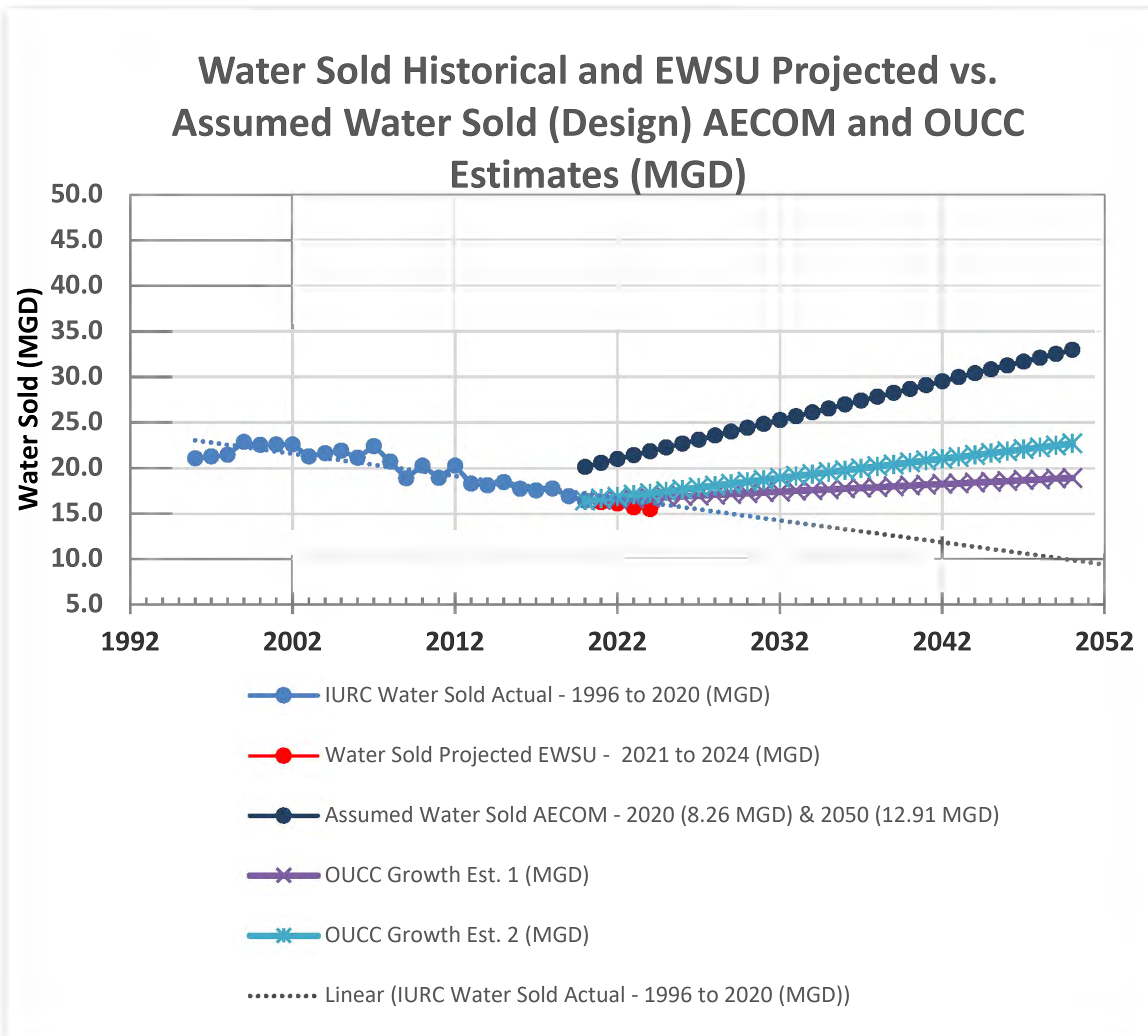

Figure 2 – Graphical presentation of historical water sold and forecasted water demands (excludes leaks and losses) by AECOM and the OUCC.

Q: What do you recommend for the new treatment plant's design capacities?

A: Petitioner's current plans to build a 50 MGD WTP are not warranted. Doing so will oversize the new surface water treatment plant ("SWTP") by 25% due to overestimated and unsupported water demand projections. I recommend that Petitioner re-evaluate AECOM's water demand forecasts, preferably using updated IBRC population forecasts based on 2020 Census data to confirm that the new treatment plant can be sized for an average day demand of 28.4 MGD in 2050 and a maximum day demand of 40 MGD instead of Evansville's proposed 50 MGD capacity. A 28.4 MGD design average day capacity is 26% higher than the 2020 average day flow, is sufficient to meet three times the IBRC forecasted population increase, and includes Petitioner's assumed higher growth rates for the industrial, wholesale, public authority classes and leaks and losses.

IV. NEW SURFACE WATER TREATMENT PLANT

Q: In Cause Nos. 44760 (2016) and 45073 (2018) what type of treatment plant did Petitioner originally propose to build?

A: Petitioner proposed to construct collector wells and new raw water mains on land along the Ohio River southeast of the existing treatment plant and a new 60 MGD groundwater treatment plant ("GWTP") at the existing City garage site using chemical oxidation of iron and manganese without softening, gravity filters and a new 6-million-gallon finished water reservoir to replace the existing Ohio River surface water treatment plant. The basis for the new groundwater plant was a 2014 Feasibility study which indicated the new GWTP and collector wells could be constructed (with a 20% contingency) for $79 million with a 20% non-construction cost of $15.8 million and a total project cost of $96 million.[40] The

[40] *New Groundwater Treatment Plant Feasibility Study*, HNTB Corporation, December 2014.

reasons for using groundwater instead of river water included protection against:

a. spills and river contamination that could force Evansville to close the river intake causing a loss of supply to utility customers;

b. water main breaks in the winter caused by near freezing river water adversely affecting the City's cast iron water mains;

c. intake structure damage during floods or barges colliding with the intake causing a loss of raw water supply; and

d. treatment variability caused by turbidity spikes and varying water quality.

AECOM discusses the groundwater benefits over river water in the Advanced Facility Plan.[41]

Q: Would a new groundwater plant address other Evansville water issues?

A: Yes. Petitioner did not mention a new GWTP would also address discharges of mercury and total suspended solids ("TSS") to the Ohio River from blowdown of sediments removed in sedimentation tanks and filter backwash water. AECOM's life cycle cost analyses looking at existing plant rehabilitation, construction of new surface water treatment or a 50:50 blend of groundwater and surface water, did not include the added construction costs and operation and maintenance cost for a residuals treatment system to address the mercury and TSS.

Q: Did Evansville previously secure funding for planning and design of the new groundwater treatment plant?

A: Yes. In 2016, under Cause No. 44760, Petitioner requested financing authority for $10 million for planning and design of the new GWTP and $650,000 for purchase of property and easements for the new Ranney collector wells and raw water

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[41] *Water Treatment Plant Advanced Facility Plan, Alternatives Report*, AECOM, April 23, 2021, pp 44-45.

mains. The Commission granted financing authorization in 2016.[42] Evansville secured funding through an open market 2016A Water Bond in December 2016. The $10 million was for work in 2017 and 2018 to complete aquifer testing, planning and design of the new GWTP including plans and specifications needed for competitive bidding.[43]

Q: What is the status of the new GWTP planning and design?

A: In this Cause, Petitioner has chosen to retain using Ohio River water for its source of supply and now plans to build a new surface water treatment plant on a new site rather than pursue the new GWTP. Evansville cites well capacity testing results below the expected 15 MGD per collector well causing the number of wells needed to increase to be able to meet Petitioner's proposed 50 MGD maximum day production.

Evansville did not purchase any properties for the new wells and has only spent $2.506 million of the $10 million total that was earmarked in 2016 for planning and design. Subsequent planning focused on AECOM's preparation of the Advanced Facility Plan for continued surface water treatment but at a new offsite plant. AECOM developed and evaluated the following alternatives:

<u>Alternative 1</u> – Rehabilitation of the existing surface water treatment plant;

<u>Alternative 2A</u> – Construct a new SWTP with conventional pretreatment, ozonation and biological filtration on the existing plant site;

<u>Alternative 2B</u> – Construct a new SWTP with conventional pretreatment, ozonation and biological filtration on the Evansville Street Maintenance Department garage site east of the existing SWTP; and

[42] Cause No. 44760 Final Order, October 5, 2016, pages 11 and 13.
[43] *See* Attachment JTP-3 for Petitioner's response to Data Requests under Cause Nos. 44760 and 45073 pertaining to the status of the proposed groundwater treatment plant.

Alternative 3 – Construct a new treatment plant with a 50:50 split between groundwater treatment with softening and a new SWTP.

Q: What treatment alternative does Petitioner propose to construct?

A: Evansville proposes to construct Alternative 2B with residuals treatment at a total estimated construction cost of $175,838,000 without engineering design. Petitioner's life cycle cost analysis used to select Alternative 2B - a new surface water treatment plant did not include the added costs for residuals treatment.

Q: What is the status of the new WTP design?

A: Evansville requested Proposals for engineering planning and design services for the new WTP in November 2018. In August 2019 Evansville retained AECOM's design team to develop alternatives including evaluation and pricing of treatment equipment for the new plant and preparation of 30% design including up to 60 drawings and a specifications list. AECOM submitted a draft Advanced Facility Plan in late 2020 and a Final WTPAFP dated March 2021. This WTPAFP was included as Attachment SMB-1 to Mr. Breese's case-in-chief testimony. The March 2021 WTPAFP recommended Alternative 2B but did not discuss or analyze the need, costs, or O&M impacts for the $30 million residuals process.

Q: Was another Advanced Facility Plan prepared?

A: Yes. A revised WTPAFP including a new Chapter 10 – Residuals Management, was prepared between March and April 2021. The OUCC did not know this revised WTPAFP existed until August 25, 2021, when the OUCC obtained a copy from the Indiana Finance Authority.

Q: Why was Alternative 2B selected?

A: AECOM conducted a 30-year life cycle cost analysis ("LCCA") that included construction costs, 30 years of operation and maintenance, and replacement costs.

The LCCA was based on construction of a new plant to treat an average day demand of 36.4 MGD and a maximum day demand of 50 MGD, but the LCCA did not include the residuals management system's $29,714,000 construction cost or $43,547,000 30-year operating and replacement cost (present worth). The total 30-year life cycle dewatering cost would be $73,261,000.[44]

Q: Do you have any observations about the proposed new surface water treatment plant?

A: Yes. The new plant does not address the issues the City identified in Cause No. 44760. These issues include the cold river water contributing to increased numbers of water main breaks in the winter, the potential risk of spills and river contamination forcing Evansville to have to completely close the river intake, and the risk of damage to the intake structure caused by floods and collisions of barges with the intake. These issues remain unaddressed with the new surface water plant.

AECOM's Non-Monetary Scoring omits cold water temperatures during the winter causing increased water main breaks and the danger of barges damaging the intake structure. The Scoring matrix also appears to be skewed with equal weighting (5 points each) for the Environmental Factors of susceptibility to earthquakes, tornados, and floods. Flooding, by far the major risk, should be weighted higher than earthquakes and tornados. Environmental Factors weighting at 20 points nearly equals factors of greater importance such as turbidity spikes in

[44] *Water Treatment Plant Advanced Facility Plan, Alternatives Rpt.*, AECOM, April 23, 2021, pp 140-142.

the river (3 points), river spills / contamination (3 points), taste and odor control (3 points), and organics and disinfection byproducts (3 points).[45]

In addition, in Cause No. 45073, Petitioner stated concerns with leakage into the 6.5 MG concrete clearwell during high river stages as a reason for a new 6.0 MG clearwell. The bottom of Petitioner's proposed 5 MG concrete clearwell (at approximate elevation 333.0 ft. based on 28 feet excavation per the Timberline estimate) appears to be 15 feet *lower* than the bottom of the existing clearwell (elevation 348.0 feet) which is located in the river levee. In addition, Petitioner's preferred site for the new plant is located in a low-lying area that is protected by Evansville's levee system. However, this area can flood when the river is at high stage if the ponding water cannot be pumped to the river.

V. NEW SURFACE WATER TREATMENT PLANT COSTS

Q: What is the estimated total project cost for Alternative 2B?

A: There are differing cost estimates for the new WTP. For purposes of the OUCC's review, we have focused on the $175,838,000 construction cost estimate listed in Mr. Baldessari's case-in-chief testimony and the Capital Improvement Plan summarized on pages 6-9 of Attachment DLB-1. Capital costs include offsite construction of a new, larger City garage, five phases of construction for the new treatment plant, a mercury/TSS treatment process, and $6.28M for construction engineering services/resident project representatives ("CES/RPR") as summarized in Table 8.

[45] *Id.*, page 149 of 291.

Table 8 Alternative 2B New Surface Water Treatment Plant Construction Cost Estimate per Attachment DLB-1[46]

Description of Work	Year	Cost Estimate	Source of Funds
City Garage Replacement Demolition and Relocation	2022	$13,200,000	Revenue Bond (non SRF eligible)
Plant Replacement, Phase I	2022	11,029,000	SRF
Mercury/TSS Treatment Process	2022	30,000,000	SRF
Plant Replacement, CES/RPR	2022	6,280,000	SRF
Plant Replacement, Phase II	2023	30,573,000	SRF
Plant Replacement, Phase III	2024	35,302,000	SRF
Plant Replacement, Phase IV	2025	37,793,000	SRF
Plant Replacement, Phase V	2026	11,661,000	SRF
Total Construction Cost		$175,838,000	

Q: What is the Estimate Class for the new WTP construction cost estimate?

A: Petitioner does not report the estimate class in its testimony. It appears that the construction cost estimates prepared to date and submitted in the case-in-chief and in the Preliminary Engineering Report should be considered AACE Class 3 estimates.[47] I consider it a Class 3 estimate for the following reasons:

a. Known water quality and treatment processes - The proposed SWTP is similar to the existing SWTP (with known river water quality, known treatment processes similar to existing, known new processes (ozone, biologically active filtration ("BAF")).

b. Components and sizing - All unit processes and system components appear to

[46] Attachment DLB-1 to Mr. Baldessari's case-in-chief testimony, pages 6-9.

[47] AACE International cost estimate classifications range from Class 5 for planning and concept screening with 0% to 2% project definition to Class 1 for bidding, project controls and change management for up to 100% project definition. AACE stands for the Association for the Advancement of Cost Engineering. *See* Attachment JTP-4 for the cost estimate classification matrix of the AACE International Class that describes the five Classes, their project definition basis and their uses.

be identified and sized.

c. Detailed unit costs - were prepared by AECOM with Assembly Level line items. This information was provided in response to a data request and included Excel worksheets, Timberline cost estimating software output and equipment quotations.[48] The level of spreadsheet detail, the material quantities, and equipment vendors budgetary quotations is a good indication the estimate is a Class 3.

d. 30% design - AECOM's contract list preparation of a Class 4 estimate and preliminary design drawings as scope of work tasks.[49]

e. Budget and financing - EWSU has established its requested project budget and is seeking financing authorization. This is another main reason to judge the estimates as Class 3.

However, AECOM identified the construction cost estimate as a Rough Order of Magnitude ("ROM") with no AACE Class level identified.[50] In other discovery, Petitioner stated that the cost estimates were based on the alternative evaluations report, which it indicated was at the conceptual level (approximately 10% design).[51]

Q: What are the various cost estimates that have been prepared?

A: AECOM shows a $150,902,000 total estimated project cost without design costs in the Advanced Facility Plan (Table 9-9 Plant Alternative 2B Total Estimated

[48] Petitioner response to DR 17-6 Attachment 1 (Excel file tabulating costs from the Timberline cost estimating software – 13 worksheets), Attachment 2 (pdf file of Timberline cost estimating software output, 20-018 Engineer's ROM Estimate Level 4, June 12, 2020 – 54 pages) and Attachment 3 (2020 and 2021 equipment vendors budgetary quotes and scopes of supply and details for major pieces of equipment). *See* Attachment JTP-5.

[49] Attachment JTP-6 for the Scope of Services from AECOM's Engineering Services Contract.

[50] Petitioner's response to Data Request 17-6.

[51] Petitioner's response to Data Request 17-7.

Construction Cost) including $13.691 million for a new City garage but omits existing plant demolition, renovations of existing treatment plant buildings that are to remain (unspecified but believed to include the original 1897 well and pump house and the 1912 and 1938 filters building), and the $30 million residuals treatment system.[52] The PER lists $166,925,000 for the Alternative 2B cost in Table 21 (on page 46 of 80) without design costs and omits demolition and City garage replacement costs (non SRF eligible) but includes $27,650,000 for the residuals treatment system. The WTPAFP and PER cost estimates are compared in Attachment JTP-7.

In the testimonies of Mr. Breese and Mr. Baldessari, the treatment plant construction costs are shown as $181 million and $175.838 million respectively. Both estimates include a $30 million residuals management system. In addition, Evansville's new SWTP has been initially listed on IFA's Project Priority List ("PPL") at an estimated $250 million cost (#4 priority project – 2022 1st Quarter PPL, July 19, 2021) which greatly exceeds the amount of financing Petitioner is requesting in this Cause.[53]

Q: What is the overall contingency included in Petitioner's WTPAFP and PER cost estimates for Alternative 2B?

A: Petitioner does not identify the project's overall contingency. Petitioner shows *additional* construction contingencies at 3% totaling $4,152,180 in the PER, Table 21 but does not identify the large estimating contingencies (20% up to

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[52] Table 11-3 - Total Estimated Project Cost of Preferred Alternative 2B in the WTPAFP shows a cost of $180,616,000 if residuals treatment (dewatering) is required by IDEM.

[53] See Attachment JTP-8, Indiana Finance Authority Drinking Water State Revolving Fund ("DWSRF") 2022 1st Quarter Project Priority List ("PPL"), July 19, 2021

30%) and the 5% construction contingencies embedded in most line items of the cost estimate. In the WTPAFP, Table 9-9, the *additional* construction contingencies at 3% total $3,602,000. The additional construction contingencies vary for each of the four Alternatives evaluated as summarized in Table 9. Given the cost details provided that identify the majority of project costs, I recommend that Petitioner use a standard 10% contingency in its cost estimates which matches the maximum contingency allowed by the Indiana Finance Authority.

Table 9 – Comparison of Added Construction Contingency for the Four Alternatives

Alternative Description		Added Construction Contingency		Construction Cost with Added Contingency
		%	Amount	
1	Rehabilitate the existing SWTP	15%	$14,319,000	$121,822,000
2A	New SWTP on existing site	10%	$12,096,000	$141,605,000
2B	New SWTP on City garage site	3%	$3,602,000	$140,049,000
3	New 50:50 SWTP / GWTP	10%	$14,795,000	$175,599,000

Q: Did Petitioner provide support for its cost estimates in its case-in-chief?

A: No. In the Advanced Facility Plan, AECOM provided single page construction cost estimates for process alternatives and for each of the four alternatives (Alternatives 1, 2A, 2B, and 3) but did not provide any detailed cost support, material quantities, unit costs or equipment quotations. The WTPAFP and PER cost estimates for each alternative show lump sum costs for various-line items representing individual unit processes. Additionally, the individual unit processes also show lump sum costs for various line items, again with no detail beyond the listed lump sum costs.

In response to discovery, Petitioner provided cost details from an estimating program called Timberline, but the output was in pdf format that did not link to an excel file that could be manipulated to understand how costs were developed and rolled up into the lump sum costs shown in the WTPAFP and PER. Because of this, the OUCC could not be easily see how costs rolled up for individual processes and then tied into the WTPAFP and PER cost tables.[54] Petitioner provided an Excel file of the Timberline data, but the data was hard coded making review difficult. The Timberline software includes assembly level detailed listings with entries for labor, materials, installation equipment, subcontractors, and process equipment costs.

Q: Did you review the lump sum costs listed in the WTPAFP and PER tables?

A: Yes. In reviewing the detailed estimates forming the basis for AECOM's cost estimates, I noticed WTPAFP and PER costs were always much higher than rolled-up costs generated through the Timberline cost estimating software. I reviewed AECOM's cost estimates in depth for two process components: 1) rehabilitating the river intake; and 2) constructing new high service pump station #4. Based on my review it appears costs that AECOM listed for the intake and HSP Station #4 in the total construction cost estimates are 107% and 272% higher than the total amount listed in the rolled-up Timberline estimate. The Timberline costs appear to be base costs without contingencies and the contractor's overhead and profit and general conditions.

[54] Petitioner's response to DR 17-6 and DR 17-10. *See* Attachment JTP-5.

I assembled the various cost estimates for the Intake and HSP Station #4 and summarized them in Attachments JTP-9 and JTP-10. I also summarized the cost estimate increases from the AECOM base costs generated through the Timberline estimating software to the estimated costs presented in the WTPAFP and PER. *See* Table 10.

Table 10 – Summary of Cost Estimate Increases for the Intake and HSP Station #4

Cost Estimate Source	Intake Rehab	HSP Station #4
DR 17-6 Attach. 2 Timberline estimate Total Amount (Base Cost)	$3,260,760	$2,995,741
DR 17-6 Attach. 2 Timberline estimate Total Price Amount	$4,995,583	$4,586,577
DR 17-6 Attach. 1 Grand Total Cost	$6,752,000	$7,870,000
Advanced Facility Plan Cost Estimate	$6,752,000	$11,130,000
Percent Increase above Base Cost	107%	272%
Advanced Facility Plan Cost Table	Table 7-5, page 51	Table 9-9, page 128

VI. NEW STREET DEPARTMENT MAINTENANCE GARAGE

Q: Where does Evansville plan to construct the new surface water treatment plant?

A: Petitioner plans to build its new plant on land occupied by the Evansville Street Maintenance Department's garage ("garage" or "City garage"). At an offsite location, Evansville proposes to construct a new City garage that is larger and with more amenities than the existing 1985 garage. Petitioner requests $13.2 million to fund the new garage's entire cost at water utility ratepayer expense.

Q: Has Petitioner started work to replace the City garage?

A: No. Petitioner provided a feasibility assessment for the new garage but did not document in its case-in-chief that it had acquired another property.[55] In response to discovery, Petitioner stated property acquisition has not started and that "design of the new Street Garage will start when it is known this rate case will move forward as petitioned. Anticipated construction schedule of the new Street Garage is embedded in the Gantt chart in the PER for the water treatment plant, previously submitted."[56] Figure 10-1 in the WTPAFP shows garage relocation work starting in the 3rd quarter of 2021 and ending by the 3rd quarter of 2022.[57]

Q: Who determined the new WTP site?

A: Petitioner's witness Mr. Labitzke stated "EWSU, in conjunction with its consultants, evaluated a number of potential locations" and stated AECOM's evaluation indicated the most cost-effective option is to build on or near the existing WTP, specifically preferring the City garage site as the (Alternate 2B).[58]

Q: What sites did AECOM evaluate for the new WTP?

A: Petitioner's witness Mr. Breese discusses only three sites for Alternative 2B:

Site 1 The City garage site immediately east of the existing WTP (selected).

Site 2 An undeveloped site 2.4 miles southeast of the existing WTP outside the floodplain or any wetlands.

Site 3 An undeveloped site 2,900 feet south of the existing WTP within the floodplain but unprotected by the existing levee.

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[55] Mr. Labitzke's case-in-chief testimony and Attachment <u>ML-5</u> *Facility Relocation Feasibility Assessment*, for the Evansville Street Maintenance Department & Evansville Vanderburgh Levee Authority, VS Engineering, Inc., Dec. 15, 2020,

[56] Petitioner response to DR 17-9, August 9, 2021.

[57] Mr. Breese's case-in-chief testimony and Attachment <u>SMB-1</u> *Water Treatment Plant Advanced Facility Plan, Alternatives Report*, AECOM, March 2021, page 138 of 276.

[58] Mr. Labitzke's case-in-chief testimony, page 12.

Q: Has Evansville considered other nearby locations for the new WTP?

A: I don't believe so. Because of benefits from being near the existing Ohio River Intake Structure (being retained) or possible well sites, Evansville was justified in only considering sites on or near the existing WTP. However, by effectively limiting its off-site review to only the adjacent Street Maintenance Department garage and Levee Authority site, Evansville failed to evaluate placing the new WTP on other unused City owned land that also sits adjacent to the existing WTP. This other adjacent 20-acre area just south of the Levee Authority and City garage would have eliminated the need to demolish and relocate the garage thereby saving $13,200,000. This city owned vacant land is shown in Figure 3.

Figure 3 – View of Evansville's existing water treatment plant looking east with the City garage, the proposed site of the new plant, in the upper left. This pre 2019 photo does not show the Waterworks Road relocation across the wooded City owned land.

Q: What infrastructure exists on the property south of the Levee Authority and City garage?

A: Until 2019 it appears that the land only had a 48-inch water transmission main running east from the water plant. Evansville installed two new 36-inch water transmission mains at a construction cost of $2,625,669.[59] Evansville also relocated Waterworks Road in 2019 as part of the Sunrise Effluent Pump Station project (wastewater) at a construction cost I estimate at $1,680,000.[60]

Q: Could Evansville save time and ratepayer money by building the new WTP on the 20-acre site south of the Levee Authority?

A: Yes. I estimate Petitioner could relocate portions of the 48-inch concrete and two new 36-inch ductile iron transmission mains and the new Waterworks Road for about $5.0 million. The cost to relocate the infrastructure on the site would be less than half of the $13.2 million requested cost to relocate the City garage.[61] Costs could even be reduced from the $5 million if portions of the new road and 36-inch and 48-inch transmission mains could remain in place or be removed, inspected, and reinstalled. Evansville could also accelerate the WTP project schedule by eliminating the need to acquire an offsite property and relocate the City garage.

Q: Please describe the existing Street Maintenance Department garage.

A: The facility, constructed in 1985, consists of a 52,800 square feet single story commercial/industrial type metal frame and metal sided garage building with a 12,000 square feet two-story brick and metal exterior office with a mezzanine and

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[59] Waterworks Road – (2) 36" Water Main Relocation project (unknown Project No.). This $2,625,669 water transmission main project was not separately listed in Cause No. 45073. It is believed to be part of the $21,032,206 PER A Project No. 25, High Service Pump Station and Clearwell that was disallowed by the Commission in Cause No. 45073.

[60] Based on an OUCC estimated road construction cost of $1,200 per lineal foot (2021 cost) times 1,400 lineal feet equals $1,680,000.

[61] The cost to relocate the existing 48-inch PCCP pipe is estimated at $500 per LF for 1,250 LF equals $625,000. Total cost to relocate the road and water transmission mains would be $1,680,000 + $2,625,669 + $625,000 equals $5,000,000 (rounded up).

two metal industrial canopies on the east and south building edges.[62] The building floor and canopy floors are concrete. The existing garage is a 36-year-old commercial/industrial type building that is rated by the Assessor to be in average condition. VS Engineering listed operational deficiencies in the *Facility Relocation Feasibility Assessment.*[63] The building sits on approximately 3.5 acres of city owned land just east of Evansville's existing WTP.[64] The parking and equipment / material storage areas are primarily unpaved (gravel). There does not appear to be any storm water detention basin for runoff control. Attachment JTP-12 contains aerial photos of the existing garage site and Attachment JTP-13 contains garage photos taken during the OUCC's July 21, 2021 site visit.

Q: What does Petitioner propose for the new City garage?

A: Petitioner proposes to build a new 85,000 square feet garage / office at an offsite location with paved employee parking separated from equipment storage areas, a storm water detention pond, fencing, and other garage features listed in Attachment ML-5. The Street Maintenance Department requested the new offices be enlarged to 15,000 square feet (25% larger) and the garage be increased in size to 70,000 square feet (34% more space).[65] The new garage would have higher 24 ft. walls to better accommodate large equipment. The new garage area would be over 20% larger than a football field.[66]

[62] The Property Record Card for the existing Street Maintenance Department garage indicates a 52,800 square feet garage and a 12,000 square feet office area. *See* Attachment JTP-11

[63] Attachment ML-5 *Facility Relocation Feasibility Assessment*, for the Evansville Street Maintenance Department & Evansville Vanderburgh Levee Authority, VS Engineering, Inc., Dec. 15, 2020.

[64] The 3.5 acres is the OUCC's estimate. Petitioner does not indicate the acreage of the City garage site.

[65] The existing garage dimensions are 352 ft. by 160 ft. equals 52,800 square feet. The proposed garage dimensions are 400 feet by 175 feet equals 70,000 square feet.

[66] Football field dimensions are 360 feet by 160 feet.

Q: Has any valuation been made of the existing City garage?

A: Yes. The Vanderburgh County Assessor determined a Replacement Cost New ("RCN") valuation of $3,115,340 for the City garage and a depreciated value of $684,900.[67] The Levee Authority building and the City garage sit on a 13.05-acre parcel valued at $566,400. The City garage parcel that I estimate to be 3.5 acres would have a prorated value of $152,000. The RCN and land value totals $3,267,340. The depreciated value of the garage and 3.5-acre site is $1,251,300.

Q: Why does Petitioner seek to include the entire cost of building a new, larger City Garage as part of the new water treatment plant project?

A: Petitioner's witness Mr. Baldessari asserts the full $13.2 million estimated construction cost of relocating and building a new City Garage is a proper acquisition cost chargeable to the new WTP project.[68] He opined the Street Maintenance Department cannot be forced to transfer the property unless the Water Utility pays for the entire replacement garage. He noted the City could simply use the condemnation process for privately owned property but cannot condemn property already dedicated to public use. He further opined that the Water Utility would have to negotiate for the purchase and that it would be reasonable to expect under such circumstances that the seller (i.e., Evansville's Street Maintenance Department) would require that Evansville's Water Utility provide the funds to acquire a new site and build a new City garage.

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[67] *See* Attachment JTP-11 for the Property Record Card from the Assessor's office

[68] VS Engineering estimated the offsite land purchase and construction cost for the new garage at $13,277,395. This cost does not include the $624,000 estimated cost to demolish the existing City garage. *See* Mr. Labitzke's case-in-chief testimony, Attachment ML-5, page 7 of 34. VS Engineering increased its cost estimate to $13,690,900 (includes the $624,000 City garage demolition cost) in the Preliminary Engineering Report, June 2021. AECOM also reported the $13,690,900 cost to acquire the City garage site and relocate the garage. *See* Mr. Breese's case-in-chief testimony, Attachment SMB-1, page 123 of 276.

Q: Did Petitioner provide any testimony about negotiations it may have held with the Street Maintenance Department?

A: No.

Q: Do you agree with Mr. Baldessari's assertion that the Water Utility must pay the entire cost of a new City garage rather than the appraised Fair Market Value of the existing garage?

A: No. Evansville's proposal to have the Water Utility absorb the replacement costs in their entirety including additional costs for a larger and more costly garage with no Street Maintenance Department funding participation is not reasonable or in the ratepayers' interest. This approach fails to account for the garage's age and condition. Both entities (Water and Street Maintenance) are City departments, but they do not have the same customer base. The Water Utility serves customers outside Evansville's city limits including wholesale customers. Approximately 32% of Petitioner's customers do not live in Evansville city limits.[69] Water Utility funds should not be used to subsidize the Street Department by replacing an aged, average condition garage with a new, improved and larger garage at a higher cost.

Q: What does the term functional replacement mean for property acquisitions?

A: Property acquisitions are based on appraised Fair Market Value. Under property acquisition rules (Federal Highway Administration and INDOT), functional replacement provides additional financial assistance when typical Fair Market Value compensation for acquiring a public facility such as the City garage may be insufficient to restore it to the level needed to provide the same services that were being provided at the acquired site. "Costs of increases in capacity and other

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[69] The percentage living outside City limits is based on the reported current population served of 173,000 minus the Evansville population of 118,000 equals 55,000 people outside City boundaries or 32%. *See* Cause No. 45545 Supplemental Workpaper, *Preliminary Engineering Report – Water Treatment Plant*, VS Engineering, June 2021, page 70 of 80.

betterments or enhancements are not eligible for federal or state participation except where necessary to replace the facility's utility, unless required by existing codes, laws or zoning regulations, or related to reasonable prevailing standards for the facility being replaced."[70]

Q: Has Evansville estimated the additional costs for the increase in capacity and other betterments or enhancements the Street Maintenance Department wants for the new City garage?

A: No. Petitioner does not address this issue and did not determine the value of the existing City garage.

Q: What should Petitioner contribute to the new Street Maintenance Department garage?

A: Instead of requiring the water customers to pay the full $13.2 million requested, Petitioner should only contribute the replacement cost of the existing garage along with the value of the land or approximately $3.5 million. I calculated this value based on the Assessor determined $3,115,340 Replacement Cost New ("RCN") for the City garage $154,600 of design fees (5% of the RCN), and the $197,00 land acquisition cost (includes surveying/legal fees) rounded up to $3.5 million.

Q: Do you have other observations about the interaction between Evansville's Street Department and the Water Utility?

A: Yes. Evansville's Water Utility relocates its water mains whenever road projects require it at no expense to the Street Department. In the previous three rate cases, Evansville obtained over $45 million for water main relocation projects as summarized in Table 11. In this Cause, Petitioner is requesting financing authority for another $40 million bringing the water main relocation total to approximately $85 million since 2013.

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[70] Indiana Department of Transportation - Real Estate Division Manual August 2018, Chapter 1, pages 23-26.

Table 11 – Funding for Water Main Relocations Caused by Road Projects

Cause No.	Period	Amount
44137 (2012)	2013-2015	$ 12,000,000
44760 (2016)	2017-2020	$ 12,000,000
45073 (2018)	2019-2021	$ 21,027,800
45545 (2021)	2022-2026	$ 39,806,000
Total		$ 84,833,800

Against this backdrop of water main relocation costs imposed on the Water Utility because of road projects, Petitioner now seeks $13.2 million to fund a new City garage at no expense to the Street Maintenance Department. The OUCC does not object to a new garage but opposes Petitioner's plan to build a larger garage with betterments and to finance it entirely through water rates. Evansville Street Department interactions with the Water Utility must be a two-way street. Therefore, I recommend the Commission only authorize financing of $3.5 million for acquiring the City garage property for the WTP project and relocating the City garage to a new offsite property. All additional costs for increased capacity, betterments, and enhancements to the new City garage should be funded through the Street Department budget and not through water rates.

VII. OTHER ISSUES

Q: Did Petitioner complete all the water main replacement and relocation projects from Cause Nos. 44760 and 45073?

A: No. In Cause No. 45073, the OUCC's testimonial positions were that water main cost estimates were inflated, the replacement schedule was overly ambitious, and the financing amount authority should be reduced. The OUCC did not oppose any water main project. Petitioner rebutted by stating the only thing holding Evansville back in achieving the 1.5% water main replacement rate was funding.

Q: How many miles of water main replacements did Evansville complete annually from 2018 to 2021?

A: In response to discovery, Evansville did not indicate how many miles *were completed*. Instead, Evansville responded "In order to provide a response to this request, EWSU *assumed the list to include encumbered projects that have received a notice to proceed*.[71] (Emphasis by the OUCC). Based on the $93,494,523 amount of funds remaining as of June 1, 2021 from the 2016A, 2018A2, and 2019A Waterworks District Revenue Bonds (total amount of $151,317,000), it is clear that Evansville is behind in its water main replacement program. Some funding from Cause No. 45073 included in the amounts listed above at $5,245,024 was for the eleven treatment plant projects allowed by the Commission that have not been completed and are on hold pending the new plant.[72] Petitioner reported that some electrical work is currently under contract.

Q: What do you recommend regarding Petitioner's completion of its proposed water main projects from prior causes and from this Cause?

A: I recommend that Petitioner file annual reports (with its IURC Annual report) outlining the status of each capital improvement project. Each report should include the estimated cost of each project, the actual costs incurred by calendar year for each project, the actual total cost of each completed project, the projected completion dates for unfinished projects, and the actual completion dates for each finished project. Such a reporting requirement was included for Evansville in

[71] Petitioner responses to DRs 10-1 to 10-6.

[72] Petitioner response to DR 15-6.

Cause No. 43190.[73] I also recommend that Evansville track its water main replacements and fill in those IURC Annual Report sections detailing the work completed annually. Evansville previously provided this information in its annual reports for the city.[74] Documenting Evansville's progress addressing its aging water main infrastructure is valuable information.

VIII. RECOMMENDATIONS

Q: What do you recommend for the capacity for the new surface water treatment plant?

A: I recommend that Evansville size its new plant for 40 MGD instead of the proposed 50 MGD. This recommendation flows from my analysis of likely future water demands and is counter to AECOM's use of overly aggressive growth projections. I also recommend Petitioner conduct another life cycle cost analysis for a properly sized plant able to meet the 28.4 MGD design average day flow and the 40 MGD maximum day design considering all capital and operating costs.

Q: What do you recommend should be authorized for constructing the new City garage?

A: I recommend the Commission authorize approximately $3.5 million for acquisition of the City garage site, relocation of the City garage to a new offsite location instead of Petitioner's requested $13.2 million. In the alternative, I recommend moving the site for the new plant to just south of the proposed City garage site. This will require moving three water transmission mains and

[73] Cause No. 43190, Finding paragraph 11, Final Order, September 26, 2007, pages 11 and 12.

[74] *See* Attachment JTP-14, 1922 Water Department report regarding water mains.

Waterworks Road but the cost for this alternative site will be approximately half of Petitioner's requested \$13.2 million.

Q: What do you recommend should be authorized for constructing the new treatment plant?

A: I recommend AECOM's estimated \$120,055,000 construction cost for the new plant be reduced by 20% or \$24,011,000 to reflect the reduced 40 MGD maximum day capacity. The new plant's total estimated construction cost with \$3.5 million for the City garage would decrease from \$140,049,000 to \$104,885,460. With non-construction costs (7.75%), the total estimated project cost would be approximately \$113,015,000 (rounded up).

Q: What do you recommend for finalizing the selection of the new treatment plant?

A: I recommend Petitioner conduct another life cycle cost analysis for a properly sized plant able to meet the 28.4 MGD design average day flow and the 40 MGD maximum day design with adjustments made to the estimated costs to correct the analysis by including demolition costs missing under some alternatives, adding in the additional costs for residuals management under the three surface water options (Alternatives 1, 2A, and 2B), and removal of some clearwell and high service pumps costs missing from the selected Alternative 2B but included in the other three Alternatives (1, 2A, and 3).

Q: What do you recommend regarding reporting by Petitioner about its water main replacement program?

A: I recommend Petitioner annually submit a capital improvements reconciliation along with its Annual report to the IURC, setting forth the projects completed, improvements actually implemented, the feet of water main replaced and the costs thereof. To the extent planned projects, including water main replacement and relocation projects, are completed for less than the estimates included in Petitioner's cases-in-chief under Cause Nos. 44760, 45073, and 45545, Petitioner should use the savings in a prudent manner toward completion of only other needed water main replacement projects identified in Petitioner's prioritized water main replacement program at the discretion of Petitioner.

Q: Does this conclude your testimony?

A: Yes.

Appendix A

Q: Please describe your educational background and experience.

A: In 1980 I graduated from Purdue University, where I received a Bachelor of Science degree in Civil Engineering, specializing in Environmental Engineering. I then worked two years with Peace Corps / Honduras as a municipal engineer on self-help rural water supply and sanitation projects funded by the U.S. Agency for International Development (U.S. AID). In 1984 I earned a Master of Science degree in Civil Engineering (Environmental) from Purdue University. I have been a Registered Professional Engineer in Indiana since 1986. In 1984, I accepted an engineering position with Purdue University, and was assigned to work as a process engineer with the Indianapolis Department of Public Works ("DPW") at the City's Advanced Wastewater Treatment Plants. I left Purdue and subsequently worked for engineering consulting firms, first as a Project Engineer for Process Engineering Group of Indianapolis and then as a Project Manager for the consulting firm HNTB in Indianapolis. In 1999, I returned to DPW as a Project Engineer working on planning projects, permitting, compliance monitoring, wastewater treatment plant upgrades, and combined sewer overflow control projects.

Q: What are the duties and responsibilities of your current position?

A: My duties include evaluating the condition, operation, maintenance, expansion, and replacement of water and wastewater facilities at utilities subject to Indiana Utility Regulatory Commission ("Commission") jurisdiction.

Q: Have you previously testified before the Commission?

A: Yes.

Appendix B - List of Attachments

Attachment JTP-1	Petitioner's responses to Data Requests 3-15 to 3-18 pertaining to annual growth assumptions used to estimate 2050 water demands for each customer class
Attachment JTP-2	Excerpts on demographics, housing, and utilities from the *Evansville-Vanderburgh County Comprehensive Plan, 2015-2035*, Evansville-Vanderburgh County Area Plan Commission, June 27, 2016
Attachment JTP-3	Petitioner's response to Data Requests under Cause Nos. 44760 and 45073 pertaining to the status of the proposed groundwater treatment plant
Attachment JTP-4	Cost estimate classification matrix - AACE International
Attachment JTP-5	Petitioner's responses to DR 17-6 and DR 17-10 regarding cost support for the new treatment plant
Attachment JTP-6	Scope of Services from AECOM's Engineering Services Contract, August 20, 2019
Attachment JTP-7	Comparisons of WTPAFP and PER Cost Estimates
Attachment JTP-8	Indiana Finance Authority Drinking Water State Revolving Fund ("DWSRF") 2022 1st Quarter Project Priority List, July 19, 2021
Attachment JTP-9	Intake cost estimates
Attachment JTP-10	High Service Pump Station #4 cost estimates
Attachment JTP-11	Property Record Card ("PRC") for the Evansville Levee Authority and Evansville Street Maintenance Department garage
Attachment JTP-12	Aerial photos of the existing Evansville Street Maintenance Department garage site.
Attachment JTP-13	Photographs of the Evansville Street Maintenance Department garage taken during the OUCC's July 21, 2021 site visit showing the conditions of the garage facilities.
Attachment JTP-14	Water Department report regarding water mains

Appendix C – Description of the Evansville Water System

Q: What are Petitioner's characteristics?

A: Petitioner currently owns and operates plant and equipment for the production, transmission and delivery of potable water to the public in and around the City of Evansville in Vanderburgh County, Indiana and to three wholesale water customers; Gibson Water, Inc., German Township Water District, and the Town of Elberfeld (two connections). Petitioner's system is connected to but does currently sell water to the Newburgh, IN operations of Indiana-American. Evansville also provides public and private fire protection service and has approximately 6,000 fire hydrants. The municipally owned Evansville Water and Sewer Utility operates as a City Department under the Water and Sewer Utility Board oversight. The five Board members are appointed by the Mayor of Evansville. Evansville provided water service in 2020 to 63,473 customers[75] representing an estimated population of 162,000, including residents in German Township, Gibson County, and the Town of Elberfeld.[76] Evansville's and Vanderburgh County's 2020 population was 117,298 and 180,136 respectively.[77] Evansville's customer base has slowly grown 0.42% annually (4.3% in the last decade), but according to Utility data from its Annual Reports to the IURC, water production and water sold have been relatively flat as summarized in Table 12.

[75] At the end of 2020, Evansville's customers included 59,605 residential, 3,495 commercial, 129 industrial, 230 public authorities, and three wholesale customer metered accounts. 2020 Annual Report to the IURC, page W-1.

[76] The 2017 population served estimate reported to the Indiana Department of Environmental Management ("IDEM") of 162,000 people includes up to 118,930 people in the City of Evansville (based on population forecasts by the Indiana Business Research Center), 650 people in Elberfeld, Indiana and 42,420 people located outside Evansville's corporate limits.

[77] 2020 US Census.

Table 12 – Customers, Water Pumped from Wells, and Water Sold, 2008 to 2020

	Customers					Water Pumped (MGD)[78]	Water Sold (MGD)	Non-Revenue Water
Year	Resid.	Comm.	Indust.	Other	Total			
2008	58,242		2264	4	60,510	26.1	20.7	5.7
2009	58,469		2249	4	60,722	22.3	18.9	3.4
2010	58,361		2250	4	60,615	22.9	20.3	2.6
2011	58,593		2245	4	60,842	23.7	18.9	4.8
2012	58,880		2260	4	61,144	25.5	20.3	5.2
2013	59,374		2274	4	61,652	21.4	18.3	3.1
2014	58,243	3,021	89	214	61,567	22.3	18.1	4.2
2015	58,160	3,536	102	215	62,013	22.1	18.5	3.6
2016	58,618	3,548	104	221	62,491	23.2	17.7	5.5
2017	58,723	3,548	121	239	62,631	22.2	17.6	4.6
2018	58,959	3,505	132	234	62,830	22.4	17.8	4.7
2019	59,206	3,491	139	234	63,070	20.1	16.9	3.1
2020[79]	59,605	3,495	129	234	63,473	17.0	14.4	2.6
Average 2011 - 2020					62,170	21.99	17.85	4.14

Q: Where does Evansville obtain its water?

A: Evansville's Water Utility has been drawing surface water from the Ohio River at approximate river mile 791.5 just upstream of downtown since the 1870s.

Q: How does Evansville treat its surface water?

A: The raw river water is screened at the Intake Structure to remove large debris by passing through three travelling screens and pumped via six low service pumps to treatment. The plant utilizes poly-aluminum chloride, caustic (sodium hydroxide)

[78] MGD means million gallons per day. MG means million gallons.

[79] In response to 45545 DR 15-11 asking why 2020 Water Sold shown on the Annual Water Sold graph as 6.011 BG/year (Mr. Baldessari's testimony, page 34) does not agree with the 5.255 BG/year of Water Sold reported on Evansville's 2020 IURC Annual report, Petitioner stated: "The information as reported on the 2020 Annual Report does not appear to have been entered correctly. The Petitioner would need to update the figures provided for the 2020 Annual Report."

for pH control, and powder activated carbon (if needed for taste and odor control) for raw water conditioning. Potassium permanganate is added to the raw water for taste and odor control, reduction of nuisance organisms, and minimization of disinfection by-products formation. Petitioner provides conventional treatment with coagulation, flocculation, primary settling, secondary settling and rapid rate gravity filtration on twenty-four (24) dual media filters (sand, and anthracite coal over a gravel base and underdrains).

The filters remove any remaining suspended solids and the filtered or finished water is then stored temporarily in three on-site clear wells (underground reservoirs with 8.5 MG total volume) before being pumped to distribution via seven high service pumps. Treatment produces an excellent finished water with low turbidity levels consistently below 0.1 NTU that averaged 0.03 NTU in 2020 (range of 0.02 to 0.06 NTUs).[80] Evansville does not remove iron or manganese or soften its water since Ohio River water is naturally low in hardness, iron, and manganese. Evansville reports the finished water's average hardness in 2020 was 119 parts per million.[81] The finished water is also fluoridated and disinfected with chlorine gas and ammonia to form chloramines, providing residual disinfection throughout the distribution system.

Q: Please describe Evansville's finished water quality

A: Evansville consistently produces excellent quality water, as documented in its Monthly Reports of Operation for the Water Treatment Plant and its Annual

[80] Nephelometric Turbidity Units – used to express turbidity levels for water cloudiness caused by particles. The EPA's Surface Water Treatment Rule requires utilities using conventional filtration to have turbidity no higher than one NTU. Samples for turbidity must be less than 0.3 NTU in at least 95 percent of samples in any month. Evansville has monitored filtered water turbidities from each of its 24 filters since 2002.

[81] 2020 Consumer Confidence Report.

Consumer Confidence Reports. Moreover, Petitioner's monitoring reports and test results indicate compliance with the Safe Drinking Water Standards.

Q: How does Evansville distribute finished water to customers?

A: From the water filtration plant, finished water flows to three interconnected clearwells with a total volume of 8.5 MG and High Service Pump stations Nos. 2 and 3. The seven High Service Pumps push finished water from the clearwells through several large diameter transmission mains to four pressure zones in the distribution system, six Booster Stations and eight finished water storage tanks including the buried concrete 20 MG Campground Reservoir built in 1927 and the 4 MG Killian steel aboveground reservoir. Elevated water storage (and year installed) includes four 500,000-gallon tanks (Lincoln - 1967, Upper Mt. Vernon - 1971, Grimm Road - 1974, and USI - 2010), one 1 MG tank (New Harmony or Darmstadt - 1974), and one 1.5 MG tank (Volkman -1999). Total storage capacity in the distribution system is 28.5 MG. Combined with the existing clearwells at the treatment plant, finished water storage capacity totals 37 MG.

Q: Please describe Evansville's transmission and distribution mains.

A: Evansville's water transmission and distribution network includes approximately 1,015 miles of water mains ranging in diameter from 1-inch up to 60-inches. Water mains are primarily cast iron (45.3% or 460 miles) according to the 2016 *Water Master Plan.* Evansville uses ductile iron and PVC pipe currently for replacement and new development mains. Evansville reports having primarily copper service lines although it also has 1,300 lead service lines.

OUCC DR 3-15

DATA REQUEST
City of Evansville

Cause No. 45545

Information Requested:

Showing calculations and inputs, please explain precisely how Evansville determined each of the growth estimates from page 18 of Attachment SMB-1 on:

a. City population growth rate of 1.5% per year, maintaining the same per capita demand through 2050.
b. Initial wholesale demand of 2.88 MGD with flow increase of 0.75% per year.
c. Initial industrial demand of 3.0 MGD with flow increase of 2.5% per year.
d. Initial commercial demand of 5.0 MGD and a growth rate of 2.0% per year.
e. Initial public authority demand of 1 MGD and growth rate of 0.25% per year.

Information Provided:

Initial demands were established from billing records and as presented in Table 3-5 Attachment SMB-1. The mathematical formula for calculating final values for demand or population through the 30-year period is as follows:

$$(Value_{Future}) = (Value_{Present})(1 + \%_{annual\ growth})^{\#\ of\ years}$$

A further explanation of the reasoning behind the growth values are provided in the response to the next question. However, the noted rates specifically considered the following factors:

a. City Population: Although Evansville has been experiencing decline in population since the 1960s, a goal of any major infrastructure project is to give the ability for the utility to comfortably meet demand while not providing an excessively oversized and expensive system. The 2016 Water Master Plan had assumed a somewhat aggressive growth rate, resulting in an anticipated maximum day water demand of 47 MGD by the year 2035 and proposing a 60 MGD facility (compared to 49 MGD by 2050 in the Advanced Facility Plan). As such, the proposed value being less aggressive provides a good balance of allowing for future growth while not spending excessive capital on the improvements.

b. Wholesale Demand: This is effectively like population growth in the City's service area. However, the wholesale areas have a lower population density and therefore assumed a lower growth rate through the planning period.

c. Industrial Demand: This growth rate was assumed to exceed that used for population and reflects land currently zoned and available for industrial growth in the water service area. Economic and industrial downturn surrounding the 2008 recession resulted in a loss of industry, with the goal now being to encourage development of the available industrial parks within the City.

d. Commercial Demand: This growth is complimented by the assumed industrial growth rate. Both industrial and commercial demand relate to overall economic growth of the area, for which Evansville has experienced an uptick in recent years.

e. Public Authority: Given the size of the City, most of the public authority bodies are well established and water demand and is not expected to experience considerable growth through the planning period. Therefore, this rate was reduced well below the population growth estimate.

OUCC DR 3-16

DATA REQUEST
City of Evansville

Cause No. 45545

Information Requested:

Please identify with relevant page numbers and provide any study, report, analysis or other authority used to determine each of the percentages listed in the preceding request?

Information Provided:

Forecasting population, land use, and water demand relies on professional opinions of consultants, developers, and owners / end-users. They are performed for the planning of infrastructure and there is no exact scientific method of determining rates of future growth or decline. Rather, values are established using an agglomeration of available factors including historical population trends, availability of undeveloped land and the designated zoning of said land, and known infrastructure projects which would impact growth or decline (i.e. construction or development of a major transportation corridor or industry). The only two recent and publicly available studies proposing a potential future water demand were the 2016 Water Master Plan and the 2016 Evansville-Vanderburgh County Comprehensive Plan for 2015 through 2035. The master plan identified a 20-year maximum day demand of 47 MGD and proposed plant capacity of 60 MGD without citing any documentation for growth rates. The Comprehensive plan suggested a projected average day demand of 33.8 MGD in 2035 by assuming a net population increase of 7% through the planning period. Historical population trends are another useful tool for projections. However, census data indicates Evansville has experienced an average population decline of 3% per decade since 1960 and continuing such a trend from today's average day demand is not a good long term planning model for a new water treatment plant. Although these two 2016 studies and previous census data could be used as a citation, EWSU worked together with their consultants to establish, review, and vet the appropriateness of the assumed growth rates and demands. The end result is a more comprehensive approach to the projections which do not propose an excessively large facility (high cost and operational challenges) while at the same not taking away capacity that may be needed in the future. As a consulting firm regularly conducting water demand forecasting for utilities throughout the county and world, AECOM stands by its recommendations for the proposed 50 MGD facility.

OUCC DR 3-17

DATA REQUEST
City of Evansville

Cause No. 45545

Information Requested:

Showing calculations and inputs, please explain precisely how Evansville determined the initial leaks and losses volume of 3.50 MGD cited on page 18 of Attachment SMB-1.

Information Provided:

The estimate of leaks and losses was effectively established by first subtracting the total volume of water sold to customers from the total water pumped to the distribution system on an annual basis. These numbers are as follows:

Year	Water Supplied	Water Purchased	Net Loss (Year)	Net Loss (Day)
2014	8147 MG	6620 MG	1527 MG	4.18 MGD
2015	8074 MG	6740 MG	1334 MG	3.65 MGD
2016	8261 MG	6410 MG	1851	5.05 MGD

As shown in the table, the annual net losses are more than 3.5 MGD and are in fact quite high compared to most water utilities. However, EWSU has been undertaking extensive capital improvement projects in recent years to replace their aging cast iron waterlines, which are a core cause of water loss, and such improvements are now starting to be realized. It was therefore assumed that leakage would continue to trend downward through the planning period and was why a value of 3.5 MGD of water loss was considered. As a net impact, altering this value by +/- 1 MGD has little or no consequence on the proposed plant capacity.

OUCC DR 3-18

DATA REQUEST
City of Evansville

Cause No. 45545

Information Requested:

Please identify with relevant page numbers and provide any study, report, analysis or other authority used to determine initial leaks and losses volume of 3.50 MGD cited on page 18 of Attachment SMB-1.

Information Provided:

EWSU or other authority have not conducted a city-wide assessment to evaluate and publish the rate of leakage or total water loss. The 3.5 MGD value was established as part of our study as noted in the response to Question 3-17 and, in our opinion, is an accurate representation of water losses to consider through the planning period.

EVANSVILLE-VANDERBURGH COUNTY COMPREHENSIVE PLAN

2015-2035

June 27, 2016

EVANSVILLE-VANDERBURGH COUNTY AREA PLAN COMMISSION

Some of the highlights of the Plan include:

POPULATION

According to Census data, the population for both Vanderburgh County and the City of Evansville increased by 14,645 persons from 1990 to 2010. The Plan presents a County population projection of 202,224 people for the year 2035 as the most likely future scenario. This projection represents the high population growth scenario from the 2010 base year (a 12.53% increase) in comparison to the other population projection in the Plan calling for a moderate growth population trend (6.99%).

EMPLOYMENT

In recent years, County employment has continued to increase. By Year 2035, the County is projected to have approximately 24,699 additional employees which represents a 19.78 percent increase. Considering the major developments under construction or expected for the near future like the projects mentioned earlier, the County employment and economic outlook is bright.

FUTURE HOUSING NEEDS PROJECTIONS

The County is projected to gain approximately 10,898 more housing units by Year 2035 requiring an additional seven square miles of residential land. Due to the aging population, the type of housing in the future is expected to change from single family homes on large lots to a more dense mix of smaller single family, attached and multi-family housing. Of the many areas designated in the Plan for future residential use, the forecast used by the model in allocating new housing units showed that the City's east side is projected to experience the most residential growth, followed by northeastern Vanderburgh County outside the City.

Although these areas are one and two in residential growth, the forecasts in the Plan show a major reversal in the urban core decline trend by predicting Pigeon Township to have the third fastest growth over the next 20 years (2015 permit records show that Pigeon Township was the second fastest City/County residential growth area). It is anticipated that about 2,000 blighted homes mostly in Pigeon Township could be demolished in the next 5 to 10 years creating significant opportunities for redevelopment. The Plan also generally calls for protecting the residential character of neighborhoods from incompatible uses.

SECTION 4: DEMOGRAPHICS

DEMOGRAPHICS

POPULATION

This Section describes the local population using data from the 2010 Census. Knowing the characteristics of our local population is essential in developing a plan that is appropriate for the residents of our community.

EVANSVILLE METROPOLITAN STATISTICAL AREA

This discussion begins at the regional level, with Vanderburgh and the surrounding counties. Our region is known as the Evansville Metropolitan Statistical Area (MSA). The City of Evansville is the central city for our MSA.

> An MSA is defined by the Census Bureau as having at least one urbanized area of 50,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties.

The MSAs were established to provide statistics on geographic areas that include large urban areas and their closely interrelated surrounding counties. A map of the Evansville MSA counties is provided in Figure 11-1 in Section 11. Table 4-1 shows the growth of the counties in the Evansville MSA since 1960. The 2010 regional population was 358,676.

Table 4-1: Evansville Metropolitan Statistical Area (MSA) Counties and their Population: 1960 - 2010

COUNTIES	1960	1970	1980	1990	2000	2010
Gibson, IN	29,949	30,444	**33,156**	31,913	**32,500**	**33,503**
Posey, IN	19,214	21,740	26,414	**25,968**	**27,061**	**25,910**
Vanderburgh, IN	**165,794**	**168,772**	**167,515**	**165,058**	**171,922**	**179,703**
Warrick, IN	23,577	**27,970**	**41,474**	**44,920**	**52,383**	**59,689**
Henderson, KY	33,519	36,031	**40,849**	**43,044**	**44,829**	**46,250**
Webster, KY	14,244	13,282	14,832	13,955	**14,120**	**13,621**
County Total	286,297	298,239	324,240	324,858	342,815	358,676
MSA Total	**199,313**	**232,775**	**309,408**	**278,990**	**342,815**	**358,676**

Notes: BOLD numbers represent those counties that were in the MSA for that decade.
(The Evansville, Indiana-Kentucky MSA was redefined in 2013 to no longer include Gibson County, Indiana and Webster County, Kentucky)
Source: STATS Indiana, Population

VANDERBURGH COUNTY AND CITY OF EVANSVILLE

The 2010 Vanderburgh County population was 179,703 as shown on the next page on Table 4-2. There was very little change in the County population between 1960 and 1990. Between 1990 and 2010, the population grew by 8.9 percent. This is the highest level of growth the County has experienced over the last 50 years.

In regard to the City population, historical data indicates that the City continued to grow until 1960. Interpretation of this data is complicated by past annexations which resulted in added population. Figure 4-1 shows the growth in City land area by annexation from 1819 to the present. Since the City population peak in 1960, Table 4-2 shows consistent population decline to its 2010 total of 117,429. It is evident that Evansville has followed the strong national trend toward decentralization of population from the urban core into outlying areas (also known as out-migration or movement of residents from inside to areas outside the City). From 2000 to 2010, the City population decreased by 3.4 percent.

Population change results from two components: natural increase (births minus deaths) and net migration (people moving into the County minus those moving out). Table 4-3 on the next page reflects the components of population change from 1990 to 2000 and 2000 to 2010. The data shows the impact that the strong birth rate and migration had on the County population. Over the last 20 years, the out-migration trend of the 1980's reversed as the County is now strongly trending to positive net migration. As a result, contributions from both the birth rate and migration have provided a welcome boost to the County population totals over the last two decades.

Figure 4-1: City Growth By Annexation

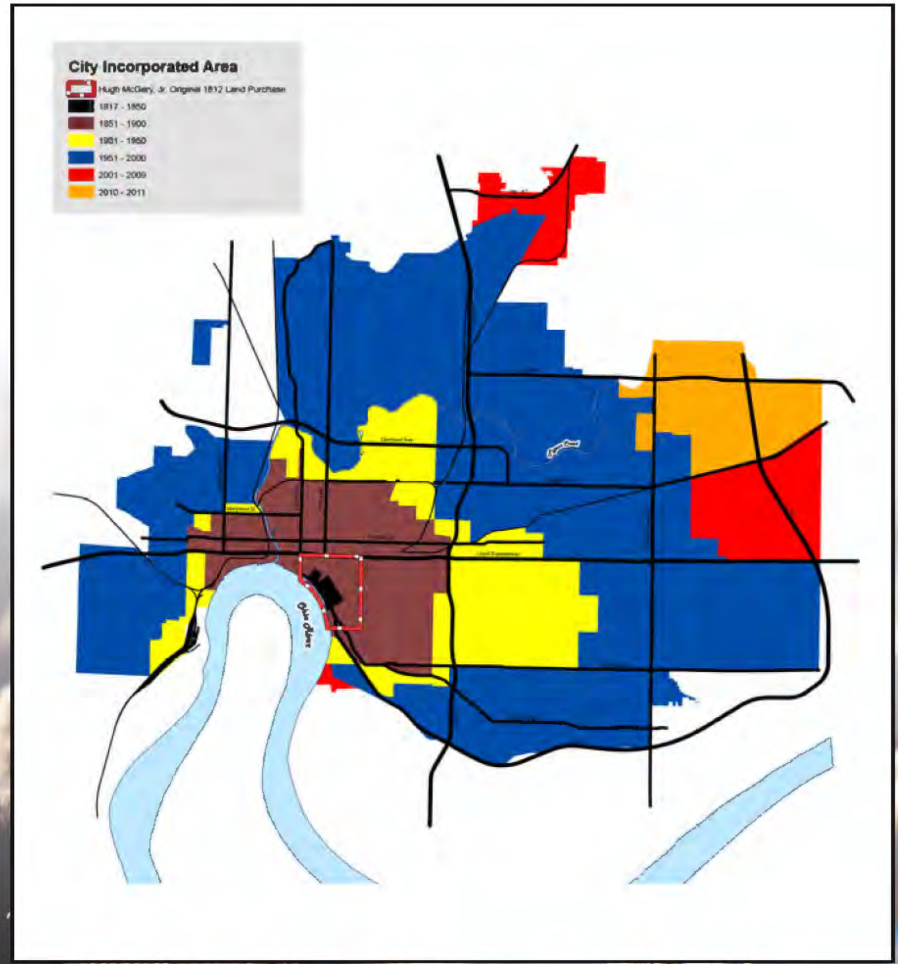


Table 4-2: Change in Population: Vanderburgh County and City of Evansville: 1950-2010

YEAR	COUNTY			CITY		
	POPULATION	AMOUNT OF CHANGE	PERCENT OF CHANGE	POPULATION	AMOUNT OF CHANGE	PERCENT OF CHANGE
2010	179,703	7,781	4.53	117,429	- 4,153	- 3.42
2000	171,922	6,864	4.16	121,582	- 4,690	- 3.71
1990	165,058	-2,457	- 1.47	126,272	- 4,224	- 3.24
1980	167,515	-1,257	- .74	130,496	- 8,268	- 5.96
1970	168,772	2,978	1.80	138,764	- 2,779	- 1.95
1960	165,794	5,372	3.35	141,543	12,907	10.03
1950	160,422			128,636		

Source: STATS Indiana, Population

Table 4-3: Components of Population Change for Vanderburgh County

YEAR	1990 to 2000		YEAR	2000 to 2010	
1990	Population	165,058	2000	Population	171,922
	Births	+ 22,787		Births	+ 28,844
	Deaths	- 17,311		Deaths	- 24,785
	Migration	+ 1,388		Migration	+ 3,772
2000	Population	171,922	2010	Population	179,703
	Net Change	+ 6,864		Net Change	+ 7,781

Source: Birth and death statistics are compiled by the Evansville-Vanderburgh County Health Department

GENERAL POPULATION CHARACTERISTICS

AGE

As shown in Table 4-4, the County population is aging. In the 2010 Census, the median age for Vanderburgh County was 37.5, which was more than 0.5 year older than the median age for the nation and state. Over the past 50 years, the median age has increased by six years, which is consistent with national and state trends. The largest increase in percentage of the overall County population was recorded in the over 65 age group, while declines in percentage occurred in the two youngest age groups shown on the Table. These trends are expected to continue in the future.

Table 4-4: Percentage of Population in Selected Age Groups: 1950-2010

YEAR	PRESCHOOL (0-4)	SCHOOL (5-17)	COLLEGE (18-24)	ADULT (25-64)	AGE 65 & OLDER	MEDIAN AGE
2010	6.47	15.72	11.80	51.60	14.41	37.5
2000	6.22	16.92	11.52	50.02	15.31	36.9
1990	6.93	16.95	10.08	50.32	15.72	34.5
1980	6.88	18.61	13.81	46.97	13.73	31.4
1970	7.48	25.39	10.81	44.75	11.56	30.3
1960	11.08	24.10	7.61	47.12	10.08	31.3
1950	10.81	18.94	10.32	51.86	8.06	30.8

Source: U.S. Census

The aging population trend results from an increase in life span and a decline in birth rate. Continuation of this trend will directly impact the City and County by affecting the types of services and facilities the population will require. Senior housing, parks and recreation, transportation, medical care, and education are only some of the services that will be affected by this age shift.

SEX

The percentage of population that is female (51.8%) is higher than that for males (48.2%). These percentages have changed very little (1%) since the 1950 census. Compared to Indiana and the nation, Vanderburgh County has had a slightly higher percentage of female population since 1950 (1%).

RACE

The U.S. Census divides population into four minority groups, including Blacks, American Indians, Asians, and other races. In the 2010 Census, the minority population in the County was 13.8 percent of the population. This was a 4 percent increase from 2000 toward diversity. Further analysis shows that 14.7 percent of the minority population lives in the unincorporated part of the County, while 85.3 percent live in the City. Historical County data on minority population is shown in Table 4-5.

Table 4-5: Percentage of County Population by Race: 1950-2010

YEAR	WHITE	BLACK	AMERICAN INDIAN	LATINO	ASIAN	OTHER
2010	85.18	9.03	.19	2.15	1.10	2.33
2000	88.68	8.15	.16	.97	.75	1.24
1990	91.25	7.51	.19	.43	.57	.05
1980	91.87	7.15	.15	.44	.36	.02
1970	93.73	6.09	.06	n/a	.05	.06
1960	94.19	5.76	.01	n/a	.02	.01
1950	94.26	5.71	.00	n/a	.01	.00

Source: U.S. Census

DEMOGRAPHIC CHARACTERISTICS OF HOUSEHOLDS

The following analysis examines demographic and housing characteristics. Data on these characteristics can shed light on the strategies and programs that are needed to have a viable housing sector in our community. This analysis of county-wide housing statistics was obtained from the 2010 Census, 2006-2010 American Community Survey 5-year estimates and from the 2010-2014 Comprehensive Housing and Community Development Plan prepared by the Department of Metropolitan Development DMD.

HOUSING UNIT TOTALS

The U.S. Census Bureau classifies living quarters as either housing units or group quarters. A housing unit is a house, an apartment, or a mobile home. The housing unit growth in Vanderburgh County and the City of Evansville over time is shown on Table 4-6. In 2010, the County had a total of 83,003 housing units, including those in the City; and Evansville had 57,799 units. This data indicates that the number of housing units has continued to increase significantly in the unincorporated County, while in the City housing units peaked in 1990 and have stayed just below that level since then. Most of the recent growth has occurred in unincorporated Center and Scott Townships. Overall, the rate of growth for housing has been exceeding the growth of the general population. Since 1990, the housing unit total in the County has grown by 14.3 percent, while the County population grew 8.9%.

TYPE OF DWELLING UNIT

There is a variety of dwelling unit types in the County from single-family homes to multi-family rental units. The most prevalent type of dwelling unit found in Vanderburgh County and in the City of Evansville is the single-family house as shown in Table 4-6. In 2010, 71.5 percent of the total units in the County were classified as single family, while the data shows that the City offers somewhat more housing options.

Table 4-6: Housing Units, Percent Single Family, Percent Built before 1939

YEAR	VANDERBURGH COUNTY			EVANSVILLE		
	TOTAL HOUSING UNITS	% SINGLE FAMILY	% BUILT BEFORE 1939	TOTAL HOUSING UNITS	% SINGLE FAMILY	% BUILT BEFORE 1939
2010	83,003	71.50	22.20	57,799	67.80	28.20
2000	76,300	70.66	21.28	57,065	66.84	25.72
1990	72,637	69.31	25.81	58,188	65.14	29.29
1980	67,502	82.77	34.21	54,210	80.88	38.90
1970	58,011	77.14	47.23	49,139	74.32	51.27
1960	55,082	84.28	59.60	47,744	81.94	62.64
1950	49,573	66.95	75.62	40,819	61.40	78.38

Source: U.S. Census

HOUSEHOLD SIZE

The U.S. Census Bureau defines a household as all persons who occupy a housing unit. The changing age structure of the population and housing supply are among many factors that will affect the size and composition of future households. Generally, household size is the lowest in the City center and climbs with distance from the center.

The 2010 household size in Evansville (2.23) and Vanderburgh County (2.31) are both lower than for the nation and state (at 2.52). Table 4-7 illustrates a downward trend for household size in Evansville/Vanderburgh County. This trend is a result of several factors including our aging population, and changes in family structure.

Table 4-7: Occupied Housing Units, Tenure and Persons Per Household

YEAR	VANDERBURGH COUNTY				EVANSVILLE			
	OCCUPIED HOUSING UNITS	PERCENT OWNER OCCUPIED	PERCENT RENTER OCCUPIED	AVERAGE PERSONS/ HOUSEHOLD	OCCUPIED HOUSING UNITS	PERCENT OWNER OCCUPIED	PERCENT RENTER OCCUPIED	AVERAGE PERSONS/ HOUSEHOLD
2010	74,454	64.50	35.50	2.31	50,588	56.00	44.00	2.23
2000	70,623	66.81	33.19	2.33	52,273	59.95	40.05	2.24
1990	66,780	64.82	35.18	2.40	52,948	58.98	41.02	2.30
1980	64,030	65.90	34.10	2.55	51,310	61.98	38.02	2.46
1970	54,771	68.69	31.31	3.00	46,404	65.01	34.99	2.90
1960	50,642	69.17	30.83	3.21	44,042	66.58	33.42	3.14
1950	47,597	58.86	41.14	3.29	39,403	54.69	45.31	3.20

Source: U.S. Census

DEMOGRAPHICS

GROUP QUARTERS

All persons not in households are classified by the Census Bureau as living in group quarters. Out of the 2010 total County population, 4.2% lived in group quarters. Table 4-8 shows the housing types of the group quarters population. Just over half of the non-institutional group quarters population are college students living in university housing managed by the University of Evansville and University of Southern Indiana. Nursing homes and the County Jail are examples of institutional group quarters.

Table 4-8: Vanderburgh Co.: Population by Type of Group Quarters

GROUP QUARTER TYPE	POPULATION	% OF GROUP QUARTER POPULATION
INSTITUTIONALIZED		
Adult Correctional Facility	691	9.2
Nursing Homes	1,497	19.9
Other	218	2.9
Total	2,406	31.9
NONINSTITUTIONALIZED		
University Housing	3,886	51.6
Other	1,239	16.5
Total	5,126	68.1
TOTAL	**7,531**	**100.0**

Source: 2010 Census

HOUSEHOLD INCOME

Household incomes since 1960 for the City and County are displayed in Table 4-9. The City median household income from the 2010 American Community Survey 5-year Estimate was $35,469, and the County estimated income was $42,369. Both of these median household income figures are well below that of the State and Nation. Generally, incomes are the lowest at the City center and climb with distance from the center. The population with income below poverty level in the County was estimated at 28,003 or 15.6% in 2010, an increase from the 11.2% living below poverty in 2000.

Table 4-9: Median Household Income

YEAR	VANDERBURGH COUNTY	EVANSVILLE
	HOUSEHOLD INCOME	HOUSEHOLD INCOME
2010 ACS	$42,369	$35,469
2000	$36,823	$31,963
1990	$25,798	$22,936
1980	$16,070	$14,565
1970	$ 7,697	$ 7,255
1960	$ 5,405	$ 5,299

Source: Decennial Census and 2010 American Community Survey 5-year Estimates

AVERAGE MONTHLY HOUSING COST

The census definition for monthly costs attributed to housing is the sum of rent or mortgages, taxes, insurance, and utilities. The conventional public policy indicator of housing affordability in the United States is the percent of income spent on housing. These expenditures that exceed 30 percent of household income have historically been viewed as the threshold indicating a housing affordability problem, or housing that is burdened by excessive costs. For example, a family earning the median household income in the City having monthly housing costs greater than $887.00 would be considered as burdened.

The percentage of households burdened by housing costs since 1960 for the City and County are shown in Table 4-10. In 2010, 22.7 percent of owner occupied units and 53.1 percent of renter occupied units were burdened in the City, which results in an estimated total of 17,612 City households burdened affecting more than 35,000 household residents. The percentages for the County were slightly lower. The negative impacts of housing cost-burden on households can result in insufficient resources for families to cover other critical needs; the threats of mortgage default; eviction and homelessness; and unhealthy levels of stress.

Table 4-10: Percent of Households Burdened by Housing Costs

YEAR	VANDERBURGH COUNTY		EVANSVILLE	
	OWNER	RENTER	OWNER	RENTER
2010 ACS	20.7	52.8	22.7	53.1
2000	15.0	35.3	16.2	35.2
1990	13.4	37.6	14.5	38.1
1980	14.1	33.3	14.8	34.2

Source: Decennial Census and 2010 American Community Survey 5-year Estimate

DEMOGRAPHICS

DESCRIPTIVE AREAS

In analyzing the 2010 Census data for Vanderburgh County, it is apparent that certain areas have similar demographic characteristics. An effort has been made to identify and map these areas to:

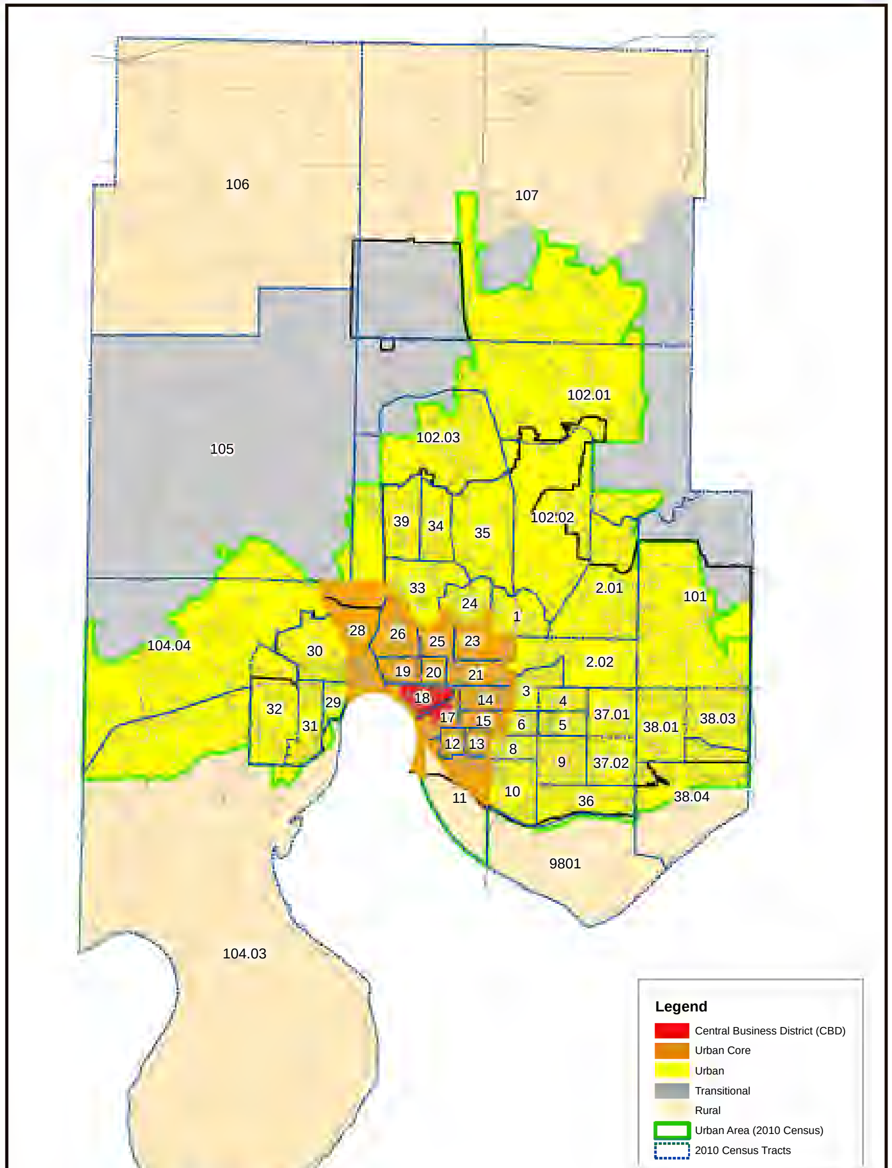
1. Better understand the demographic characteristics, similarities and differences in the Census Tracts that make up the County; and
2. Provide descriptive areas that can be referred to throughout the Plan.

The following variables and what they measure or reflect were used in identifying the descriptive areas:

- Population Density
- Longevity In The Same Residence
- Owner/Renter
- Housing Built Before 1939
- Vacancy

The analysis of Census data for these select demographic variables resulted in the identification of five distinct areas within the County. The five Descriptive Areas illustrated on Figure 4-2, were established using census tract/block group boundaries. The following is a general discussion of each descriptive area.

Figure 4-2: Descriptive Areas



Source: Area Plan Commission Analysis of 2010 Census

CENTRAL BUSINESS DISTRICT

The Central Business District (CBD), the traditional downtown area for the City of Evansville, is Census Tract 18. It is the location where the City of Evansville began in 1819. Today, the Evansville CBD can be characterized as a regional financial center with significant service, entertainment, and government sectors.

URBAN CORE

The Urban Core area can be characterized as having population densities greater than in the City as a whole. Applying other criteria, this portion of the City has a higher percentage of homes built before 1939, a higher renter-occupied housing percentage, and higher vacancy rates than found in the City as a whole. Its boundaries are nearly the same as Pigeon Township. Most of the City's redevelopment efforts focus on this area.

URBAN

The primary criterion used to identify this area was the Census Bureau's Urban Area designation. Other defining characteristics of this area include: lower vacancy rates, more owners than renters, and higher percentage of residents who have lived in the same house when compared to the City as a whole. Although this area is predominantly residential, many of the community's commercial areas are located in this zone. Most of the Urban area within the City has been annexed since 1950, and can be characterized as being suburban style development.

TRANSITIONAL

The main characteristic of this area is that it has a population density between that of the Urban Area (as defined by the Census Bureau) and that of Indiana as a whole. Land uses in the Transitional area are being converted from agricultural or open land to suburban uses, primarily residential subdivisions. This area forms a growth ring around the City. The development of this area increases the urban footprint and extends the infrastructure service area, in lieu of infill or redevelopment closer to or in the City core.

RURAL

The Rural area is identified as having a population density less than the State of Indiana as a whole, and a higher percentage of rural farm households than any other area in the County. The dominant land use in the Rural area is agriculture, along with some scattered woodlands, villages, and single-family homes. Most of the residences in this area use septic systems for sewage disposal since public sewers are not available. Growth in this area potentially presents problems such as traffic and farm versus new subdivision conflicts.

FUTURE DWELLING NEEDS ANALYSIS

2035 POPULATION PROJECTIONS

The population size of a city or county gives an indication as to the dimensions of the man-made environment. It supplies a base measurement from which current estimates of needs can be made. When planning for the future, estimates or projections of the population size are essential to quantify the “target” population for the planning process, which helps determine what tomorrow's needs might be.

As shown in the Historical Population graph on Figure 6-5, the population of the County has experienced both growth and decline. In the past 20 years (1990-2010) the County grew by 8.9%. Past trends are one of the factors considered in the methodologies used for calculating the population projections.

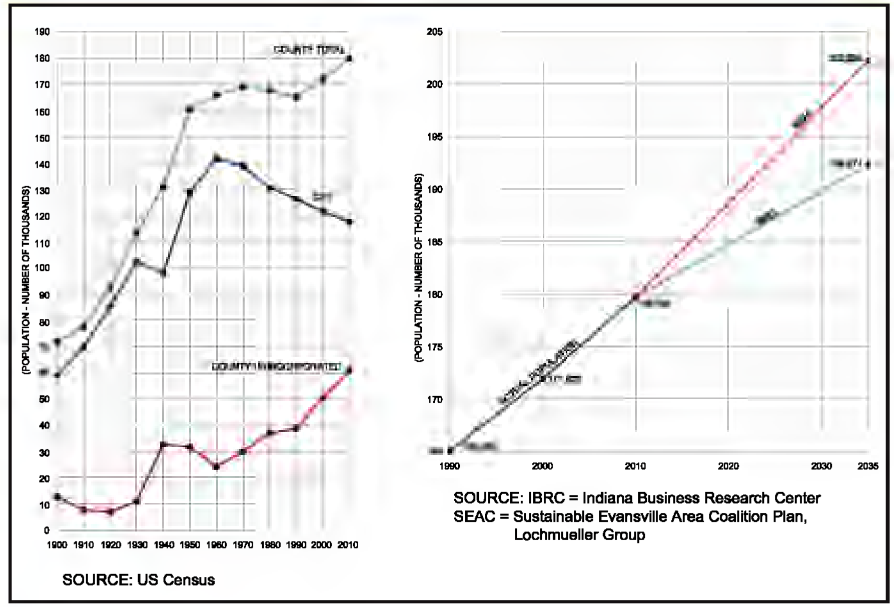
It is common practice for comprehensive plans to use a 20-year horizon as the planning period. To be consistent with standard planning practice and our previous comprehensive plans, this Plan projects the population to Year 2035.

There are many methods that can be used in population projections with each producing somewhat different results, and some being better or more scientific than others. For this reason, the two Vanderburgh County population projections presented below for comparison, discussion and analysis are the two most recently published projections for the County. The range of these future population figures provides a moderate and a high projection alternative for the County.

The Indiana Business Research Center (IBRC)

The IBRC, the demographic clearinghouse for the State of Indiana, produced population projections in 2012 for all Counties in Indiana. Their projections are developed using the Cohort Survival Method, which involves the distribution of the population into age cohorts. It forecasts the age groups forward into the future, applying past birth and death rates, and factoring the impact of migration. The results of the IBRC methodology predicts a 2035 population of 192,271 persons.

Figure 6-5: Historical and Projected Population



SEAC Plan

The Sustainable Evansville Area Coalition (SEAC) Regional Plan for Sustainable Development compared the projections from the IBRC, Kentucky State Data Center (KSDC), and Woods & Poole Economics, Inc. Population projections from Woods & Poole are based on trends in economics, population and employment over time. These three data sources were compared to straight-line trends for the three counties included in the SEAC Plan, and a line of best fit was calculated to produce a composite population projection for the entire three county area. A land use model was used to distribute population between all three counties based on higher or lower amounts of infill development. Of these infill scenarios, the one selected as the best fit for the future development pattern in the SEAC Plan resulted in a 2035 County population projection of 202,224 people. Table 6-4 summarizes these County population projections that provide both a moderate and high growth scenario.

Table 6-4: CommunityViz Modelling Population Projections

Source	2010 Census Population	2035 Projected Population	Amount & Percent of Change
IBRC	179,703	192,271	12,568 (6.99%)
SEAC	179,703	202,224	22,521 (12.53%)

Sources: Indiana Business Research Center and the Sustainable Evansville Area Coalition Regional Plan for Sustainable Development

These projections quantify our growth and show a relatively bright outlook for the County population in the future. The SEAC projection would involve significantly higher in-migration than the IBRC projects. Some of the recent and expected positive developments in regard to future population are that:

- Employment and business establishments in the County continue to steadily increase according to the IU Kelley School of Business short-term forecasts of employment and income; and the currently improving national economic trends suggest a strong local economy for the foreseeable future.
- Employment and quality of life factors will continue to attract new residents to Vanderburgh County (in-migration) and also play a role in keeping current residents here. One of the most important findings from the 2010 Census was that the County continued to grow at a steady rate even though in the later years of the last decade the economy was in a significant recession.
- A strong natural population increase is expected to continue to occur in both the County and region.
- Positive impacts are expected from the completion and opening of I-69, the downtown convention hotel, and the IU School of Medicine.

ALLOCATION OF HOUSEHOLDS AND EMPLOYMENT

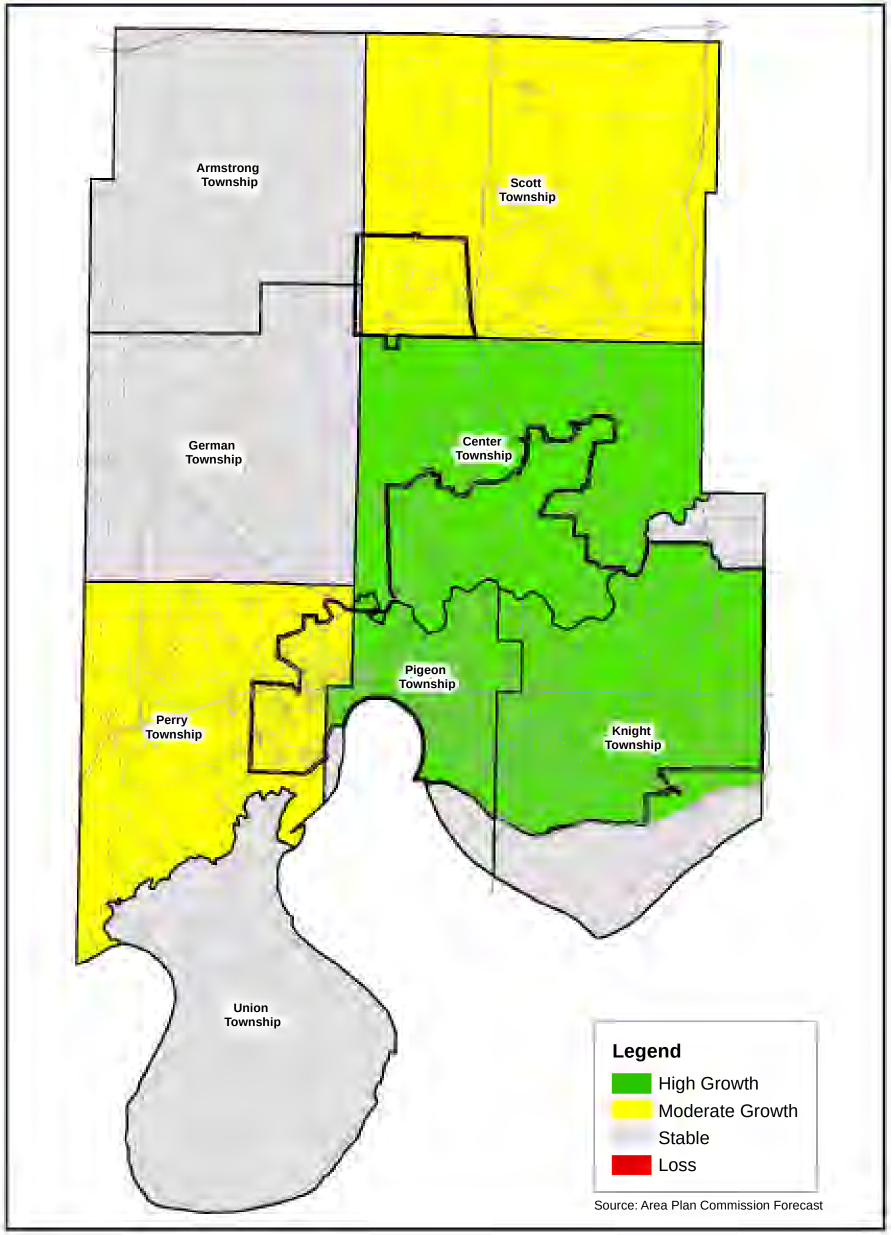
Once all of these steps are complete, CommunityViz allocates households and employment to parcels in the County based on the maximum number of households permitted or the maximum commercial square footage feasible, household and employment projections, and the suitability score of each parcel.

Based on the SEAC Plan 2035 County population total, the land use model calculated estimates for occupied housing units for each township. Table 6-5 shows the projected amount of occupied housing change between 2010 and 2035 by Township. The Table also shows the future population projections for Townships based on the occupied housing projections from the land use model, and an APC analysis assigning population into the projected 2035 housing. The assumptions used in these calculations were based upon recent Census data trends and the following assumptions:

- The percentage of occupied housing to the total number of housing units will stay consistent with the current trend;
- The number of institutional and group quarter residents will remain the same;
- Average household size will continue to decline;
- The estimate of total housing units needed for the 2035 population is for occupied units (projecting volatile vacancy rates is problematic); and
- The density of new single and multi-family housing (measured by average housing units per acre) will increase.

The final results of the modeling process are shown in Table 6-5 and Figure 6-6, which illustrate the projected amount of change in occupied housing units between 2010-2035 by Township. Comparing the historic growth data for residential units on Figure 6-1 with the anticipated growth shown on Figure 6-6, it is evident that growth trends are expected to change somewhat. Knight Township, located mostly within the City but also partially in the unincorporated County, is expected to be the fastest growing area through Year 2035 with a gain of 3,808 households (or almost a 13 percent increase) and an additional 7,133 new residents. Center Township, which has been the leading growth area in the County for many years, is projected to have the second highest gain. The majority of this growth is still projected to be single-family houses, although it is expected to also include a variety of housing types.

Figure 6-6: 1990 - 2010 Housing Change by Township



For other areas, this forecast shows significant growth projected for the City, while Armstrong, German and Union Townships are to remain stable. In Pigeon Township, the trend of decline is expected to transition to infill growth for the neighborhoods surrounding the downtown. Instead of the decline that has gripped the Urban Core since the late 1950's, Pigeon Township is projected to add almost 2,000 new households representing a 16 percent increase from the 2010 total, and over 4,000 additional residents by Year 2035. This projected change would be both exciting and refreshing news, as past perceptions of the Urban Core would become invalid once major redevelopment and new construction begins to transform the area. The current options for buying new housing are nearly all located in the unincorporated County. However, as redevelopment occurs in the Urban Core, the options for new housing in the City will also increase, expanding the residential market in that area. Revitalizing Pigeon Township is the biggest challenge facing the future of Evansville.

Table 6-5: 2010-2035 Population and Housing Change by Township

	Population				Occupied Housing Units			
	2010 Census	2035 Projection	Amount of Change	Percent of Change	2010 Census	2035 Projection	Amount of Change	Percent of Change
Vanderburgh	179,703	202,224	22,697	12.63%	74,454	85,352	10,898	14.64%
Armstrong TWP	1,599	1,817	218	13.63%	604	695	91	15.07%
Center TWP	39,007	43,842	4,835	12.39%	15,478	17,691	2,213	14.30%
German TWP	7,441	8,145	704	9.46%	2,791	3,096	305	10.93%
Knight TWP	67,945	75,078	7,133	10.50%	30,070	33,878	3,808	12.66%
Perry TWP	25,092	27,777	2,685	10.70%	9,904	11,253	1,349	13.62%
Pigeon TWP	29,797	33,836	4,039	13.55%	12,275	14,262	1,987	16.19%
Scott TWP	8,528	11,437	2,909	34.11%	3,191	4,336	1,145	35.88%
Union TWP	292	292	0	0%	141	141	0	0%

Source: 2010 Census; Housing Projections from Land Use Model and Population Projections from APC Analysis

SECTION 17: PUBLIC UTILITIES

PUBLIC UTILITIES

The public utilities addressed in this section are water, sanitary sewer, storm sewer/ drainage, and solid waste. The other utilities that serve the community such as cable (television and internet), electric, trash collection, natural gas, and telephone (land and cell) are private. The location and availability of water and sewer utilities are essential in order for land development to occur. Therefore, the capacity and extension of public utilities are effective tools to allow for and guide growth.

The Evansville Water & Sewer Utility mission is:

> *To provide the Evansville metro area with high quality, safe, dependable water and sewer service at rates which encourage economic development. The Utility will manage land and water resources to ensure quality for future generations.*

WATER

The Evansville Water Utility has a service area of approximately 100 square miles. Figure 17-1 shows the Evansville Utility Direct Water Service Area. Water is provided to approximately 93 percent of the residents within Vanderburgh County. The population served is approximately 163,000, and the Water Utility has a total of 60,000+ residential and commercial customers. It also has four wholesale customers: the German Township Water District in Vanderburgh County and three others in Gibson and Warrick Counties. The German Township Water District also serves Armstrong Township and some of Posey County.

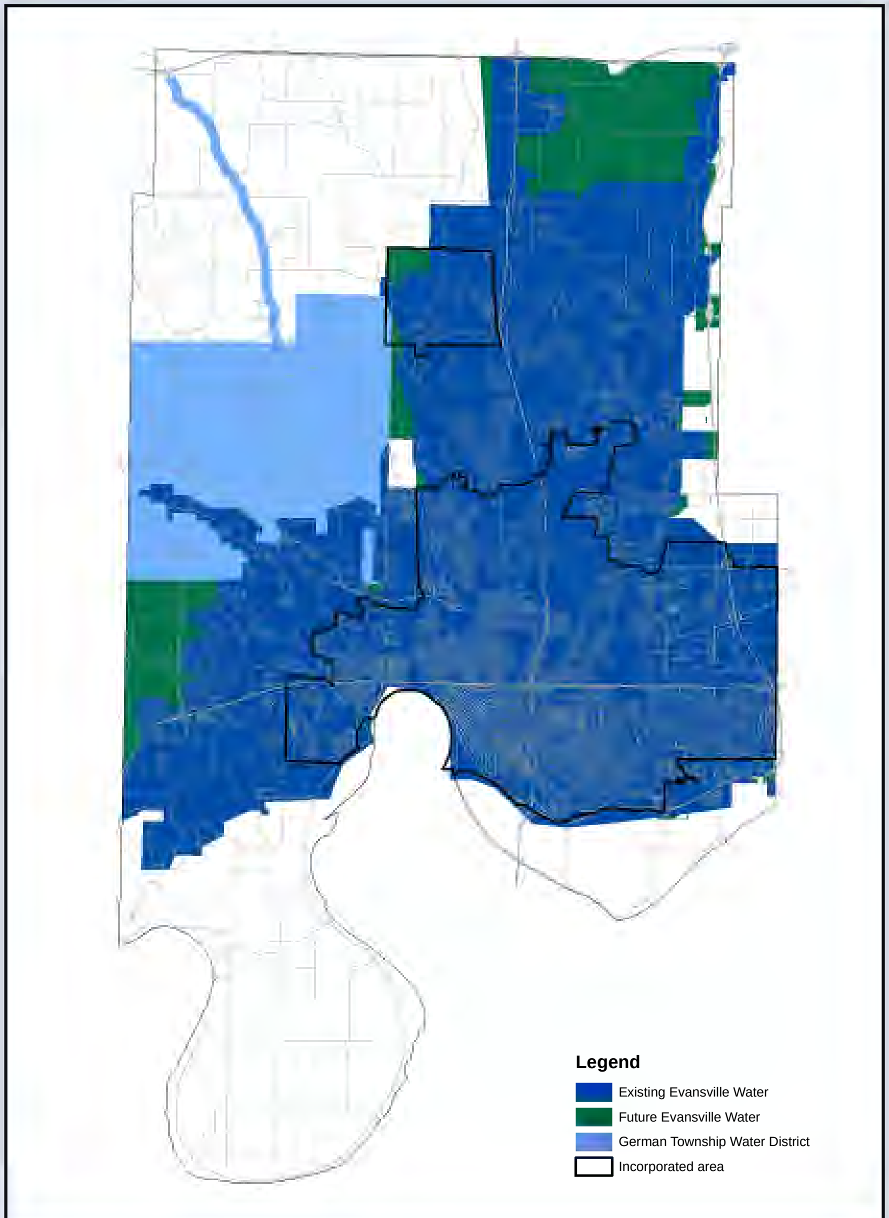
EXISTING FACILITIES

The source of water for the system is the Ohio River. The intake water is treated to potable standards in a treatment plant located just southeast of and upriver from downtown Evansville. The Evansville Water Treatment Plant first supplied treated water to the City in 1912. Since then, the plant has been expanded and modernized several times. The treatment processes must comply with the federal standards and requirements of the Safe Drinking Water Act. This plant has a filtering capacity of 60 million gallons per day (MGD). The average daily amount of water processed and treated is 35 MGD, while the average pumped to customers is 29 MGD. In 2014, it had a one day maximum of 45.4 MGD of water filtered. The plant's seven existing raw water supply pumps have an 80 MGD capacity, greatly exceeding projected needs.

The distribution system includes approximately 1,000 miles of water mains, seven existing pumping stations of varying capacity, and approximately 6,000 fire hydrants. The Evansville water system contains eight water storage facilities ranging in size from 500,000 gallons to 20 MG. The total system storage capacity is 37 MG.

One of the major challenges the Utility faces is its aging infrastructure and equipment. This, in fact, is a national challenge facing most communities across the United States. The Evansville water system was constructed in the early 1900s. Most of the water lines are cast iron, which are at the end of their life and increasingly require maintenance and expensive repairs to stay operational. Line breaks often cause collapse of the street. These necessary repairs continue to increase the Utility operating costs. The state of the system is due to years of under investment and lack of a long term capital plan for system-wide older water line replacement.

Figure 17-1: Water Service Area (approximate)



FUTURE CAPACITY

Table 17-1 illustrates the projected amount of water that will be required on a daily basis to meet future demands on the Evansville water system. The 10-year projection from the 2009 Water Master Plan was based on the areas designated for future growth in the 2004 Evansville-Vanderburgh County Comprehensive Plan. The 2035 projected water demand will need to accommodate the areas planned for development on the Future Land Use Map in Appendix I. The projected rate of population growth of about seven percent through 2035 should be a good indicator of future water needs. The table below shows that the 2035 daily water use is projected to increase by 4 MGD from the 2014 level to a total of 33.8 MGD.

Table 17-1: Projected Average Day User Demand
in MGD (Million Gallons per Day)

Existing Filtering Capacity	2014	2018 Projected	2035 Projected*
60	29.7	31.5	33.8

Note: * Projection from Water Master Plan extended at same growth rate to 2035

RECOMMENDED WATER SYSTEM IMPROVEMENTS

The primary responsibility of the Evansville Water Utility is to provide customers with an adequate supply of high quality water at acceptable pressures. In order to evaluate whether the system is accomplishing this responsibility, periodic hydraulic analyses are conducted. These identify deficiencies in the distribution system and facilitate the establishment of an improvement program designed to reinforce the existing system, keep pace with growth, assure high quality water service, and provide a reliable base for commercial and industrial development.

A Capital Improvement Projects (CIP) list was developed to address the improvement needs through Year 2018. The total cost of the capital water projects proposed to 2018 is $90 million dollars. With the current and projected demands, the CIP developed for the water filtration plant and the distribution system will keep the system at least 20 percent ahead of demand through Year 2018. The 2035 projected daily user demand of 33.8 MGD is well below the existing 52.5 MGD filtering capacity at the Water Plant. Therefore, unless water demand is much higher than currently anticipated, there should be adequate excess water capacity in 2035. A new 30-year Water Master Plan will be completed in 2016 which will explore and make recommendations for plant capacity and distribution system improvements.

SEWER

The area where sewer service is currently available includes the City of Evansville and the portions of Vanderburgh County shown on Figure 17-2. This area contains approximately 60 square miles. Buildings in the portions of the County located outside of the existing sewer service area are on individual septic systems. The Town of Darmstadt's pressurized sewer system connects to and discharges sewage through the Evansville wastewater collection and treatment system.

EXISTING TREATMENT FACILITIES

The Water and Sewer Utility owns, operates, and maintains the City sewer system including two wastewater treatment plants (WWTP) referred to as the East and West Plants. Built in 1954 and 1956 respectively, the WWTP's have undergone several improvement and upgrade projects over the years. Table 17-2 describes the two plants' capabilities.

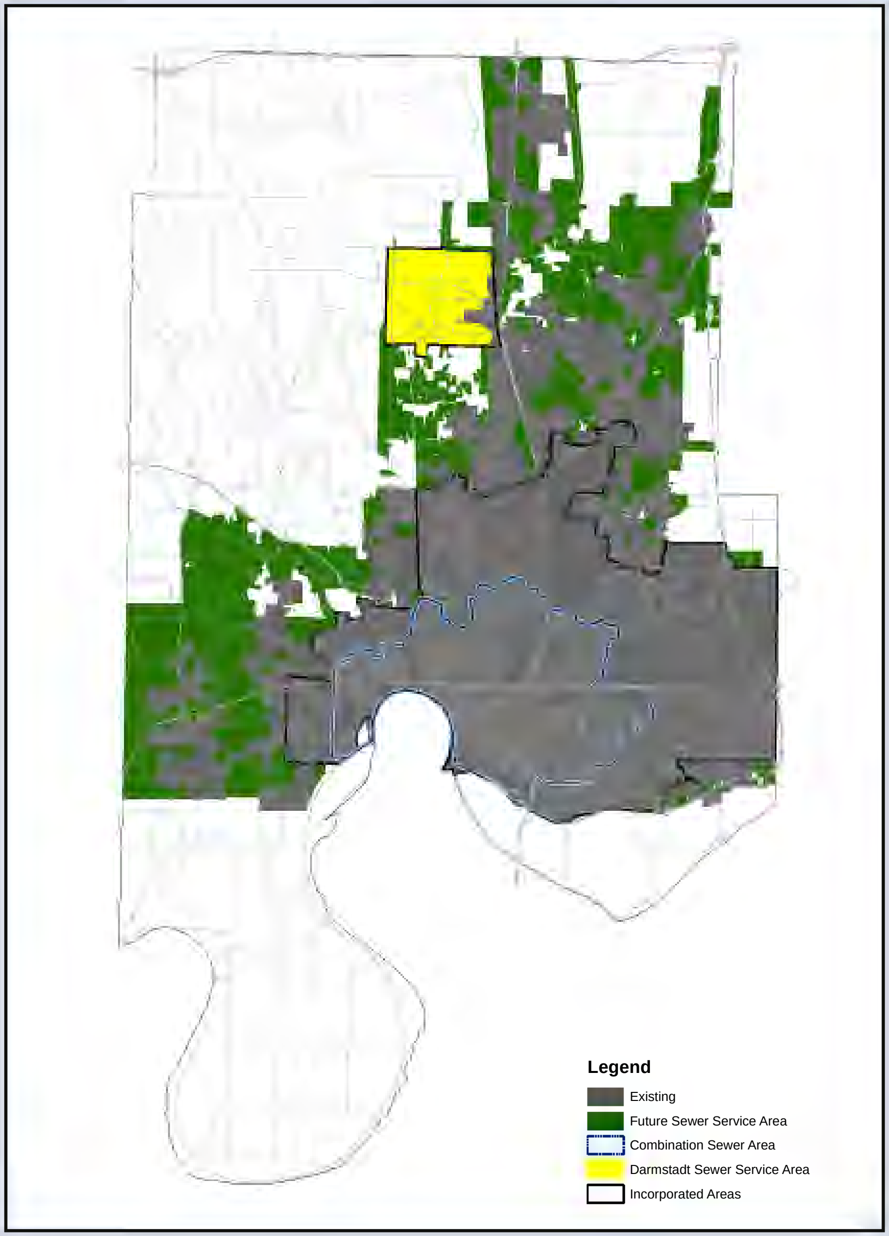
Table 17-2: Treatment Plant Statistics
in MGD (Million Gallons per Day)

Plant	Treatment	Design Capacity	2014 Process Average Flows
East	Secondary	22.5	12
West	Secondary	30.6	12

COLLECTION

The collection system contains approximately 890 miles of sewer collector lines and 93 lift stations. Some of these collectors carry separated wastewater and some carry combined wastewater and storm water. The construction of separate systems has been required for all new development since the mid 1970's.

Figure 17-2: Sewer Service Area (approximate)



COMBINED SEWERS

The first wastewater collectors to be installed were the combination storm water and sanitary sewers. These combined sewers were made of brick and many of them were built over 100 years ago. There are over 500 miles of combination sewer lines in the system. The majority of the older areas of the City (south of Pigeon Creek, roughly west of Vann Avenue and east of Tekoppel Avenue) are served by the combined collectors. This area is shown in the Sewer Service Area Map in Figure 17-2.

During heavy rainfall, Evansville residents are all too familiar with the problems associated with the combined system. These problems include local street flooding, reduced capacity and efficiency of the treatment plant operations caused by treating storm water, sewers backing up into basements, and direct sewage overflow discharge. When the amount of storm water in the system exceeds plant capacity, the overflow gates open to allow the contents of the combined sewers to discharge directly into the Ohio River and Pigeon Creek. These gates and discharges are known as combination sewer overflows (CSOs). There are a total of 22 permitted CSO outfalls in the collection system -- nine discharge into the Ohio River, nine into Pigeon Creek and four into Bee Slough. To provide a quantitative figure on the magnitude of this problem, the Utility estimates that 2 billion gallons of sewer overflow are discharged on an average annual basis.

The City has made progress over the years to separate the sewer systems. In conjunction with major road widening projects, the City has separated the storm and sanitary sewers along corridors such as St. Joseph Avenue, Weinbach Avenue, Fulton Avenue, Diamond Avenue, and Vann Avenue. Areas that will benefit from future separation projects include both sides of Diamond Avenue, the State Hospital, and around Akin Park.

More than a thousand cities throughout the United States have or have had combined systems similar to Evansville's. To meet U.S. Clean Water Act standards, these cities must eventually eliminate combination sewers, and many of them are currently going through the process of making system changes to comply with this mandate. The list includes cities in Indiana such as Indianapolis, Fort Wayne and South Bend.

To this end, the City of Evansville Water and Sewer Utility entered into a Consent Decree with the federal government and the State of Indiana in February, 2011 on a plan to address the combination sewer overflow volumes through remedial actions. Consent Decree modifications were agreed to by the parties in February, 2016 in final negotiations that resulted in additional projects being included in the CSO plan at an estimated total cost of $729 million to be phased in over the next 24.5 years. The effort to comply with the Consent Decree and the specific mandates of the agreement with state and federal regulators is known as "Renew Evansville". In accordance with the agreement, the Utility developed an integrated set of specific planning documents creating:

- An overall capital improvements plan for the Combined Sewer and Sanitary Sewer Systems, referred to as an Integrated Overflow Control Plan (IOCP), which proposes to remedy the capacity, operation and maintenance deficiencies in the Sewer Systems and the East and West Treatment Plants. The IOCP contains two distinct parts: the Sanitary Sewer Remedial Measures Plan (SSRMP); and the Long Term Control Plan (LTCP).
  - The SSRMP is a prioritized set of projects focused on identifying and addressing any recurring capacity-related sanitary sewer overflows, system defects, and deficiencies that could potentially cause or contribute to overflows; and
  - The new LTCP identifies strategies to reduce the frequency and duration of overflows from the combined sewer system.

Major IOCP Projects and Consolidated Cost Estimates (in millions)

• Work at CSO Locations	$284.06
• Treatment Plant Improvements	$107.00
• Seventh Avenue Lift Station	$110.79
• Wetland at Bee Slough	$151.20
• Downtown Green Infrastructure	$ 18.03
• Sanitary Sewer Upgrades	$ 53.56

Under the new modified terms of the Consent Decree, 98 percent of the sewage overflow that currently goes into the Ohio River will be captured, allowing Evansville to comply with the Clean Water Act. Additionally, EWSU will create one of the largest wetland treatment systems in the U.S., replacing Bee Slough with a sustainable, green infrastructure solution. Other upgrades include the addition of several storage facilities, improvements to the wastewater treatment facilities, and the separation of combined storm water and sanitary sewers.

The City will use a combination of options to eliminate sanitary sewer and combination sewer overflows by: continuing to separate storm sewers from the combined sewers; reducing the amount of storm water entering the system; increasing storage prior to treatment; increasing treatment plant capacity; and adding satellite treatment. As part of the last option mentioned, the Utility's strategy will also involve a Green Infrastructure (GI) component. The GI initiative will include ways to eliminate storm water from entering the combined sewers by increasing infiltration (green areas allowing percolation of water into the soil), interception/absorption by new trees and other plantings; and storm water reuse. Implementation of the GI initiative will likely involve policy and ordinance changes.

Given the importance of the Consent Decree, complying will be a major emphasis of the Water and Sewer Department for the foreseeable future. The City's goal is to accomplish compliance in a manner that minimizes sewer rate increases needed to fund system improvements. Achieving this goal, however, will be complicated by the fact that Renew Evansville will be the most extensive and costly capital improvements initiative ever undertaken by the City.

RECOMMENDED WASTEWATER IMPROVEMENTS

A system-wide wastewater plan was prepared for the City in 2009 by a consultant. This Plan addressed existing deficiencies and future needs by identifying a list of recommended long-range capital improvement projects to be implemented. This plan will expire in 2018 and a new master plan effort is underway to run parallel with the Consent Decree. A new 30-year Wastewater Master Plan will be completed in 2016 which will explore and make recommendations for non-Consent Decree projects including lift station rehabilitation, waste treatment plant modification for pending additional regulations, collection system rehabilitation, and collection system expansion for projected growth.

There are several projects related to CSOs currently underway or in the planning stage involving the addition of green infrastructure, underground storage and infiltration of storm water, inflow and infiltration reduction projects in the sanitary sewer system, large interceptor cleaning, and the addition of inlets in Bee Slough. Aside from these current projects, the final approved IOCP, along with the non-IOCP project list, will contain a well defined project list of improvements for the City to work from. Implementation of these improvements by the City will fulfill the federal mandate.

Extensions of the existing sewer service area are expected to occur in the future to serve new development. Figure 17-2 shows the recommended 2035 future service area. This area is based upon past growth patterns, the results of the land use model and the Area Plan Commission 2035 growth projections.

The areas recommended for sewer service extension are:

- The remaining un-served pockets in the City;
- The remaining un-served portions of unincorporated Center Township;
- The areas around the Boonville-New Harmony/I-69 and S.R. 57/I-69 interchanges due to growth expected from the I-69 project; and
- Western unincorporated Perry Township including the area around the University Parkway south of Upper Mt. Vernon Road.

Sanitary sewer improvements must be in place for extensive development to occur. Proper utility planning is needed to guide utility extensions to serve these growth areas.

WATER AND SEWER UTILITY ACTION PLAN

Source: Water and Sewer Utility, community input and Area Plan Commission

GOAL

- Provide the Evansville metro area with high quality, safe, dependable water and sewer service at rates which encourage economic development. The Utility will manage land and water resources to ensure quality for future generations.

OBJECTIVES

- To improve treatment plant facilities and processing to meet the needs of the community while simultaneously achieving compliance with Federal and State regulations, particularly Clean Water and Safe Drinking Water Act Amendments.
- To keep a 20 percent capacity surplus so that the system can stay ahead of the demand for new water and sewer service.
- To increase the system's reliability and maintain minimum residual pressure of 20 pounds per square inch under maximum hour demand conditions.

POLICIES

- A financing mechanism should be developed for extending and connecting service to all unserved structures within the water and sanitary sewer service areas.
- Implement the recommendations of the Water and Sewer Master Plan.
- All costs associated with extending and/or accessing the water and sanitary sewer network for new service to a development are the responsibility of the developer.
- After inspection and acceptance, the Utility shall assume ownership and maintenance of all water and wastewater facilities installed in the service area.
- Unaccepted facilities not meeting adopted standards shall be privately maintained and their expansion shall be prohibited until standards can be met.
- Ensure that the water and sewer system improvements necessary to accommodate new development are in place when needed to mitigate development impacts.

OBJECTIVE

- Phase out the flow of storm water through the combined sewer system to reduce the clear water volume reaching the treatment plants.

POLICIES

- Give priority to the use of green infrastructure concepts and other cost effective alternatives to meet the requirements of the Consent Decree in a manner that minimizes structural improvements and substantial sewer fee increases.
- To help lessen the quantity of storm water entering the system, encourage land owners/developers to add green space and plantings including trees that intercept and absorb water, and allow for infiltration of runoff into the ground.

OUCC DR 1-005

DATA INFORMATION REQUEST 04/02/2016
City of Evansville, Indiana

Cause No. 44760

Information Requested:

Petitioner's proposed capital improvement plan includes $10.0 million for Preliminary Engineering for Treatment Plant. What is the basis for the $10.0 million estimate? Please provide a copy of any documents prepared by or for Petitioner to support it proposed estimate. Please provide a copy of any bids Petitioner has received to support its proposed estimate.

Information Provided:

The basis for the $10.0 million estimate is the December 2014 document prepared by HNTB Corporation titled *New Groundwater Treatment Plant Feasibility Study* and that document is attached. Specifically, see Table 5.1 on page 32 of that document. The $10 million estimate represents the design portion (typically referred to as preliminary engineering) of the $15.8 million figure and it does not include the construction engineering (layout) and resident representative (inspection) services which would not occur until the eventual construction of any project. Professional services for preliminary engineering have not yet been solicited and will be dependent on the availability of funding.

Attachment:

Attachment to OUCC DR 1-5.pdf

New Groundwater Treatment Plant Feasibility Study, HNTB, December 2014

OUCC DR 2-001

04/13/2016

DATA INFORMATION REQUEST
City of Evansville, Indiana

Cause No. 44760

Information Requested:

On page 6 of Exhibit DLB-1, Umbaugh Accounting Report, Petitioner provides a Schedule of Estimated Project Costs and Funding. Petitioner estimates it will incur $10,650,000 for Engineering and property acquisition (NWTP and Raw Water Line) costs. That total cost is broken down on Petitioner's Exhibit No. 2, Attachment PRK-8, page 1 of 2. Please answer the following related questions:

a. Please explain how Petitioner estimated the $10 million cost for "Preliminary Engineering for the Treatment Plant". If Petitioner has retained an engineering firm to complete the Preliminary Engineering for the Treatment Plant, please provide a copy of the letter of engagement or contract for services. Please provide any documentation that supports the $10 million estimated cost.

b. Please explain how Petitioner estimated the $650,000 cost for "Raw Water Main and Treatment Plant Property Acquisition". Please provide any documentation that supports the $650,000 estimated cost.

Information Provided:

a. The industry-standard method for estimating the cost of engineering services is to base the cost of those services on the estimated construction costs, with preliminary design engineering services typically ranging from 8% to 15% of the estimated construction costs. In this instance, the estimated construction costs of the new treatment plant are $79.0 million, as detailed in Table 5.1 on page 32 of the December 2014 document titled *New Groundwater Treatment Plant Feasibility Study*. That document is attached and was previously provided as OUCC DR 1.5 in response to the OUCC Data Request 1. Please note, that the estimated costs of construction, engineering and resident representative services have been deducted from the $15.8 million figure detailed in Table 5.1, as those services would not be incurred until the commencement of actual construction. After deducting these costs, the remaining $10.0 million represents the design portion estimate, which is 12.7% of the estimated construction cost of $79.0 million. An engineering firm has not been retained for preliminary engineering, as performance of these services would be contingent on the availability of funding.

b. The basis for the estimated \$650,000 cost of the "Raw Water Main and Treatment Plant Property Acquisition" is the above referenced and attached *New Groundwater Treatment Plant Feasibility Study*. The cost is detailed on pages 30 and 31 of that document and is summarized as follows:

\$260,000 -	Well field evaluation
\$300,000 -	Property acquisition cost for wells
\$ 60,000 -	Permanent easement cost for raw water main
\$ 30,000 -	Contingency
\$650,000 -	**Total**

Attachment:

Attachment to OUCC DR 2-1.pdf

New Groundwater Treatment Plant Feasibility Study, HNTB, December 2014

EVANSVILLE, INDIANA
EVANSVILLE WATER AND SEWER UTILITY

Evansville
WATER AND SEWER UTILITY

NEW GROUNDWATER TREATMENT PLANT FEASIBILITY STUDY

December 2014

HNTB

Evansville
WATER AND SEWER UTILITY

EVANSVILLE, INDIANA
EVANSVILLE WATER AND SEWER UTILITY

NEW GROUNDWATER TREATMENT PLANT FEASIBILITY STUDY

December 2014

Prepared by:

The HNTB Companies
Infrastructure Solutions

HNTB

HNTB CORPORATION
111 MONUMENT CIRCLE, SUITE 1200
INDIANAPOLIS, INDIANA 46204
(317) 636-4682

HNTB Job No. 61237

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LIST OF EXHIBITS

LIST OF WATER WELL RECORDS

LIST OF TABLES

1.1 GROUNDWATER AVAILABILITY

Available information from the Indiana Department of Natural Resources (DNR), Division of Water was reviewed to develop **Exhibit 1-1**. **Exhibit 1-1** includes the general areas in Evansville where a high-capacity groundwater well could produce in excess of 2,000 gallons per minute (gpm). Also included on **Exhibit 1-1** are registered high-capacity wells defined by the DNR as wells that produce over 100,000 gallons of groundwater per day.

Exhibit 1-2 is a similar map including floodplain, floodway and wetlands information. To construct wells in the floodway or floodplain, the well casing must be sealed to a minimum of three (3) feet above the 100-year flood elevation. This means the wells will be elevated with platforms, and at certain times access to the wells will only be available by boat. An additional permit will also be required to construct wells in the floodway.

As a further confirmation of aquifer characteristics, well records were researched with locations shown on **Exhibit** 1-3. Following **Exhibit** 1-3 are the individual records by reference number. Of the included records, 338815, 338804 and 224459 were drilled to the full depth of the unconsolidated aquifer as indicated by the presence of sandstone or shale. The depth of the aquifer for these locations range from 120 feet below grade to 136 feet below grade. This available depth, along with the medium to large gravel near the bottom of the aquifer, provide confirmation that a large quantity of groundwater is available.

UNCONSOLIDATED AQUIFER SYSTEMS
Vanderburgh County, Indiana

EXHIBIT 1-1

Evansville

HNTB

Evansville
WATER AND SEWER UTILITY

HNTB

N
W E
S

Date Last Revised:
December 2014

EXHIBIT 1-2

Wetlands and Floodplain Mapping

0 1,000 2,000 4,000 Feet


Evansville WTP
EXHIBIT 1-3
Record of Water Wells
Evansville
WATER AND SEWER UTILITY
HNTB
N
W
E
S
Date Last Revised:
November 2014
0
1,000
2,000
4,000 Feet

Record of Water Well

Indiana Department of Natural Resources

Reference Number	**Driving directions to well**	**Date completed**
338815	EAST SEWER PLANT	Oct 29, 1991

Owner-Contractor	**Name**	**Address**	**Telephone**
Owner	I.G.S.		
Driller	HARDESTY DRLG & TESTING CO	RR 2 BOX 651 LINTON IN	(812) 847-2296
Operator	DALE D HARDESTY	License: 867	

Construction Details			
Well	**Use:** Test	**Drilling method:** Rotary	**Pump type:**
	Depth: 118.3	**Pump setting depth:**	**Water quality:**
Casing	**Length:** 110.5	**Material:** PVC	**Diameter:** 2.0
Screen	**Length:** 2.0	**Material:** WELL SCREEN	**Diameter:** 2.0 **Slot size:** .040

Well Capacity Test	**Type of test:**	**Test rate:** gpm for hrs.	**BailTest rate:** gpm for hrs.
	Drawdown: ft.	**Static water level:** ft.	**Bailer Drawdown** ft.

Grouting Information	**Material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**
Well Abandonment	**Sealing material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Administrative	**County:** VANDERBURGH		**Township:** 6S **Range:** 10W	
	Section: SE of the NW of Section 31			**Topo map:** EVANSVILLE SOUTH,IN-KY
	Grant Number:			
	Field located by:		**on:**	
	Courthouse location by:		**on:**	
	Location accepted w/o verification by:		**on:**	
	Subdivision name:		**Lot number:**	
	Ft W of EL:	**Ft N of SL:**	**Ft E of WL:**	**Ft S of NL:**
	Ground elevation:	**Depth to bedrock:**	**Bedrock elevation:**	**Aquifer elevation:**
	UTM Easting:		**UTM Northing:**	

Well Log

Top	Bottom	Formation
0.0	5.0	SURFACE FILL
5.0	6.0	CLAY & FILL MED BROWN W/FILL
6.0	10.0	CLAY-GRAY
10.0	15.0	CLAY-BROWN/GRAY MXD,SILTY,SAND
15.0	25.0	CLAY-BROWN, SILTY/SLIGHT GRIT
25.0	35.0	SNAD-BROWN/GRAY MXD-MED TO CRS
35.0	45.0	SAND-BROWN MED TO FINE GRAIN
45.0	61.0	SAND-BROWN FINE GRAIN TO SILTY

61.0	88.0	S&G SMOOTH SURFACE GRAVEL SLIG
88.0	106.1	GRAVEL 1/2" DOWN TO 1/4" SIZE
106.1	118.3	SANDSTONE LT GRAY W/SHALE BNDS
118.3		TD

Comments

Record of Water Well

Indiana Department of Natural Resources

Reference Number	**Driving directions to well**			**Date completed**
240197	WELL IN ? OF INLAND MARINA, DEPENDS ON RIVER WHETHER OR NOT IT IS IN KY OR IND			
Owner-Contractor	**Name**	**Address**	**Telephone**	
Owner	INLAND MARINA	HENDERSON KY		
Driller	I L LITTLE	EVANSVILLE IND		
Operator	I L	License: null		
Construction Details				
Well	**Use:** Industry	**Drilling method:** Cable Tool	**Pump type:**	
	Depth: 81.0	**Pump setting depth:**	**Water quality:**	
Casing	**Length:** 7.0	**Material:**	**Diameter:** 6.63	
Screen	**Length:** 10.0	**Material:**	**Diameter:** 4.0 **Slot size:** .020	
Well Capacity Test	**Type of test:**	**Test rate:** gpm for hrs.	**BailTest rate:** 60.0 gpm for 1.0 hrs.	
	Drawdown: ft.	**Static water level:** 20.0 ft.	**Bailer Drawdown** 5.0 ft.	
Grouting Information	**Material:**		**Depth:** from to	
	Installation Method:		**Number of bags used:**	
Well Abandonment	**Sealing material:**		**Depth:** from to	
	Installation Method:		**Number of bags used:**	
Administrative	**County:** VANDERBURGH		**Township:** 7S **Range:** 10W	
	Section: of Section 6		**Topo map:** EVANSVILLE SOUTH,IN-KY	
	Grant Number:			
	Field located by:		**on:**	
	Courthouse location by:		**on:**	
	Location accepted w/o verification by:		**on:**	
	Subdivision name:		**Lot number:**	
	Ft W of EL:	**Ft N of SL:**	**Ft E of WL:** **Ft S of NL:**	
	Ground elevation:	**Depth to bedrock:**	**Bedrock elevation:**	**Aquifer elevation:**
	UTM Easting:		**UTM Northing:**	

Well Log

Top	Bottom	Formation
0.0	8.0	CLAY
8.0	60.0	SAND, RIVER
60.0	85.0	SAND AND SM GRAV MIXED

Comments

Record of Water Well

Indiana Department of Natural Resources

Reference Number	**Driving directions to well**	**Date completed**
338804	LANDFILL HWY 41	Oct 31, 1991

Owner-Contractor	**Name**	**Address**	**Telephone**
Owner	IGS		
Driller	HARDESTY DRLG & TESTING CO	RR 2 BOX 651 LINTON IN	(812) 847-2296
Operator	DALE D HARDESTY	License: 867	

Construction Details

Well	**Use:**	**Drilling method:** Rotary	**Pump type:**
	Depth: 146.5	**Pump setting depth:**	**Water quality:** UNKNOWN
Casing	**Length:** 134.5	**Material:** PVC	**Diameter:** 2.0
Screen	**Length:** 2.0	**Material:** WELL SCREEN	**Diameter:** 2.0 **Slot size:** .010

Well Capacity Test	**Type of test:**	**Test rate:** gpm for hrs.	**BailTest rate:** gpm for hrs.
	Drawdown: ft.	**Static water level:** ft.	**Bailer Drawdown** ft.

Grouting Information	**Material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Well Abandonment	**Sealing material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Administrative

County: VANDERBURGH

Township: 7S **Range:** 10W

Section: SE of the NW of Section 4

Topo map: EVANSVILLE NORTH

Grant Number:

Field located by: **on:**

Courthouse location by: **on:**

Location accepted w/o verification by: **on:**

Subdivision name: **Lot number:**

Ft W of EL: **Ft N of SL:** **Ft E of WL:** **Ft S of NL:**

Ground elevation: **Depth to bedrock:** **Bedrock elevation:** **Aquifer elevation:**

UTM Easting: **UTM Northing:**

Well Log

Top	Bottom	Formation
0.0	1.9	SURFACE/TOPSOIL
1.9	3.0	CLAY-GRAY/BROWN MXD
3.0	9.0	TRASH/CLAY-LT BROWN CLAY
9.0	10.0	CLAY-GRAY
10.0	30.0	TRASH/CLAY (MOSTLY TRASH)
30.0	40.0	TRASH/CLAY (LOST CIRCULATION)
40.0	65.0	SAND-FINE GRAIN, MED GRAY
65.0	72.0	GRAVEL 1/4"SM, SMOOTH SURFACE

72.0	96.0	SAND-DK GRAY
96.0	114.0	CLAY-GRAY, SOFT
114.0	121.0	GRAVEL-1/4"-1/8" SMOOTH SURFAC
121.0	136.5	S&G/SAND CONTENT 50%
136.5	138.0	SHALE-GRAY,SOFT

Comments

Record of Water Well

Indiana Department of Natural Resources

Reference Number 224518

Driving directions to well

Date completed May 01, 1962

Owner-Contractor	**Name**	**Address**	**Telephone**
Owner	LOEWS THEATHER		
Driller	D.L. LITTLE	2509 KORING,RD.	
Operator	D.L. LITTLE	License: null	

Construction Details

Well	**Use:** Industry	**Drilling method:** Cable Tool	**Pump type:**
	Depth: 104.0	**Pump setting depth:**	**Water quality:**
Casing	**Length:** 85.0	**Material:**	**Diameter:** 6.63
Screen	**Length:** 20.0	**Material:**	**Diameter:** 8.0 **Slot size:** .020

Well Capacity Test	**Type of test:** Pumping	**Test rate:** 350.0 gpm for 4.0 hrs.	**BailTest rate:** gpm for hrs.
	Drawdown: ft.	**Static water level:** 44.0 ft.	**Bailer Drawdown** ft.

Grouting Information	**Material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Well Abandonment	**Sealing material:**	**Depth:** from to
	Installation Method:	**Number of bags used:**

Administrative

County: VANDERBURGH — **Township:** 6S **Range:** 10W

Section: NW of the SE of the NE of Section 30 — **Topo map:** EVANSVILLE SOUTH,IN-KY

Grant Number:

Field located by: RJW — **on:** Oct 20, 1964

Courthouse location by: — **on:**

Location accepted w/o verification by: — **on:**

Subdivision name: — **Lot number:**

Ft W of EL: 850.0 — **Ft N of SL:** 3600.0 — **Ft E of WL:** **Ft S of NL:**

Ground elevation: 385.0 — **Depth to bedrock:** — **Bedrock elevation:** — **Aquifer elevation:** 285.0

UTM Easting: 450033.0 — **UTM Northing:** 4202757.0

Well Log

Top	Bottom	Formation
0.0	12.0	SUBSOIL & CLAY
12.0	100.0	S & G

Comments

Record of Water Well

Indiana Department of Natural Resources

Reference Number 224459

Driving directions to well AT NORTH END OF NW PROPERTY ADJACENT TO SHOWNEE DRIVE APPROX. 260 FEET FROM RIVER

Date completed Jan 01, 1950

Owner-Contractor	Name	Address	Telephone
Owner	EVANSVILLE WATER WORKS		
Driller	DIEHL PUMP & SUPPLY	EVANSVILLE	

Construction Details

Well	**Use:** Test	**Drilling method:**	**Pump type:**
	Depth: 120.0	**Pump setting depth:**	**Water quality:**
Casing	**Length:**	**Material:**	**Diameter:** 6.0
Screen	**Length:**	**Material:**	**Diameter: Slot size:**

Well Capacity Test **Type of test:** **Test rate:** gpm for hrs. **BailTest rate:** gpm for hrs.
Drawdown: ft. **Static water level:** 31.1 ft. **Bailer Drawdown** ft.

Grouting Information **Material:** **Depth:** from to
Installation Method: **Number of bags used:**

Well Abandonment **Sealing material:** **Depth:** from to
Installation Method: **Number of bags used:**

Administrative

County: VANDERBURGH **Township:** 6S **Range:** 10W
Section: SE of the NW of the NE of Section 31 **Topo map:** EVANSVILLE SOUTH,IN-KY
Grant Number:
Field located by: **on:**
Courthouse location by: **on:**
Location accepted w/o verification by: USGS **on:** May 01, 1963
Subdivision name: **Lot number:**
Ft W of EL: **Ft N of SL:** **Ft E of WL:** **Ft S of NL:**
Ground elevation: **Depth to bedrock:** **Bedrock elevation:** **Aquifer elevation:**
UTM Easting: **UTM Northing:**

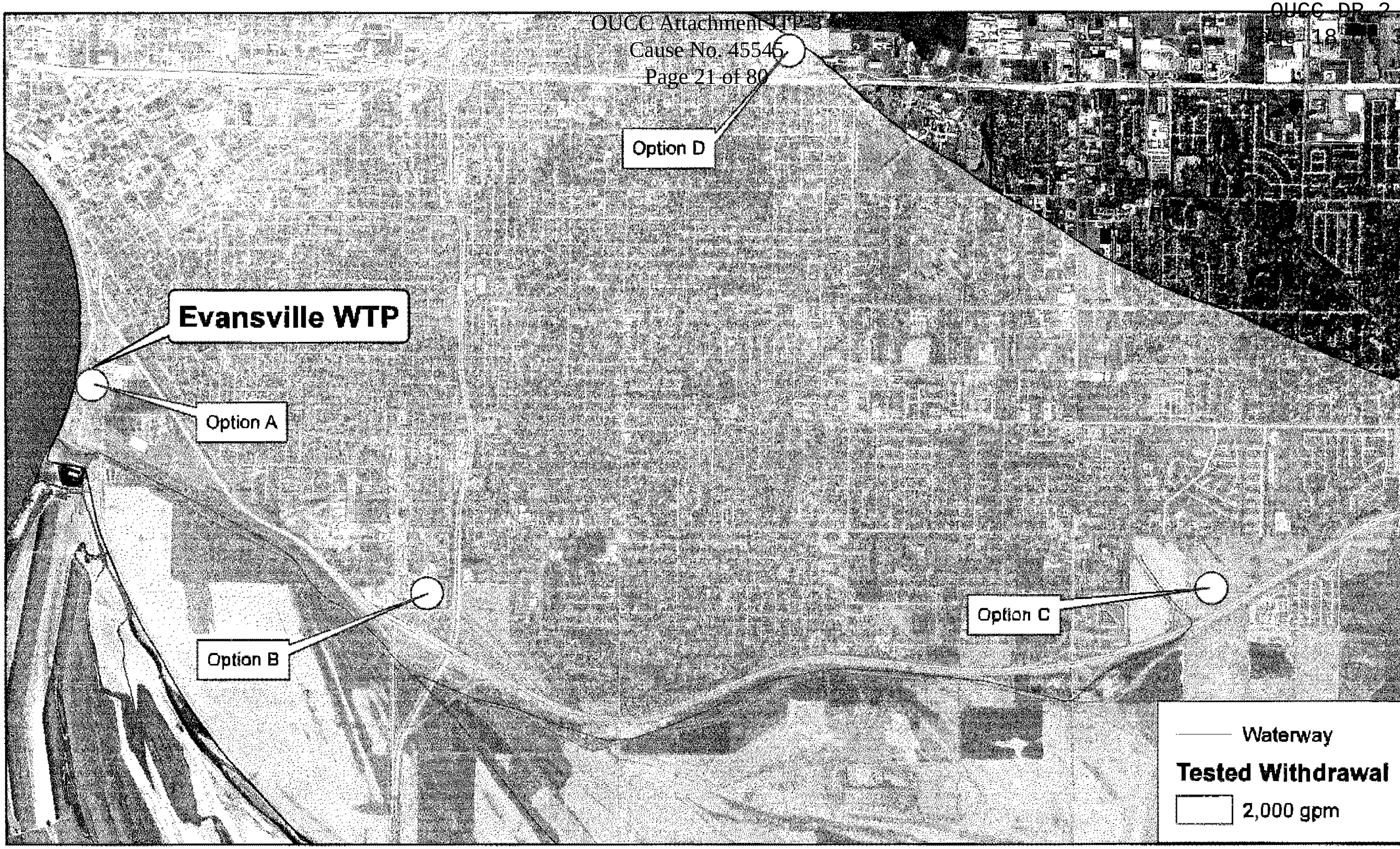
Well Log

Top	Bottom	Formation
0.0	16.0	TOPSOIL
16.0	50.0	CLAY
50.0	65.0	QUICKSAND
65.0	76.0	FINE SAND COARSE GRAVEL
76.0	80.0	MED SAND
80.0	90.0	COARSE SAND, GRAVEL BLUE CLAY
90.0	107.0	MED. CRS SAND W/ SOME FINE SAN
107.0	112.0	CRS. SAND & GRAVEL
112.0	114.0	LARGE GRAVEL PEA GRAVEL & CRS.
114.0	120.0	LARGE GRAVEL CRS SAND MED SAND

	120.0	BLUE STONE
Comments	TEST WELL #1	

2.1 POTENTIAL NEW GROUNDWATER TREATMENT PLANT LOCATIONS

Once the viability of developing a 60-MGD groundwater supply was confirmed, the next step was to identify potential locations for the collector wells and the treatment plant. **Exhibit 2-1** includes the original four options where sufficient water supply and available property appear to be available. **Exhibits 2-2, 2-3, 2-4 and 2-5** provide additional details for each location. Of these original four, Option D located at the former Roberts Stadium site was quickly ruled out because it is close to the boundary where sufficient raw water quantity is expected to be available and high-capacity wells will have a large radius of influence potentially pulling in contaminants from old industrial facilities, gas stations or dry cleaners.



Evansville
WATER AND SEWER UTILITY

HNTB

Date Last Revised:
December 2014

EXHIBIT 2-1

Potential Groundwater Treatment Plant Locations

0 1,300 2,600 5,200 Feet

*Information referenced from IDNR, Division of Water, Resource Assessment Section maps

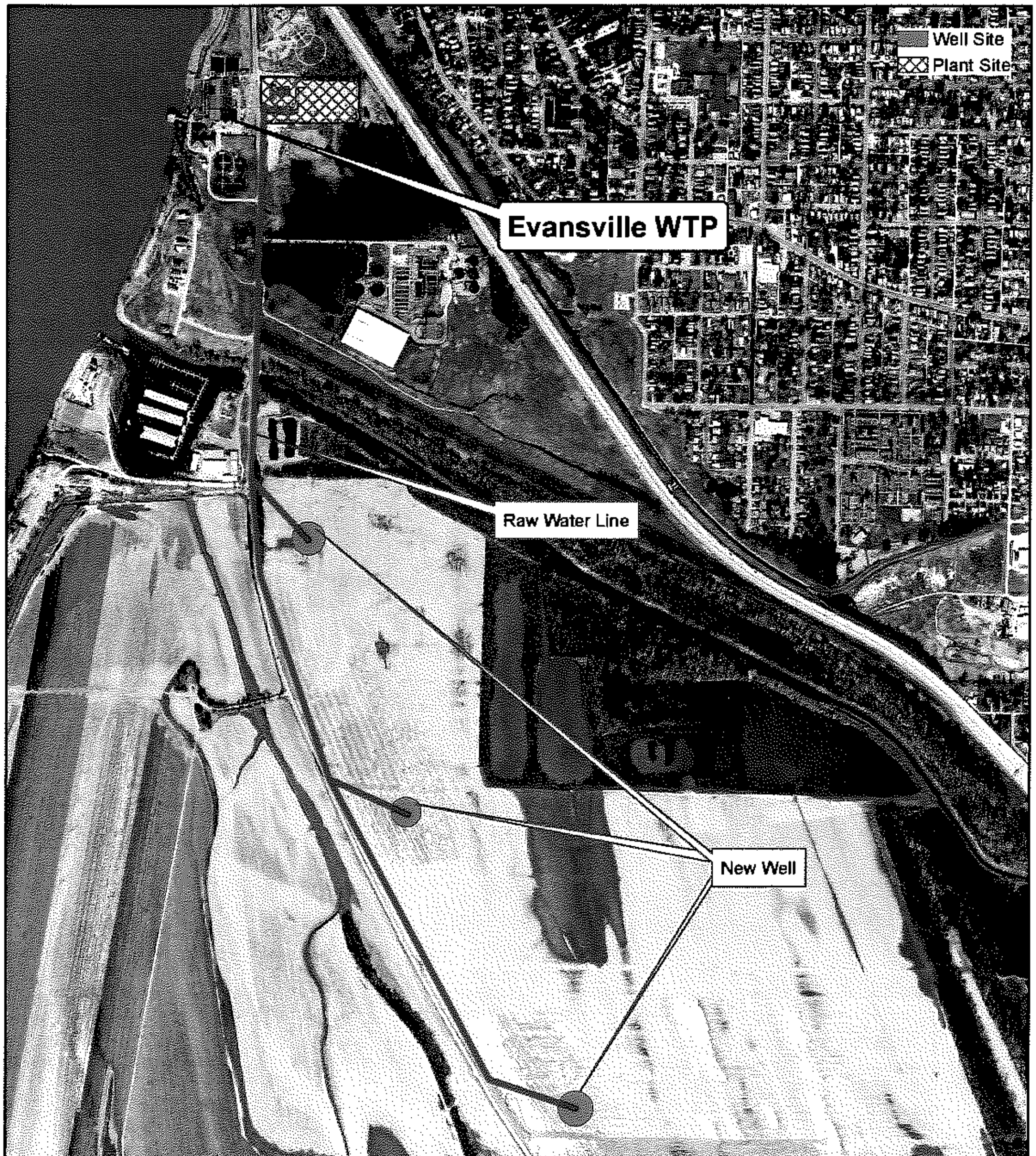


EXHIBIT 2-2

Option A - Potential Groundwater Well and Treatment Plant Locations

*Information referenced from IDNR, Division of Water, Resource Assessment Section maps

Evansville
WATER AND SEWER UTILITY

HNTB

N
W E
S

Date Last Revised:
September 2014

EXHIBIT 2-3

Option B - Potential Groundwater Well and Treatment Plant Locations

0 500 1,000 Feet

*Information referenced from IDNR, Division of Water, Resource Assessment Section maps

EXHIBIT 2-4

Evansville WATER AND SEWER UTILITY

HNTB

Date Last Revised: September 2014

Option C - Potential Groundwater Well and Treatment Plant Locations

0 350 700 1,400 Feet

*Information referenced from IDNR, Division of Water, Resource Assessment Section maps

Evansville WATER AND SEWER UTILITY

HNTB

EXHIBIT 2-5

Option D - Potential Groundwater Well and Treatment Plant Locations

N
W E
S

Date Last Revised:
September 2014

0 212.5 425 850
Feet

*Information referenced from IDNR, Division of Water, Resource Assessment Section maps

3.1 POTENTIAL CONNECTIONS TO DISTRIBUTION SYSTEM

In addition to the new treatment plant and wells, water mains must be installed from the wells to the plant and from the plant to provide adequate flow and pressure of finished water into the distribution system. **Exhibits 3-1, 3-2 and 3-3** include potential locations and lengths of water main required as determined utilizing the existing WaterCAD model.

For all three options, the length and size of raw water main is essentially the same. To provide redundancy, the exhibits include dual, 48-inch-diameter mains from the wells to the new plant location. Depending on the final layout, the length may vary, but will not be enough to significantly impact the overall project cost.

From this evaluation, the primary difference between the options is the site and length of the finished water main required to provide up to 60 MGD into the system while allowing for potential breaks in major transmission mains. With the proximity to the existing plant, Option A is the least-cost option with no major finished water mains required. The new high-service pumps can be directly connected to the 36-inch and 48-inch transmission mains near the existing plant. **Exhibit 3-1** includes potential locations for the collector wells, raw water main and new water treatment plant. Table 3.1 includes the estimated cost of almost $14,000,000 for the raw water main.

The model results for Option B included on **Exhibit 3-1** indicate the high-service pumps would need to provide slightly more pressure, approximately 10 feet total dynamic head, to provide the same level of service into the distribution system. Option B would also require a significant investment in finished water mains estimated to include:

- 13,000 feet of 48-inch
- 16,000 feet of 30-inch

As can be seen on **Table 3.2**, the Option B total water main cost is estimated to be approximately $36,000,000, over $22,000,000 more than Option A.

By being located further from the largest transmission main in the system, Option C is even more challenging to tie into the distribution system. As indicated on **Exhibit 3-3**, the finished water mains required to provide the same level of service into the distribution system include:

- 24,000 feet of 48-inch
- 25,000 feet of 30-inch

As expected, the cost estimate included in **Table 3.3** is significantly higher than either Option A or B coming in at just over $51,000,000.

Because of the significant difference in costs associated with the water main installation, Option A is the recommended alternative to be further evaluated.

EXHIBIT 3-1

Evansville
WATER AND SEWER UTILITY

HNTB

N W E S

Option A - Distribution System Tie-In

Date Last Revised: December 2014

0 500 1,000 2,000 Feet


Evansville WTP
Evansville
WATER AND SEWER UTILITY
HNTB
N
W
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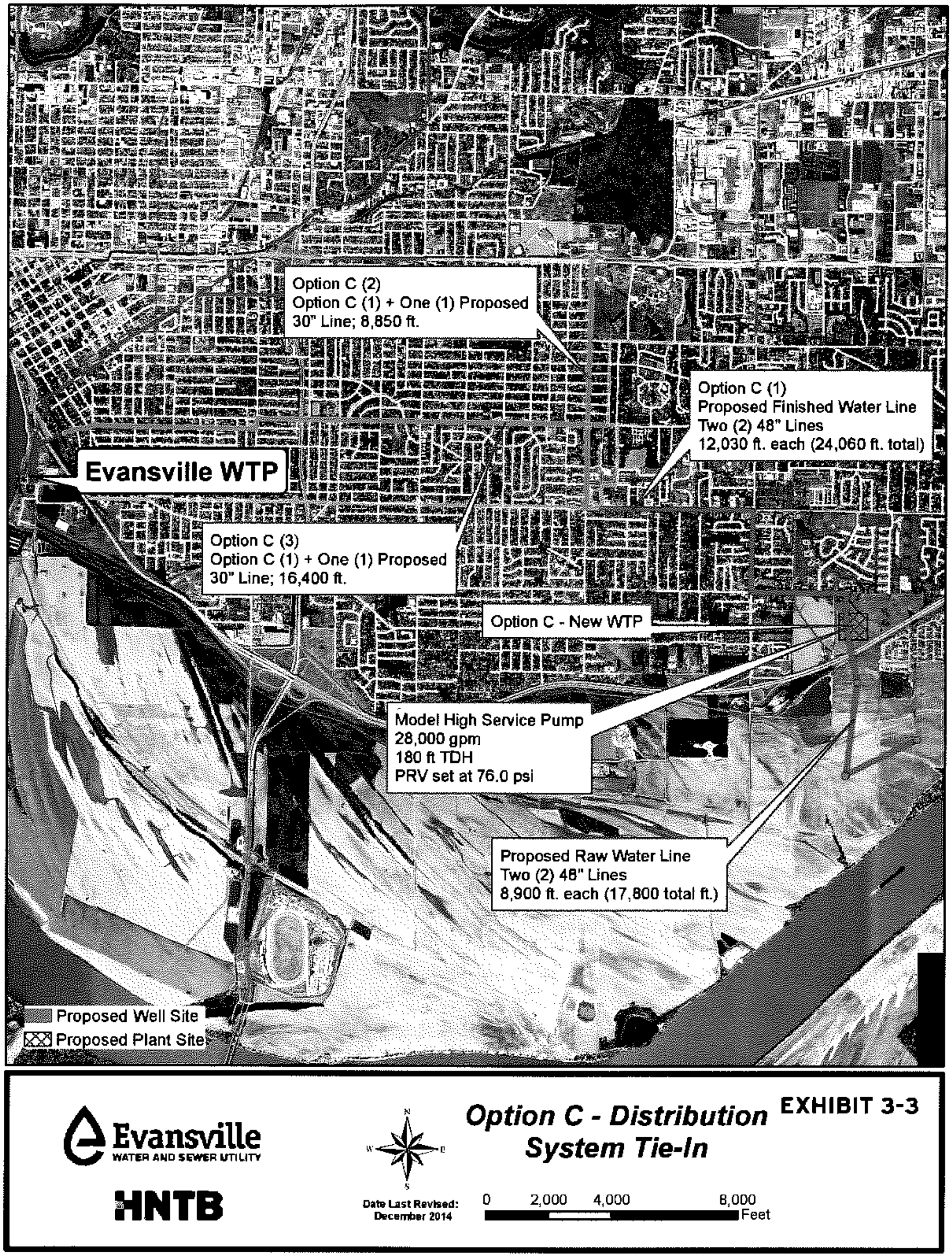
S
Option B - Distribution System Tie-In
EXHIBIT 3-2
Date Last Revised: December 2014
0 1,000 2,000 4,000
Feet



Option C - Distribution System Tie-In EXHIBIT 3-3

TABLE 3.1
OPTION A

HNTB	CONSTRUCTION COST ESTIMATE				
OPTION A - WTP ADJACENT TO EXISTING					
PROJECT NO.: 61237-PL-001-001	PREPARED BY:	SAL	DATE:	11/24/2014	
PROJECT NAME: Evansville WTP Planning	CHECKED BY:	RTP	DATE:	11/24/2014	
	CHECKED BY:		DATE:		
PROJECT MGR.: JAT					
ITEM / DESCRIPTION	**QUANTITY**	**UNIT**	**UNIT PRICE**	**ESTIMATED CONS. COST**	**REMARKS**
Construction Costs					
DIVISION 2 - SITE WORK					
Erosion and sedimentation control	1	LS	$5,000	$5,000	
Excavation for raw water mains	49,100	CY	$50	$2,455,000	
48" DI pipe for dual raw water mains- installed	17,200	LF	$400	$6,880,000	
Backfill for water mains	33,200	CY	$35	$1,162,000	
SUBTOTAL				**$10,502,000**	
Mobilization/Demobilization (5%)	1	LS	$526,000	$526,000	
Site restoration (3% of site work)	1	LS	$316,000	$316,000	
SUBTOTAL				**$11,344,000**	
Contingency @ 20%				$2,270,000	
TOTAL				**$13,614,000**	

NOTE ! **This estimate represents our judgment as professionals familiar with the construction industry. We cannot and do not guarantee that bids will not vary from this estimate.**

TABLE 3.2
OPTION B

HNTB	CONSTRUCTION COST ESTIMATE				
OPTION B - WTP NEAR US 41/VETERAN'S MEMORIAL PARKWAY INTERCHANGE					
PROJECT NO.: 61237-PL-001-001	PREPARED BY:		SAL	DATE:	11/24/2014
PROJECT NAME: Evansville WTP Planning	CHECKED BY:		RTP	DATE:	11/24/2014
	CHECKED BY:			DATE:	
PROJECT MGR.: JAT					
ITEM / DESCRIPTION	**QUANTITY**	**UNIT**	**UNIT PRICE**	**ESTIMATED CONS. COST**	**REMARKS**
Construction Costs					
DIVISION 2 - SITE WORK					
Erosion and sedimentation control	1	LS	$5,000	$5,000	
Excavation for raw water mains	52,700	CY	$50	$2,635,000	
48" DI pipe for dual raw water mains- installed	19,800	LF	$400	$7,920,000	
Backfill for raw water mains	34,400	CY	$35	$1,204,000	
Excavation for finished water mains	60,000	CY	$50	$3,000,000	
48" DI pipe for dual finished water mains-installed	12,900	LF	$600	$7,740,000	
30" DI pipe for finished water mains-installed	16,300	LF	$250	$4,075,000	
Backfill for finished water mains	40,000	CY	$35	$1,400,000	
DIVISION 9 - FINISHES					
Coatings	1	LS	$10,000	$10,000	
SUBTOTAL				**$27,989,000**	
Mobilization/Demobilization (5%)	1	LS	$1,400,000	$1,400,000	
Site restoration (3% of site work)	1	LS	$840,000	$840,000	
SUBTOTAL				**$30,229,000**	
Contingency @ 20%				$6,046,000	
TOTAL				**$36,275,000**	

NOTE ! **This estimate represents our judgement as professionals familiar with the construction industry.**
We cannot and do not guarantee that bids will not vary from this estimate.

TABLE 3.3
OPTION C

HNTB	CONSTRUCTION COST ESTIMATE				
OPTION C - WTP ON EAST SIDE OF CITY					
PROJECT NO.: 61237-PL-001-001	PREPARED BY:	SAL	DATE:	11/24/2014	
PROJECT NAME: Evansville WTP Planning	CHECKED BY:	RTP	DATE:	11/24/2014	
	CHECKED BY:		DATE:		
PROJECT MGR.: JAT					
ITEM / DESCRIPTION	**QUANTITY**	**UNIT**	**UNIT PRICE**	**ESTIMATED CONS. COST**	**REMARKS**
Construction Costs					
DIVISION 2 - SITE WORK					
Erosion and sedimentation control	1	LS	$5,000	$5,000	
Excavation for raw water mains	47,500	CY	$50	$2,375,000	
48" DI pipe for dual raw water mains-installed	17,800	LF	$400	$7,120,000	
Backfill for raw water mains	31,000	CY	$35	$1,085,000	
Excavation for finished water mains	110,000	CY	$50	$5,500,000	
48" DI pipe for dual finished water mains-installed	24,100	LF	$600	$14,460,000	
30" DI pipe for finished water main- installed	25,000	LF	$250	$6,250,000	
Backfill for finished water mains	75,000	CY	$35	$2,625,000	
DIVISION 9 - FINISHES					
Coatings	1	LS	$10,000	$10,000	
SUBTOTAL				**$39,430,000**	
Mobilization/Demobilization (5%)	1	LS	$1,972,000	$1,972,000	
Site restoration (3% of site work)	1	LS	$1,183,000	$1,183,000	
SUBTOTAL				**$42,585,000**	
Contingency @ 20%				$8,517,000	
TOTAL				**$51,102,000**	

NOTE ! This estimate represents our judgement as professionals familiar with the construction industry. We cannot and do not guarantee that bids will not vary from this estimate.

4.1 GROUNDWATER TREATMENT PLANT DESCRIPTION AND PROCESS SCHEMATIC

Raw water quality and the treatment approach are the two aspects that would be most impacted should Evansville change their raw water source from the Ohio River to groundwater from the aquifer southeast of the existing water treatment plant (WTP) site. This narrative describes the anticipated raw groundwater quality and the treatment facilities anticipated to efficiently treat it to potable water standards (following Ten States Standards).

Raw water would be higher in iron, manganese and hardness as compared to surface water, in the approximate ranges tabulated in Table 4.1.

TABLE 4.1
RAW WATER QUALITY ESTIMATE

Constituents	*Units*	*Anticipated Concentrations*	
		Groundwater	*Surface Water*
Hydrogen Sulfide	mg/L	Detectable Odor	Undetectable
Iron	mg/L	2.0 - 2.5	Trace
Manganese	mg/L	0.5 - 0.8	Trace
Hardness (as $CaCO_3$)	mg/L	180 - 400	150

The treatment processes described below are designed to produce water meeting the following finished water quality goals:

- Compliance with secondary standard goals for maximum concentrations of iron (0.3 mg/L) and manganese (0.05 mg/L).
- Filtered water turbidity below 0.1 NTU.
- Stable water that will comply with the Lead and Copper Rule and minimize corrosion, precipitation and deposition within the water distribution system.
- Reduction of taste and odor to the lowest acceptable level.
- Maintaining a free chlorine residual of 1.0 mg/L through the treatment process and provide adequate disinfection protection in the distribution system by meeting the TSS standard of 1.0 to 2.0 mg/L throughout the system.
- Maintaining minimum finished water pH of 7.5.
- Planning WTP layout and hydraulics to allow a softening process to be added in the future (producing finished water with hardness in the 120-150 mg/L range).
- Providing WTP with a firm treatment capacity of 60 MGD and an onsite finished water storage capacity of 6 million gallons (MG), in a two-train arrangement so that 30 MGD can be filtered, stored and pumped with half the filters and clearwell out-of-service.

The basic treatment process schematic, included as **Exhibit 4-1**, illustrates the primary features of a groundwater treatment plant applicable for the Evansville groundwater. Following metering of the raw water, chemical oxidation of iron and manganese with chlorine and potassium permanganate will result in the formation of insoluble iron and manganese hydroxides precipitates. The incoming water will be conditioned to a pH of about 7.5 while maintaining a chlorine residual of 0.5 to 1.0 mg/L.

The chemically conditioned raw water will be conveyed by gravity and distributed to the filters, where those oxidized metals solids will be removed by adsorption and entrapment within the filter media. Media will consist of anthracite and sand in a deep-bed gravity arrangement with modern block or plate underdrain media supports.

Ten State Standards recommend filtering rates with regard to raw water quality, pretreatment and filter media. The recommended range is from 2 to 4 gallons per minute per square foot of filter media surface (gpm/sf). In using the maximum filtering rate of 4 gpm/sf with a firm capacity of 60 MGD (one filter out-of-service), 10 filters will be required. Each 1,200 sf filter is recommended to be a two-cell arrangement (with each cell 600 sf, with an approximate geometry of 20 ft by 30 ft).

Following filtration, the water will be disinfected with chlorine and chemically conditioned with sodium hydroxide (for pH adjustment), hydrofluorosilic acid (for fluoridation) and a corrosion inhibitor, if warranted.

Finished water will be stored in an onsite ground storage reservoir prior to the distribution to the Evansville system via high-service finished water pumps. The clearwell will consist of two 3 MG baffled compartments and interconnected with three pumping wells (two for finished water pumps and one for the filter backwash pumps).

Each filter cell will be backwashed separately but sequentially (one backwashed while the other cell-isolated). The maximum backwash flow rate is approximately 9,000 gpm, which represents a filter cell with an area of 600 sf and Ten States Standards maximum wash rate of 15 gpm/sf. The backwash pumps will be adjustable speed so that backwashing flow rates can be fine-tuned as the WTP transitions from a new to established facility, as well as adjustments for seasonal operation.

Per Ten States Standards, the filters will have a backup backwash water supply system consisting of a pressure-reducing valve between the finished water pump discharge main and the backwash water supply header. This secondary system takes finished water going from the discharge main, and reduces its pressure to an acceptable level for backwashing prior to entering the filters.

The iron and manganese residuals removed from the treated water will be collected in a two-compartment backwash water holding tank. Residuals settled in the tank will be pumped to the sanitary sewer system. The spent backwash water drawn off the holding tanks will be chemically conditioned to eliminate its chlorine residual and filtered through a slow sand filter to reduce any solids, prior to being discharged to the Ohio River.

Table 4.2 shows the cost estimate for the plant, as described.

TABLE 4.2
GROUNDWATER TREATMENT PLANT
COST ESTIMATE SUMMARY FOR 60 MGD WTP

Description	*2014 Total Cost*
Site Work and Residuals Pump Station	**$ 3,000,000**
Treatment and Chemical Building Equipment	**$14,300,000**
Treatment and Chemical Building Piping and Fittings	**$ 6,400,000**
Yard Piping and Fittings	**$ 2,600,000**
Concrete	**$ 9,100,000**
Building Components	**$ 2,400,000**
HVAC Components	**$ 800,000**
Plumbing Components	**$ 200,000**
Electrical Components	**$ 3,400,000**
Instrumentation and Controls	**$ 1,200,000**
Subtotal	**$43,400,000**
Mobilization and Bonds (8% of Subtotal)	**$ 3,500,000**
Contingency (20% of Subtotal)	**$ 8,700,000**
Escalation for 2 Years (6% of Total)	**$ 2,600,000**
TOTAL ESTIMATED CONSTRUCTION COST	**$58,000,000**

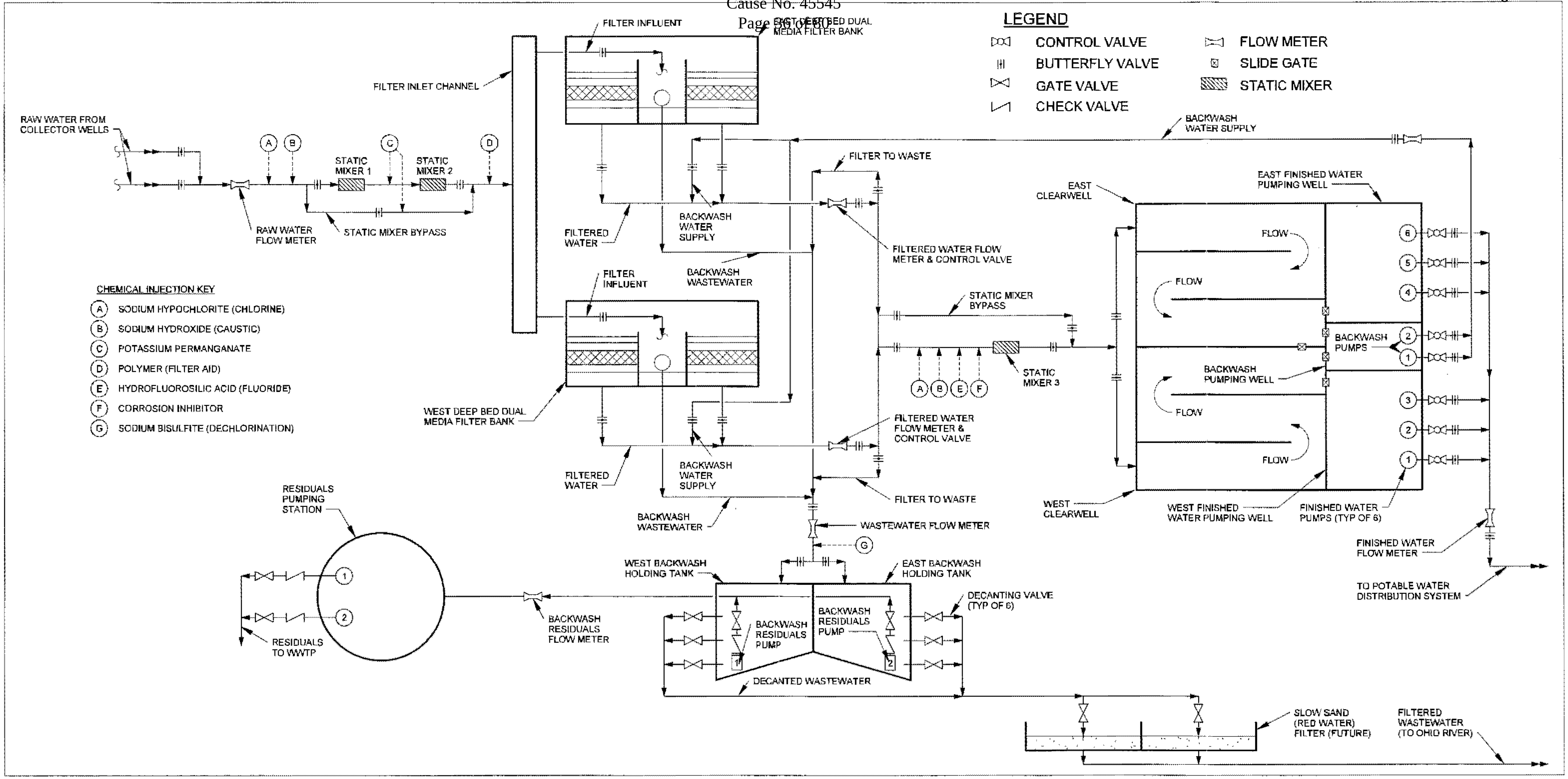


EXHIBIT 4-1

Evansville
WATER AND SEWER UTILITY

HNTB

Basic Process Schematic
New Evansville Groundwater Treatment Plant

5.1 RECOMMENDED LOCATION AND COST SUMMARY

As described in **Section 4**, the determining factor in choosing a location for the new groundwater treatment plant is the ability to efficiently pump water into the distribution system. With the difference in cost of at least $20,000,000 for finished water main design and construction, Option A along Waterworks Road is the recommended location for the new groundwater treatment plant. **Exhibit** 5-1 includes a basic layout for the new facilities to be located at the existing Levee Authority office and DPW garage site. **Exhibit** 5-2 provides a potential layout for the three (3) collector wells, raw water main and treatment facilities along with the estimated amount of land to be purchased or for permanent easements.

5.2 SUMMARY OF COSTS TO COMPLETE WELL FIELD EVALUATION, WELL, RAW WATER MAIN, NEW GROUNDWATER TREATMENT PLANT AND FINISHED WATER DISTRIBUTION DESIGN AND CONSTRUCTION

5.2.1 Well Field Evaluation

Obtain options on approximately 40 acres to conduct exploratory test drilling program. Estimated cost $500 per acre, total: $20,000.

Complete exploratory test drilling to verify subsurface conditions, collect formation and water samples for analysis and conduct tests to determine transmissivity. Estimated cost of $20,000 per location for three locations, total: $60,000.

Conduct detailed aquifer testing to refine aquifer characteristics, predict well yield and gather information for final well design, including installation and test pumping of a temporary production well. Estimated cost: $150,000.

Complete data analysis and final report with well design criteria. Estimated cost: $30,000.

TOTAL ESTIMATED COST FOR WELL FIELD EVALUATION: **$260,000**

5.2.2 Well Field Property Acquisition Collector Well Design and Construction

Purchase property for wells. Approximately 10 acres are required for each of 3 wells for a total of 30 acres at $10,000 per acre. Total property cost for wells: $300,000.

Design and construct collector wells complete with pumps, buildings, and auxiliary equipment. Three (3) wells at $3,000,000 each would be a total of $9,000,000. Add design, bidding, construction engineering and resident representative services at 20 percent of the estimated construction cost for a total estimated cost of $10,800,000. Cost estimate for wells provided by Ranney Collector Wells, a division of Layne Henry Civil.

TOTAL ESTIMATED COST FOR PROPERTY ACQUISITION, WELL DESIGN AND CONSTRUCTION: **$11,100,000**

5.2.3 Raw Water Main from Well Field to New Water Treatment Plant

Acquire easements to install raw water main. Estimated distance from furthest well to new plant site is 9,200 feet with 30-foot-wide permanent easement and 100-foot-wide temporary easement required. Permanent easement will require approximately 6 acres at $10,000 per acre for a total of $60,000.

Design and construct new raw water main from well field to new water treatment plant. To provide redundancy, install dual 48-inch-diameter ductile iron mains. Estimated construction cost for dual 48-inch ductile iron main is $11,500,000. Add design, bidding, construction engineering and resident representative services at 20 percent of estimated construction cost for a total cost of $13,800,000.

TOTAL ESTIMATED COST FOR THE RAW WATER MAIN DESIGN, PROPERTY ACQUISITION AND CONSTRUCTION: **$13,900,000**

5.2.4 New Water Treatment Plant

Locate new plant and finished water reservoir on existing City-owned property now consisting of Levee Authority offices and Department of Public Works (DPW) facilities. No costs are expected to acquire the property; however, costs will be incurred to demolish the existing buildings and prepare the site for construction. The estimated cost to prepare the site is $250,000, plus additional costs to relocate the Levee Authority and DPW depending on the arrangement with the City. For the purpose of this report, it is estimated the Evansville Water and Sewer Utility (EWSU) will contribute $250,000 towards moving the Levee Authority and DPW for a total property cost of $500,000.

Design and construct a new 60 million gallons per day (MGD) groundwater treatment plant utilizing chemical oxidation of iron and manganese, gravity filters and a new 6-million-gallon finished water reservoir. The total estimated construction cost for the plant and reservoir is $58,000,000. Adding 20 percent for design, bidding, construction engineering and resident representative services, brings the total estimated project cost to **$70,000,000.**

5.2.5 Finished Water Mains and Connections into Existing Distribution System

By locating the new plant at the site of the existing Levee Authority and DPW garage, minimal improvements are necessary to connect the new high-service pumps into the distribution system. For this estimate, the total cost of this effort is not expected to exceed **$500,000.**

TABLE 5.1
SUMMARY

Well Field Evaluation	$ 260,000
Property Acquisition	
• Well Field	$ 300,000
• Raw Water Main	$ 60,000
• Treatment Plant	$ 500,000
Construction	
• Collector Wells	$ 9,000,000
• Raw Water Main	$ 11,500,000
• Water Treatment Plant	$ 58,000,000
• Finished Water Main Connection to Distribution System	$ 500,000
Total Estimated Construction Cost with 20% Contingency	$ 79,000,000
Engineering (Design, Bidding, Construction Engineering and Resident Representative Services) at 20% of Total Construction	$ 15,800,000
TOTAL ESTIMATED PROJECT COST	**$ 96,000,000**


Evansville
WATER AND SEWER UTILITY
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Date Last Revised:
December 2014
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400 Feet
Option A - Proposed
WTP Layout
EXHIBIT 5-1

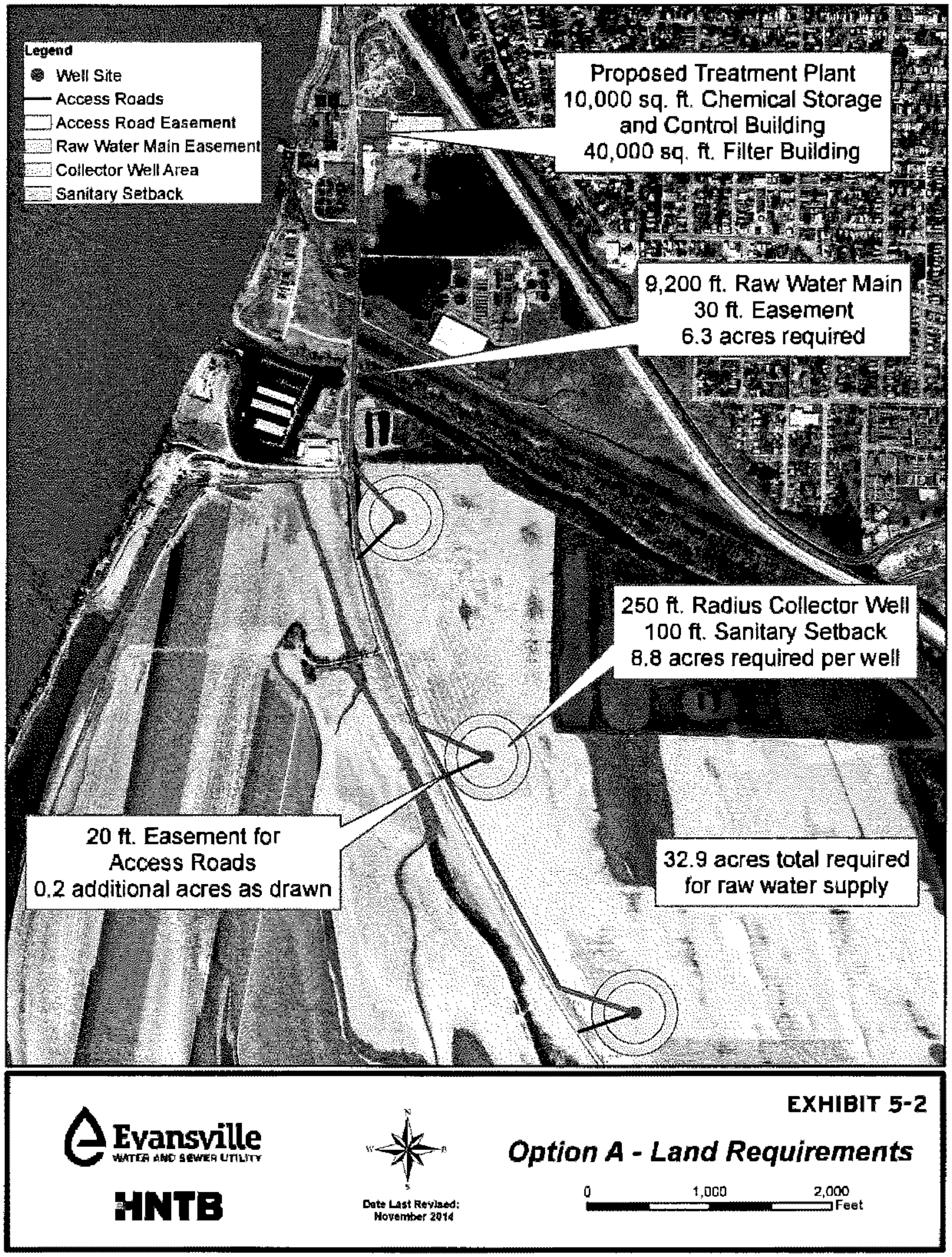

EXHIBIT 5-2

Option A - Land Requirements

OUCC DR 8-001

06/20/2016

DATA INFORMATION REQUEST
City of Evansville, Indiana

Cause No. 44760

Information Requested:

In response to OUCC data request 1-5, Petitioner indicates that the basis for the $10 million dollar estimate for "Preliminary Engineering for Treatment Plant" is the New Groundwater Treatment Plant Feasibility Study, Table 5.1, on page 32 (prepared by HNTB Corporation). Petitioner stated that the $10 million estimate "represents the design portion (typically referred to as preliminary engineering) of the $15.8 million figure …" Please answer the following questions:

a. Please list and explain what services will be provided for the $10 million figure.
b. Please provide the cost for each service described above.
c. Please explain how the costs associated with each service were determined or developed.
d. Please explain the need for each service to be provided.
e. Will any construction be funded by the $10 million?

Information Provided:

a. The services to be provided would consist of the design and preparation of detailed construction drawings and specifications for:

   1. a new facility utilizing the existing source water (Ohio River); or

   2. a new facility utilizing groundwater as the source water; or

   3. upgrade of the existing facility (originally constructed in the late 1800's) and continuing to utilize the existing source water; or

   4. conversion of the existing facility to utilize ground water as the source water.

   The determination of which option is to be designed will be made based on the studies identified in the response to Request 8-003 below.

DATA INFORMATION REQUEST

06/20/2016

City of Evansville, Indiana

Cause No. 44760

Information Provided (cont'd):

b. The cost of the aforementioned design and preparation of construction drawings and specifications would be lump sum and the eventual amount of these professional services (currently estimated at $10 million) would be negotiated with the consultant eventually selected.

c. The cost was estimated as detailed in OUCC DR 2-001.

d. The existing facility is approximately 120 years old and is Petitioner's sole source of supply to provide water to over 60,000 service connections and a population of approximately 200,000 individuals. Continued reliance on this aging facility is not an option. Petitioner must do something (i.e. replace or refurbish the existing facility) to address the age of the facility and mitigate risks related to barge traffic, chemical spills, etc. The completion of the studies identified in the response to Request 8-003 will allow Petitioner to determine the preferred recommended course of action.

e. The $10 million figure does not include any construction.

OUCC DR 8-002

06/20/2016

DATA INFORMATION REQUEST
City of Evansville, Indiana

Cause No. 44760

Information Requested:

Please describe or explain what studies Petitioner has performed in its effort to determine the long-term source of supply and water treatment option Petitioner will pursue (i.e. (1) upgrade existing plant to continue treating surface water; (2) upgrade / modify existing plant to treat ground water; or (3) construct new groundwater treatment plant to treat groundwater).

Information Provided:

The only formal study to-date that has been performed towards this effort is the document titled *New Groundwater Treatment Plant Feasibility Study* (previously provided in response to OUCC DR 1.5)

OUCC DR 8-003

06/20/2016

DATA INFORMATION REQUEST
City of Evansville, Indiana

Cause No. 44760

Information Requested:

Please describe or explain what studies Petitioner still needs to perform in its effort to determine the long-term source of supply and water treatment option Petitioner will pursue (i.e. (1) upgrade existing plant to continue treating surface water; (2) upgrade / modify existing plant to treat ground water; or (3) construct new groundwater treatment plant to treat groundwater).

Information Provided:

Studies remaining to be performed in order to determine which option will be pursued are the pending master plan update that will detail the needs to keep the existing plant in operation for the next 30 years and the estimated $650,000 project titled *Raw Water Main and Treatment Plant Property Acquisition* that was discussed in the response to OUCC DR 2-001.

OUCC DR 3-15

06/29/2018

DATA REQUEST

City of Evansville
Cause No. 45073

Information Requested:

On page 3 of Mr. Keepes rebuttal testimony in Cause No. 44760, he said "we should analyze the costs and benefits of the various options and present it as part of our next case when we recommend financing for whatever choice is made." This is also referenced in the Commission's order on the top of page 7. Has Evansville performed this analysis? If so, please provide this analysis.

Information Provided:

The analysis of the costs and benefits of the various options has commenced and been ongoing since the October 5, 2016 Order of the Commission and subsequent availability of funding for the wellfield evaluation. A part of that effort is attached in the form of the document titled *Preliminary Test Drilling Results-September 8, 2017* (Attachment OUCC DR 3-15.pdf). As was outlined in direct testimony, that document details the fact that potential quantities were not as promising as was hoped. However, the magnitude of importance of a thorough investigation and the long-term impacts of the eventual decision dictated that the preliminary professional recommendations in that report be followed, and easement acquisition efforts commenced to perform additional test borings. This has, unfortunately, resulted in delays to the overall analysis. Specifically, additional time was required for acquisition of these easements, and unusually high river levels resulting in inundation of the additional sites delayed the actual drilling until March 22nd, 23rd and 25th of this year. Three borings (one on each of those dates) were performed when unusually high river levels once again forced demobilization of the drilling crew. When conditions permitted, two more test borings were performed, one on May 21st and another on May 23rd. The results of these five additional borings are not yet complete but are anticipated by July 2018. As discussed in the Direct Testimony of Patrick R. Keepes in Cause No. 44760, at pg. 5, the CIP is a 4-year plan which extends until 2020. As stated previously, Evansville is currently only in Year 2 of the 4-year plan.

Attachments:

OUCC DR 3-15.pdf

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MEMO

Ranney Collector Wells
Columbus, Ohio
614.888.6263

To: **Joe Thais, HNTB**

From: **Henry Hunt**

Date: **September 8, 2017**

Subject: **Preliminary results from test drilling, Evansville, IN**

Test drilling was performed in accordance with our proposal of July 22, 2016 for Phase 2 –Test Drilling and Preliminary Testing during the period from July 25, 2017 – August 11, 2017. Six test borings were installed in the easement area along Waterworks Road, generally south and east from the existing City water treatment plant. The approximate locations of these six borings are shown on the attached Figure 1.

The test area consists of a wide floodplain south and east from the existing water treatment plant (WTP) that extends upriver past Route 41 to within about 3 miles of Newburgh, Indiana. The entire area consists of reworked channel and riverbank deposits of the Ohio River that have evolved over many years. The last major change in the course of the Ohio River was reportedly in the 1800's possibly as the result of seismic activity. This change resulted in the present-day course of the Ohio River which may have shifted the river about 1 mile to the south and west from its' previous northern (Indiana) bank located in the vicinity of Waterworks Road, which follows the approximate current boundary between Kentucky and Indiana. This Phase of the investigation was confined to drilling sites within the State of Indiana, along Waterworks Road a distance of about 2 miles from the WTP.

Boring location, coordinates, depths and other pertinent information is presented following table.

Test Boring/Observation Well Summary

Boring ID	Date Drilled	State Plane Coordinates Indiana West Zone 1302		Grade Elevation (NAVD88)	Total Depth Drilled [1]	Depth to Bedrock [1]	Bedrock Surface Elevation (NAVD88)	Static Water Elevation (NAVD88)	Screen Setting for Well/ Piezometer [1]
		Easting	Northing						
		(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)
TB2017-1	7/26/2017	2,811,850	983,909.5	364.83	116	110	254.8	348.9	90 - 100
TB2017-2	7/28/2017	2,812,054	983,066.7	365.20	115	111	254.2	348.7	Abandoned
TB2017-3	7/30/2017	2,812,973	981,202.4	365.82	114	112	253.8	349.1	Abandoned
TB2017-4	8/9/2017	2,813,390	980,386.3	366.42	113	111	255.4	350.2	65 - 75
TB2017-5	8/1/2017	2,814,267	979,149.1	367.24	113	110	257.2	351.3	90 - 100
TB2017-6	8/8/2017	2,815,413	977,792.8	367.39	112	110	257.4	351.6	75 - 85

Notes: (1) All depths are referenced from land surface at boring location.

In general, sandy soil conditions were encountered in all six borings, common in alluvial sediments found along the Ohio River. The stratigraphic column showed layers of soils typical of the alluvial-related deposition that would have occurred over the years as a result of glacial activity and the river migration reported in this area. TB2017-5 and TB2017-6 encountered increased amounts of coarser deposits, including coarser sands and gravels.

All test drilling sites indicated aquifer materials that could be utilized to develop a groundwater supply to wells. The finer-grained deposits encountered in borings TB2017-1 through TB2017-4 showed generally fine to coarse sands with some silt. TB2017-6 showed a similar sequence of sand but contained gravel deposits over the interval from 55 to 86 feet. TB2017-5 showed a higher percentage of coarse gravel deposits that extended over the interval from 54 to 104 feet below grade (with a sequence of sand from 80 to 90 feet).

While each boring encountered aquifer formation deposits suitable for developing a groundwater supply, the yield for each well will vary according to the hydraulic characteristics of the aquifer formation that would be screened by each well. From our preliminary evaluation of the test data, we would expect that a collector well constructed at the locations of TB2017-1 through TB2017-4 could develop a capacity ranging from about 4-6 MGD. A collector well located at TB2017-5 would be expected to be in the range of 10 MGD, while a collector well constructed at the location of TB2017-6 would be expected to be in the range of 5-6 MGD. Site specific aquifer testing (Phase 3) is required to develop firm estimates of the aquifer characteristics necessary to verify expected well capacities and develop well design parameters. Typically, the detailed aquifer test is conducted at the boring site with the most indicated potential, in this case TB2017-5.

The boring sites were located along Waterworks road, and the distance from the borings to the Ohio River (recharge source) varied from about 2000 feet at TB2017-1 to over a mile at TB2017-4, 5 and 6. This distance from the river would likely result in wells that pump largely groundwater from storage within the floodplain area. Wells constructed closer to the Ohio River would be expected to develop some percentage of water that would recharge the aquifer through induced (e.g. riverbank) infiltration which would be expected to support 30% to 50% higher individual well yields. Additionally, wells located near the river would be expected to produce water lower in mineral content than wells constructed further back, such as along Waterworks Road.

As part of the preliminary testing of the test borings, a short pumping test was conducted and water samples were collected and submitted to a laboratory for preliminary screening purposes. A general summary of the laboratory results for each boring is presented in the following table.

Laboratory Water Quality Results

Constituent	Units	TB2017-1 90-100 ft	TB2017-2 90-100 ft	TB2017-3 70-76 ft	TB2017-4 65-75 ft	TB2017-5 90-100 ft	TB2017-6 75-85 ft
Arsenic	mg/l	0.009	0.008	ND	ND	0.008	0.005
Iron	mg/l	3.63	3.38	1.75	1.70	4.46	1.49
Manganese	mg/l	0.276	0.398	2.260	3.390	0.359	1.950
Hardness, (Total)	mg/l	410	420	360	310	590	350
pH	S.U.	6.9	6.8	6.8	6.6	6.9	6.8
Total Dissolved Solids	mg/l	480	480	430	380	700	390
Chloride	mg/l	15	17	21	23	43	36
Nitrate as N	mg/l	ND	ND	ND	ND	ND	ND
Nitrite as N	mg/l	ND	ND	ND	ND	ND	ND
Sulfate	mg/l	100	120	86	71	200	30

These concentrations are reflective of groundwater quality in alluvial aquifers along the Ohio River. If the wells could be constructed closer to the river, we would expect recharge from the river would result in lower concentrations in some parameters. For comparison, concentrations of hardness observed in several collector wells located along the riverbank of the Ohio River have been observed at:

Industry in Brandenburg, KY – 300 mg/l
Industry in Henderson, KY – 180 mg/l
Louisville Water Company – 200-250 mg/l

Additional Investigation

Based upon the preliminary testing conducted in Phase 2 to date, it will require multiple collector wells to develop a firm capacity of 40 MGD, or more. If sites can be identified that have more favorable aquifer characteristics, higher individual well capacities would be expected and fewer wells would be required to meet the projected demand. The test borings at TB2017-5 and TB2017-6 encountered the most favorable aquifer deposits at the southeastern end of the line of borings. It appears that formation deposits may be improving in that direction, suggesting that further exploratory test drilling could identify additional sites, and sites with better potential to meet higher well capacities.

Four additional areas (Figure 2) have been tentatively identified as possible sites where additional exploration is warranted:

A: area away from the river, generally to the east of Waterworks Road. Since the property owner where TB2017-5 and 6 were installed appears amenable to allowing site access, perhaps areas on that property should be considered.

B: area toward the river, on property within the State of Kentucky. As mentioned above, higher individual well capacities and improved raw water quality are anticipated from wells located closer to the river.

C: areas continuing down the easement along Waterworks Road across and past Route 41 (this becomes Shawnee Drive), possibly extending down as far as the intersection of Shawnee Road and the Ohio River.

D: areas where Shawnee Road reaches the Ohio River. If favorable geologic deposits exist and a hydraulic connection exists between the aquifer the river, wells in this area could offer the benefit of developing higher percentages of infiltrated water which should provide increased well capacities and improved raw water quality.

Preliminary Recommendations

The test drilling has identified suitable aquifer formation deposits to develop a groundwater supply to meet future demands for EWSU. The results of the test drilling showed improving geologic conditions as the borings progressed down Waterworks Road, suggesting that more favorable locations may exist outside of the area designated for the preliminary test drilling. It is critical to locate the most favorable sites to minimize the number of wells needed. Wells located closer to the river will have higher yields as well as better water quality, especially in regard to dissolved solids and hardness. By locating wells within 300 feet of the river, yield increases of 30- 50 % are possible, along with quality improvements.

It is recommended that additional test borings be made in one or more of the areas listed above to identify the most favorable site (or sites) for the detailed aquifer testing proposed for Phase 3.

Figure 1 - Location of Test Borings

Evansville Water & Sewer Utility, Evansville, IN

Layne Christensen - 6360 Huntley Road Columbus OH 43229 614-888-6263

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Figure 2 – Potential Additional Testing Areas

Evansville Water & Sewer Utility, Evansville, IN

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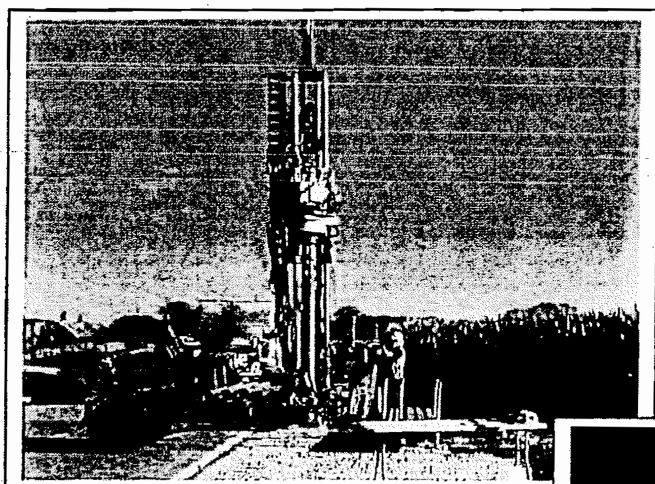
Report of Findings
Collector Well Feasibility Investigation

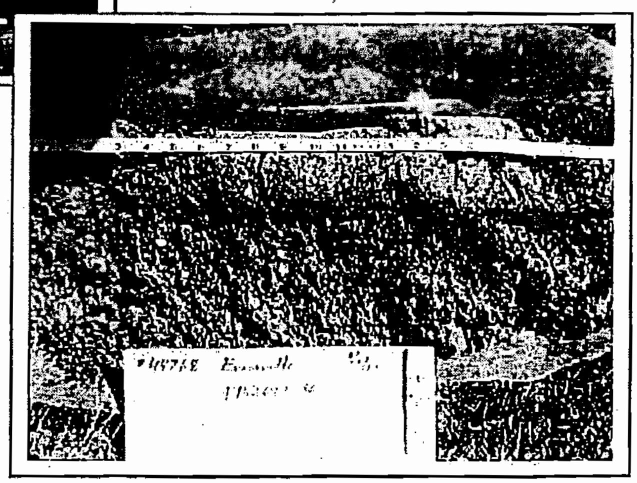


Prepared for:

Evansville Water & Sewer Utility (EWSU)

and

HNTB



Prepared By:

Layne
Ranney Collector Wells

Columbus, Ohio
August 3, 2018

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1 INTRODUCTION

Ranney Collector Wells (Ranney), a division of Layne Christensen (Layne) was contracted by the HNTB Corporation (HNTB) to assist with a hydrogeological investigation along the Ohio River to locate a groundwater supply of up to 40 million gallons per day (MGD) for the City of Evansville Water and Sewer Utility (EWSU). The purpose of this investigation was to determine the potential for developing a riverbank filtration (RBF) water supply using horizontal collector well technology. The focus area of this investigation was located along Waterworks Road to the southeast of the EWSU Waterworks (Figure 1). The work was conducted in accordance with the Ranney proposal dated July 22, 2016 as authorized by the Professional Services Agreement between Ranney and HNTB for HNTB Project No. 62609 dated October 2016.

1.1 BACKGROUND

The focus area for Phase 1 consists of a wide floodplain within the Green River Island area. The surficial geology along the Ohio River valley in this area consists of a variety of glacial and interglacial lithologic sequences characterized by alluvial and lake depositional events (USGS, 2011). The only aquifer in the area potentially capable of yielding the desired quantity and quality of water is the unconsolidated alluvium and glacial outwash deposits that fill the Ohio River bedrock valley. The thickness of these deposits can exceed 100 feet in the Evansville area. The fill is mainly fine to medium-grained lithic quartz sand, interbedded with lenses of clay, clayey silt, silt, coarse sand, and gravel (USGS, 2009). Typically, the lower part of the fill is gravelly sand to sandy gravel, the middle part is mostly sand, and the upper part consists of a surficial veneer of silt and clay interspersed with sandy levee deposits (USGS, 2009). These deposits conceal Pennsylvanian age bedrock consisting of interbedded shale and sandstone.

In 1951, an evaluation of the alluvial deposits at the Evansville Waterworks was conducted to determine the feasibility of developing a groundwater supply. This evaluation indicated the depth to bedrock at the Waterworks was over 100 feet with about 70 feet of saturated sand and gravel deposits (Mikels, 1951). Aquifer testing was completed and indicated that alluvial aquifer is hydraulically connected with the Ohio River, which would provide a source of recharge to the aquifer through induced RBF infiltration. The evaluation of the Waterworks site concluded that substantial groundwater development was possible in the area (Mikels, 1951). A review of the aquifer test data from this evaluation indicated an aquifer transmissivity in the range of 150,000 to 180,000 gallons per day per foot of drawdown (gpd/ft). Based upon this information and the close proximity to the Ohio River (recharge), it is estimated that a collector well could yield up to 15 MGD at this location.

1.2 SCOPE OF WORK

The scope of the Phase 1 evaluation was divided into two Tasks.

- Task 1 – Exploratory Test Drilling and Hydraulic Interval Testing
- Task 2 – Data Analysis and Reporting

Task 1 involved field activities consisting of the drilling and sampling of ten (10) exploratory test holes to collect site-specific hydrogeological data to evaluate the character of the aquifer for horizontal collector well development. The Task 1 activities have been completed and are the subject of this report (Task 2).

1.3 LIMITATIONS

This report was prepared for the exclusive use of EWSU and HNTB. This report was prepared for the specific application of developing a ground water supply using horizontal collector well technology. Ranney makes no warranty, whether expressed or implied, as to the actual water supply or quality available. Conclusions reached in this report are based upon the objective data made available to Ranney at the time this work was performed and the accuracy of the report depends upon the accuracy of these data. Ranney's responsibility is to apply its hydrogeology expertise, and collector well experience to provide an opinion regarding the development of water supplies of adequate capacity from horizontal collector wells developed in the alluvial aquifer along the Ohio River.

2 FIELD PROCEDURES

The yield of a collector well will be dependent upon the water transmitting properties of the aquifer present, well design and recharge. The aquifer targeted for evaluation is the unconsolidated alluvium and glacial outwash deposits that fill the Ohio River bedrock valley. Initially for Task 1 of this investigation, the evaluation of the water transmitting properties of this aquifer was conducted by the drilling and sampling of six (6) exploratory test borings (TB2017-1 through TB2017-6) (Figure 1) in July and August 2017. A follow-up investigation was conducted in March and May 2018 by the drilling of four (4) additional exploratory test borings (TB2018-7 through TB2018-10). To date a total of ten (10) exploratory test borings have been drilled and hydraulically tested for Task 1 of this investigation.

2.1 TEST DRILLING

HNTB/EWSU arranged for access to and selected the test drilling locations along a 4½ mile stretch of Waterworks Road. The borings were generally drilled within the right-of-way for Waterworks Road as local property owners were reluctant to provide permission to drill on their properties within the State of Indiana. Access was granted for one boring (TB2018-7) that was drilled along a farm lane about 2,600 feet east of Waterworks Road. Prospective sites on the south side of Waterworks Road were suggested, but not pursued due to being on the Kentucky side of the border. The drilling was directed by a Ranney Hydrogeologist experienced in collector well evaluations. The test borings were drilled by the Layne Specialty Drilling Division using rotasonic drilling technology. In rotasonic drilling, a drill casing is advanced into the ground using rotary/vibrosonic techniques. The rotasonic drilling method produces a nearly continuous core of the subsurface materials penetrated by the sample tube. This method does not require the use of drilling mud, so there is no mud to dispose of, and disturbance of the ground surface is minimal.

Each boring was advanced until bedrock was encountered. Lithologic samples were generally obtained every five feet and at each change in formation materials. The lithologic samples were placed in suitable containers, plainly identified as to date of collection, hole number, and depth of stratum. Sieve analyses were performed on selected lithologic samples collected from the test borings to help characterize aquifer materials and evaluate hydraulic conductivity. Upon completion of the project, all samples not selected for sieve analysis were turned over to EWSU.

Hydraulic interval tests (discussed below) were completed on both test holes. Following completion of the hydraulic interval testing, the test holes were either converted to 2-inch PVC observation wells or properly abandoned by filling the boreholes with bentonite grout.

Following the completion of the drilling and testing activities, HNTB arranged for surveying of the drilling locations. The horizontal coordinates and ground surface elevations at the drilling locations were surveyed.

2.2 HYDRAULIC INTERVAL TESTING

Hydraulic interval testing was completed at each of the boring locations. The vertical interval tested in the test holes was selected by the hydrogeologist on the basis of the drilling and sampling results. Upon reaching the total completion depth of the test boring, the casing was pulled back to the bottom of the interval to be tested, and a temporary well was constructed by installing a 10-foot length of well screen (4-inch diameter, wire-wrapped continuous slot) using the pullback method. The screen slot size was selected based on the grain size of the formation materials, with 0.020 inch to 0.060 inch slot screens utilized during the testing.

Development of the test interval was accomplished by air lifting for a two hour period after which the water produced was visibly clear and contained little or no sediment. The temporary well was equipped with a temporary pump capable of pumping up to 100 gallons per minute (gpm). An in-line electromagnetic flow meter (4-inch diameter Omega FMG1000 Series) was used to measure the pumping rates during the testing. The selected interval was pumped for a minimum of two (2) hours, with the pumping period divided into four (4) steps of at least thirty (30) minutes duration. During each step, the pumping was maintained at a constant rate.

Depths to water were measured to the nearest 0.01 foot in the temporary well prior to and during the pumping period. The elapsed time of pumping to the nearest minute and the pumping rate associated with each water level measurement were recorded.

During each step of the pumping period, water level measurements in the temporary well were made on approximately the following schedule:

- Every 1 minute for 0 to 6 minutes from the start of the step;
- Every 2 minutes for 6 to 12 minutes from the start of the step;
- Every 5 minutes after 15 minutes from the start of the step.

During the hydraulic interval testing, water samples were field screened for pH, conductivity, total hardness, iron and temperature. Additionally, water samples taken at the end of the pumping period were submitted to National Testing Laboratories (NTL) of Ypsilanti, Michigan for laboratory analysis and general quality screening.

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3 TASK 2 RESULTS

This section presents the findings of the field activities. From this information, preliminary collector well yield and conceptual design elements can be developed.

3.1 DRILLING RESULTS

Ten (10) test borings (TB2017-1 through TB2017-6 & TB2018-7 through TB2018-10) were drilled to evaluate the aquifer properties (Figure 1) along the right-of-way for Waterworks Road. Logs for the test borings and photographs of the lithologic samples are presented in Appendix A and a summary of information on the test holes is presented in Table 1. A generalized northwest to southeast cross-section A-A' (Figure 2) was developed from the test boring lithologic information. The cross-section is presented in Figure 3.

The total drilled depths of the test borings varied from 64 to 116 feet. The depths at which the top of bedrock was encountered generally varied from 100 to 112 feet. The exception to this was the eastern most boring (TB2018-10), which encountered bedrock much shallower at a depth of 60 feet. TB2018-10 was located near the Ohio River and directly across from the edge of the valley (bedrock high) located on the opposite side of the river. It is likely that this bedrock high continues across the river into Indiana at the TB2018-10 location. Based on the surveyed ground surface elevations and the depths at which the bedrock surface was encountered, the bedrock surface is relatively uniform across the other drilling sites. The bedrock surface elevations in the test holes varied from a minimum of 254 feet NAVD88 at TB2017-3 to a maximum of 261 feet NAVD88 at TB2018-9. While the bedrock surface elevation at the shallow TB2018-10 location was 310 feet NAVD88.

The alluvial materials above the bedrock are generally comprised of a fining upward sequence comprised predominantly of fine to medium-grained lithic sand, interbedded with lenses of clay, clayey silt, silt, coarse sand, and gravel. Typically, the lower portion of the alluvial materials encountered were generally comprised of coarse-grained materials including gravelly sand and sandy gravel with occasional cobbles. The middle portion is mostly fine to medium-grained lithic sand. Occasional thin, layers of clay were encountered in each of the test drilling locations. The upper part consists of finer overbank surficial deposits of sandy silt and clay. The bedrock encountered in the borings consisted of Pennsylvanian aged mudstone/shale and fine to medium grained sandstone. The bedrock is considered to be non-water bearing.

The two rounds of test drilling were conducted under substantially different river and groundwater level conditions. The groundwater level elevations in the test holes drilled in July-August 2017 (TB2017-1 through TB2017-6) ranged from 348.7 to 351.6 feet NAVD88 and indicated a west to northwest groundwater flow direction towards the river. The normal river pool elevation for this stretch of the Ohio River is 342 feet. During the 2017 test drilling program, the Ohio River level elevations reported at the Evansville gage (USGS 03322000) ranged from 342.1 to 349.6 feet NAVD88. The groundwater levels observed in the test borings at the time of the drilling were within depths at which the formation material was predominantly sand to silty sand indicating that the aquifer is under unconfined to semi-confined conditions.

The groundwater level elevations in the test holes drilled in March 2018 (TB2018-8 and TB2018-9) were considerably higher ranging from 360.0 feet NAVD88 (TB2018-8) to 361.6 feet NAVD88 (TB2018-9). The elevated groundwater levels observed in these borings were due the recent flooding of the Ohio River. The Ohio River level elevations at the Evansville gaged during the March 2018 drilling ranged from 351.9 to 356.7 feet and had recently been as high as 375 feet. Flood waters prevented access to the TB2018-7 location until May 22, 2018. During the testing of TB2018-7, the groundwater level was found to be flowing to at least 3 feet above grade under artesian pressure (grade elevation 356.6 feet). The flowing artesian conditions were likely the result of the recent Ohio River flooding.

3.2 GRAIN SIZE DISTRIBUTION ANALYSIS

Lithologic samples from each boring were selected for sieve analysis to determine the grain size distributions. The sieve analysis results are summarized in Table 2 and the sieve analysis data and grain size distribution graphs are presented in Appendix B.

As shown in Table 2, the range of the 60% passing grain diameter (D_{60}) of the samples analyzed varies from a minimum of 0.008 inch to a maximum of 0.202 inch. The uniformity coefficients ($C_u = D_{60}/D_{10}$) for the selected samples ranged from 1.5 to 16.9, with the majority having uniformity coefficients less than 4. Material with a C_u less than 4 is considered poorly graded or uniform.

Using the sieve analysis results, hydraulic conductivity values were estimated from grain size distribution based on equations presented in Vukovic and Soro (1992). These equations relate hydraulic conductivity to the effective grain size, grain size distribution and degree of sorting in the lithologic samples. It should be noted that hydraulic conductivity estimates based on grain size distribution are considered to have a low level of accuracy. They are presented in Table 2 to allow comparison of the vertical and horizontal variations within the aquifer materials and for comparison with the hydraulic conductivity values determined from the hydraulic interval tests.

3.3 HYDRAULIC INTERVAL TEST RESULTS

The data obtained from the hydraulic interval tests were utilized to calculate the aquifer transmissivity and hydraulic conductivity. Due to the short duration of the hydraulic interval tests and because they are single well pumping tests, the results for the aquifer parameters should be considered as approximate and are intended primarily to allow comparison of the test hole locations.

The transmissivity and hydraulic conductivity of the aquifer can be estimated from data collected during the interval tests. Transmissivity of an aquifer can be estimated from specific capacity using the following equation (Driscoll, 1986):

$$T = 1500 * Q/s \quad \text{(unconfined)}$$

or

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$$T = 2000 * Q/s \quad \text{(confined)}$$

Where: T = transmissivity, gpd/ft
Q/s = specific capacity, gpm/ft

Hydraulic conductivity is related to transmissivity by the following equation:

$$K = T/b$$

Where: K = hydraulic conductivity, gpd/ft^2
b = aquifer thickness, feet

For the hydraulic interval tests, the temporary small diameter wells were used to evaluate the permeability of the selected interval in the borings. The specific capacity data from the test were adjusted for well loss and the effects of partial penetration effects using an equation by Kozeny (Driscoll, 1986), such that:

$$T = \frac{1500 \cdot Q/_s}{X \cdot E}$$

$$X = L \cdot \left[1 + 7 \cdot \sqrt{\frac{r}{2 \cdot b \cdot L}} \cdot \cos\left(\frac{\pi \cdot L}{2}\right)\right]$$

Where: r = well radius, in feet
b = aquifer thickness, feet
L = well screen length as a fraction of aquifer thickness
and E = efficiency, obtained from analysis of the step test

The Kozeny equation to adjust for partial penetration is based on the assumption that the aquifer is homogeneous and isotropic. Because the aquifer materials have a fining upward character at the sites tested, the partial penetration adjustment could result in an overestimate of the transmissivity and hydraulic conductivity values. For the transmissivity estimates, only the coarser deposits of sand to sandy gravel were considered in determining the saturated thickness of the alluvial aquifer at the sites.

The hydraulic interval testing results are presented in the following discussion and summarized in Table 3, with the water level data being included in Appendix C. Semi-logarithmic plots showing the time-drawdown relationships during the individual hydraulic interval tests are depicted in Figures 4 through 12.

Following the drilling of TB2017-1, a temporary well screen (0.020-inch slot openings) was set between depths of 90 and 100 feet for hydraulic interval testing. The TB2017-1 temporary well was pumped at rates of 40, 55, 70 and 88 gpm, with the observed drawdown at the end of the 4th step being 6.44 feet

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equating to a specific capacity of 14 gallons per minute per foot of drawdown (gpm/ft). The transmissivity of the aquifer materials at TB2017-1 was estimated to be 116,000 gallons per day per foot (gpd/ft) and the hydraulic conductivity was estimated to be 1,400 gpd/ft^2, based upon an unconfined aquifer thickness of 81 feet. Following testing, the boring was converted to a 2-inch PVC observation well with a 10-slot milled PVC screen set from 90 to 100 feet. The observation well was completed with a flush-mount protective cover.

For TB2017-2, the temporary well screen (0.020-inch slot openings) was also set between depths of 90 and 100 feet for hydraulic interval testing. The temporary well was pumped at rates of 44, 60, 74 and 91 gpm, with the observed drawdown at the end of the 4th step being 8.67 feet equating to a specific capacity of 11 gpm/ft. The transmissivity of the aquifer materials at TB2017-2 was estimated to be 113,000 gpd/ft and the hydraulic conductivity was estimated to be 1,600 gpd/ft^2, based upon an aquifer thickness of 71 feet. TB2017-2 was abandoned with bentonite following testing.

With the consistent results from the first two tests, a zone of coarser deposits located in the middle of the aquifer was selected for testing at TB2017-3. The temporary well screen (0.040-inch slot openings) was set from 69 to 76 feet at TB2017-3. The temporary well was pumped at rates of 37, 61, 72 and 92 gpm, with the observed drawdown at the end of the 4th step being 12.24 feet equating to a specific capacity of 8 gpm/ft. The transmissivity of the aquifer materials at TB2017-3 was estimated to be 94,000 gpd/ft and the hydraulic conductivity was estimated to be 1,400 gpd/ft^2, based upon an aquifer thickness of 67 feet. TB2017-3 was abandoned with bentonite following testing.

For TB2017-4, the temporary well screen (0.060-inch slot openings) was also set between depths of 65 and 75 feet for hydraulic interval testing. The temporary well was pumped at rates of 36, 61, 75 and 93 gpm, with the observed drawdown at the end of the 4th step being 7.21 feet equating to a specific capacity of 13 gpm/ft. The transmissivity of the aquifer materials at TB2017-4 was estimated to be 101,000 gpd/ft and the hydraulic conductivity was estimated to be 1,900 gpd/ft^2, based upon an aquifer thickness of 54 feet. Following testing, TB2017-4 was converted to a 2-inch PVC observation well with a 10-slot milled PVC screen set from 65 to 75 feet.

At TB2017-5, the temporary well screen (0.060-inch slot openings) was set from 90 to 100 feet in a coarse zone of sandy gravel. The well was pumped at rates of 38, 61, 75 and 93 gpm, with the observed drawdown at the end of the 4th step being 2.10 feet equating to a specific capacity of 44 gpm/ft. The transmissivity of the aquifer materials at TB2017-5 was estimated to be 241,000 gpd/ft and the hydraulic conductivity was estimated to be 3,800 gpd/ft^2, based upon an aquifer thickness of 63 feet. Following testing, the boring was converted to a 2-inch PVC observation well with a 10-slot milled PVC screen set from 90 to 100 feet.

For TB2017-6, the temporary well screen (0.060-inch slot openings) was set between depths of 75 and 85 feet for hydraulic interval testing. The temporary well was pumped at rates of 42, 62, 77 and 94 gpm, with the observed drawdown at the end of the 4th step being 4.67 feet equating to a specific capacity of 20 gpm/ft. The transmissivity of the aquifer materials at TB2017-6 was estimated to be 143,000 gpd/ft and the hydraulic conductivity was estimated to be 3,000 gpd/ft^2, based upon an aquifer thickness of 48 feet. After testing was completed, TB2017-6 was converted to a 2-inch PVC observation well with a 10-slot milled PVC screen set from 75 to 85 feet.

For TB2018-7, the temporary well screen (0.020-inch slot openings) was set between depths of 85 and 95 feet for hydraulic interval testing. Prior to testing, the well was flowing under artesian conditions at about 1 to 2 gpm. The temporary well was pumped at rates of 40, 60, 82 and 99 gpm, with the observed drawdown at the end of the 4th step being 27.17 feet equating to a specific capacity of 4 gpm/ft. The transmissivity of the aquifer materials at TB2018-7 was estimated to be 34,000 gpd/ft and the hydraulic conductivity was estimated to be 500 gpd/ft^2, based upon an aquifer thickness of 66 feet. After testing was completed, TB2017-6 was abandoned with bentonite.

At TB2018-8, the interval selected for hydraulic testing was from 60 to 70 feet (0.040-inch slot openings). The temporary well was pumped at rates of 48, 66, 86 and 105 gpm, with the observed drawdown at the end of the 4th step being 7.52 feet equating to a specific capacity of 14 gpm/ft. The transmissivity of the aquifer materials at TB2018-8 was estimated to be 90,000 gpd/ft and the hydraulic conductivity was estimated to be 2,000 gpd/ft^2, based upon an aquifer thickness of 45 feet. After testing was completed, TB2017-8 was converted to a 2-inch PVC observation well with a 10-slot milled PVC screen set from 60 to 70 feet.

For TB2018-9, the temporary well screen (0.040-inch slot openings) was set between depths of 80 and 90 feet for hydraulic interval testing. The temporary well was pumped at rates of 37, 60, 77 and 103 gpm, with the observed drawdown at the end of the 4th step being 7.80 feet equating to a specific capacity of 13 gpm/ft. The transmissivity of the aquifer materials at TB2018-9 was estimated to be 113,000 gpd/ft and the hydraulic conductivity was estimated to be 1,600 gpd/ft^2, based upon an aquifer thickness of 69 feet. After testing was completed, TB2018-9 was converted to a 2-inch PVC observation well with a 10-slot milled PVC screen set from 80 to 90 feet.

Hydraulic interval testing was not conducted at TB2018-10 due the shallow depth to bedrock and limited thickness of sand and gravel deposits. This boring was abandoned immediately following drilling.

3.4 FIELD WATER QUALITY RESULTS

Field testing of the water discharged from the temporary wells was conducted. The discharge water was tested for temperature, pH, specific conductance, iron and total hardness. The field water quality results are presented in Table 4.

Specific conductance is a useful indicator of the total dissolved solids concentration of water because it is proportional to the dissolved ion concentrations. The specific conductance values from the discharge ranged from a low of 617 microsiemens per centimeter (µS/cm) for the average of samples from TB2018-8 to a high of 1,088 µS/cm for the samples from TB2017-5. In general, the deeper the sampled interval the higher the specific conductance value. The average pH values ranged from 6.9 to 7.4

standard units (SU). The average temperature of the water discharged from the wells ranged from 54.7 to 61.7° F.

The average of field test results for iron ranged from 0.3 to 7.6 milligrams per liter (mg/l). The high value of 7.6 mg/l (TB2017-5) exceeded the range of the test kit. In order to estimate the iron content from TB2017-5 a 50% solution of distilled water was used and the result doubled to estimate the iron content. This method could have introduced some error into the field iron result for TB2017-5. The field hardness values varied from 360 mg/l to over 400 mg/l, which exceeded the range of the field kit. Overall these concentrations are reflective of groundwater quality in alluvial aquifers along the Ohio River.

3.5 LABORATORY WATER QUALITY RESULTS

Water samples were collected from the temporary wells and submitted to NTL for laboratory analysis of selected parameters. The laboratory results confirmed the field quality analyses, indicating that the groundwater is relatively hard and high in iron, manganese and total dissolved solids (TDS). The total hardness values ranged from 310 mg/l at TB2017-3 to 590 mg/l TB2017-5. The concentrations in the samples from each of the borings exceeded the USEPA secondary maximum contaminant levels (SMCLs) for iron (SMCL = 0.3 milligrams per liter (mg/l)), with the exception of TB2018-8 (0.12 mg/l). The samples from each boring exceeded SMCL of 0.05 mg/l) for manganese. The samples from TB2017-5, TB2018-7 and TB2018-9 exceeded the SMCL for TDS (SMCL = 500 mg/l). None of the VOCs or any pesticides/herbicides that were analyzed for were detected at or above the minimum reporting limits.

For quick comparison of the water quality differences between the samples, a summary table of selected general groundwater quality parameters is presented below. A complete listing of all the parameters analyzed for is presented in Table 5 with the laboratory reports included in Appendix D.

Laboratory Water Quality Results

Constituent	Units	TB2017-1 90-100 ft	TB2017-2 90-100 ft	TB2017-3 70-76 ft	TB2017-4 65-75 ft	TB2017-5 90-100 ft	TB2017-6 75-85 ft	TB2018-7 85-95 feet	TB2018-8 60-70 ft	TB2018-9 80-90 ft
Arsenic	mg/l	0.009	0.008	ND	ND	0.008	0.005	0.016	ND	ND
Iron	mg/l	3.63	3.38	1.75	1.70	4.46	1.49	3.83	0.12	5.17
Manganese	mg/l	0.276	0.398	2.260	3.390	0.359	1.950	0.478	2.720	2.440
Hardness	mg/l	410	420	360	310	590	350	540	320	540
pH	S.U.	6.9	6.8	6.8	6.6	6.9	6.8	6.8	6.7	6.6
TDS	mg/l	480	480	430	380	700	390	650	370	580
Chloride	mg/l	15	17	21	23	43	36	33	23	9.6
Nitrate as N	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrite as N	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sulfate	mg/l	100	120	86	71	200	30	120	48	110

As shown, the overall water quality from the lower intervals tested was poorer than the shallower intervals tested. The only exception was for the manganese levels, which were generally higher in the shallower interval tests.

The water quality results represent the groundwater quality in the aquifer under the ambient conditions. Given the distances of the sites from the Ohio River, the overall water quality is unlikely to change significantly if collector wells were to be installed at these locations. If collector wells were installed adjacent to the river and pumped continuously at sufficient rates, the quality of water produced from the wells should improve due to the recharge from induced infiltration from the river, whose quality is lower in most dissolved parameters.

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4 COLLECTOR WELL YIELD ESTIMATES

The results of the drilling and hydraulic interval testing allow the estimation of potential collector well yield under conditions that vary from those observed during testing. The theoretical drawdown under steady-state pumping conditions in a collector well near a stream can be calculated using the following equation developed by Hantush and Papadopulos (1962):

$$s_{cs} \geq \left(\frac{Q}{2\pi Kb}\right) \mathrm{Ln}\left(\frac{\Gamma^{\Gamma}}{\varepsilon^{\varepsilon}}\left(\frac{\left(\frac{b}{\pi r_w}\right)^2}{2\left(1 - \cos\frac{\pi}{b}\left(2z_l + r_w\right)\right)}\right)^{\frac{b}{4l}}\right)$$

where:

	s_{cs}	= Drawdown in collector well, ft
	Q	= Yield of collector, gal/day
	K	= Hydraulic Conductivity, gal/day/ft^2
	b	= Saturated thickness of aquifer, ft
	Γ	= (2 (a - rc))/l
	a	= Effective distance to a line of recharge, ft
	l	= Average length of laterals, ft
	r_c	= Radius of collector caisson, ft
	ε	= (2a - rc - l)/l
	r_w	= Effective radius of each lateral, ft
	z_l	= Depth of lateral below static water level, ft

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For the purposes of estimating the potential collector well yields, the effective "a" distance to the recharge boundary represented by the Ohio River was set to the physical distance of the test sites to the river bank. The static water level was conservatively set to the normal pool elevation of 342 feet for this stretch of the Ohio River. The centerline of the collector well laterals was assumed to be in the lower portion of the intervals hydraulically tested at each boring. The average lateral length was assumed to be 200 feet and the available drawdown was set to maintain at least 20 feet of water above the laterals.

Table 6 summaries the preliminary collector well yields estimated using the above equation and site-specific information collected during the recent test drilling program. As listed the individual yields for collector wells installed at the test boring locations are estimated to range from 1.6 to 11 MGD.

The test borings are located distances of 2,000 to 7,300 feet from the Ohio River (recharge source). These distances from the river would likely result in wells that pump largely groundwater from storage within the floodplain area. Collector wells constructed closer to the river would be expected to develop a significant percentage of water through induced (e.g. riverbank) infiltration which would be expected to support 30% to 50% higher individual well yields assuming similar aquifer deposits.

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5 SUMMARY AND RECOMMENDATIONS

5.1 SUMMARY

Ranney Collector Wells, under subcontract to HNTB, recently completed a hydrogeological investigation along the Ohio River in the Green River Island area south of Evansville, Indiana. The objective of the project was to evaluate the feasibility of obtaining a groundwater supply of at least 40 MGD for the City of Evansville Water and Sewer Utility. The scope of work for Ranney's portion of the project consisted of the test borings, hydraulic interval testing and data analysis reporting.

The Phase 1 investigation, which included the drilling and sampling of ten (10) test borings and conducting hydraulic tests in these test borings. The majority of test holes were located within the right-of-way for Waterworks Road, generally south and to the east of the City's water treatment plant. The exception to this was TB2017-7, which was located down a farm access lane 2,600 feet east of Waterworks Road.

The drilling results indicated that the alluvial aquifer along the Ohio River at the test boring locations is comprised predominantly of a fining upward sequence comprised fine to medium-grained lithic sand, interbedded with lenses of clay, clayey silt, silt, coarse sand, and gravel. The lower portion of the alluvial materials is generally comprised of coarse-grained materials including sand and gravel with occasional cobbles. Occasional thin, layers of clay were encountered at the test drilling locations.

The total drilled depths of the ten (10) test borings varied from 64 to 116 feet. The depths at which the top of bedrock was encountered generally varied from 110 to 112 feet. The exception was TB2018-10, which encountered a bedrock high at a depth of 60 feet. Excluding TB2018-10, the bedrock elevation showed little variation ranging from about 254 to about 261 feet. Results of hydraulic interval tests indicated aquifer transmissivities ranged from 33,000 to 240,000 gpd/ft, with hydraulic conductivity values ranging from 500 to 3,800 gpd/ft^2. The water quality results indicated that the water is relatively hard with significant levels of iron, manganese and total dissolved solids.

The results of the test drilling and hydraulic interval testing program indicate that the materials present are of sufficient thickness and permeability to be considered for the development of collector wells. Preliminary collector well yields were estimated for each of the test boring locations. The individual yields for collector wells installed at the test boring locations are estimated to range from 1.6 to 11 MGD.

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5.2 RECOMMENDATIONS

Based upon the preliminary testing completed in Phase 1 to date, it will require multiple collector wells to develop a firm capacity of 40 MGD, or more. If EWSU desires to move forward with the potential development of a water supply utilizing RBF with collector well technology it is recommended that additional sites located adjacent to the Ohio River be evaluated. Collector wells located within 300 feet of the river would be expected to develop a significant portion of water through RBF and would be expected to support 30% to 50% higher individual well yields than those sites tested so far, along with water quality improvements. It is recommended that the area to the south of Evansville Waterworks along the Ohio River be evaluated (Figure 12). Existing information indicates that the bedrock surface elevation in this area ranges from approximately 240 to 260 feet (IGS, 1986 & USGS 2009). This indicates that there would be over 100 feet on unconsolidated materials at these locations, with the potential of up to 80 feet of saturated sand and gravel deposits.

It is also recommended that the site of the 1951 investigation of the Evansville Waterworks be evaluated to confirm their findings. A review of the available data from the 1951 investigation indicated an aquifer transmissivity in the range of 150,000 to 180,000 gpd/ft for the Waterworks site. Based upon this information and the close proximity to the Ohio River (recharge), it is estimated that a collector well could yield up to 15 MGD at this location. Water produced from the collector well at the Waterworks location could be used to augment the existing supply or blend with the existing surface water supply to possibly simplify treatment. Water produced from a collector well would be significantly lower in suspended solids than the existing surface water supply. Additionally, the water produced by a collector well would have a lower range of seasonal temperature fluctuations. The seasonal temperature range for a collector well at the Waterworks location would be expected to range from about 50 ° F to 65 ° F, which could be blended with the existing surface water supply to help mitigate the large temperature fluctuations observed with the existing supply.

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6 REFERENCES

Bruin, J. and H. E. Hudson, Jr., 1955. Selected Methods for Pump Test Analysis, Illinois State Water Survey, Report of Investigations, No. 25.

Driscoll, F. G., 1986. Groundwater and Wells, 2nd Edition. Johnson Division, St. Paul, MN.

Hantush, M. S. and I. S. Papadopulos, 1962. Flow of Ground Water to Collector Wells, Proceedings of the American Society of Civil Engineering, Hydraulics Division Journal, pages 221- 244.

Indiana Geological Survey (IGS), 1986. Alluviation of the Ohio River Valley near Evansville, Indiana, and its Effect on the Distribution of Sand and Gravel in the Area. IGS Special Report 36.

Mikels, F.C., 1951. *Report on a Pumping Test at Evansville, Indiana*, U.S. Geological Survey in Cooperation with the Indiana Department of Conservation – Division of Water Resources, September 1951.

Rorabaugh, M. I., 1956. *Ground Water in Louisville and Northeastern Kentucky with Reference to Induced Infiltration*, U.S. Geological Survey Water Supply Paper 1360-B.

US Geological Survey (USGS), 2009. Surficial Geologic Map of the Evansville, Indiana, and Henderson, Kentucky, Area. USGS Scientific Investigations Map 3069.

US Geological Survey (USGS), 2011. Probabilistic Seismic Hazard Assessment Including Site Effects for Evansville, Indiana, and the Surrounding Region Kentucky, Area. USGS Open-File Report 2011-1231.

US Geological Survey (USGS), 2017. Internet Web Page: USGS 03322000 OHIO RIVER AT EVANSVILLE, IN. https://waterdata.usgs.gov/in/nwis/uv/?site_no=03322000&agency_cd=USGS, Accessed: 8/25/2017.

Vuković, M. and A. Soro, 1992. *Determination of Hydraulic Conductivity of Porous Media from Grain-Size Composition*, Translated by D. Miladinov, Water Resources Publications, Littleton, Colorado.

Wenzel, L.K., 1942. Methods for determining permeability of water-bearing materials with special reference to discharging-well methods, USGS Water Supply Paper 887, US Gov. Printing Office, Washington, D.C.

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IN0043117
Vanderburgh Co

LLOYD WINNECKE
MAYOR

EVANSVILLE WATER & SEWER UTILITY

ALLEN MOUNTS
DIRECTOR

1 NW Martin Luther King Blvd. Room 104 · Evansville, Indiana 47708
P O Box 19, Evansville, Indiana 47740-0001
(812) 436-7846 · FAX (812) 436-7863 · TDD (812) 436-7864

June 28, 2019

RECEIVED
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IDEM/OWQ

Attn: Branch Chief
Indiana Department of Environmental Management
Office of Water Quality
Compliance Evaluation Section
100 North Senate Avenue
Indianapolis, Indiana 46204

Subject: **Evansville Water and Sewer Utility (EWSU) – Water Treatment Plant Vanderburgh County, Indiana - NPDES Permit No. IN0043117**

The following information is provided in regards to the above referenced subject and pursuant to the *SCHEDULE OF COMPLIANCE* in *Part I D.1:* that states "*This schedule of compliance shall not commence until a final determination on the mercury variance submittal is made by the Commissioner. Until a final determination on the variance request is made, the permittee shall continue to evaluate whether additional control technologies or pollution prevention measures exist to comply with the final effluent limitations or reduce the level of those pollutants currently being discharged by the plant. This evaluation shall be submitted to IDEM, OWQ, Compliance Evaluation Section every nine (9) months from the effective date of the permit. Monitoring and reporting of influent and effluent is required during the interim period*":

1) **Update on control technologies/pollution prevention** - no further feasible treatment or control technologies have been identified beyond those evaluated as part of the submitted *APPLICATION FOR A VARIANCE FROM INDIANA WATER QUALITY STANDARDS (MERCURY)* dated September 27, 2016.

2) **Summary of influent and effluent mercury data** – except for the current month (June) which is pending and will be provided once available, the following table summarizes the mercury concentrations as reported on the Monthly Monitoring Reports (MMR's) and Discharge Monitoring Reports (DMR's) for the previous nine (9) month period:

Mercury ng/L				
Date (collection)	**Effluent**			**Influent**
	Outfall 002	Outfall 004	Outfall 005	River
10/2018	7.13	6.22	44.5	<5.00
12/2018	<5.00	<5.00	<5.00	<5.00
02/2019	<5.00	<5.00	<5.00	<5.00
04/2019	262.00	16.3	7.40	6.89
06/2019				

A summary of the influent (river) and effluent (outfalls 002, 004 & 005) flow data for the corresponding period is attached with this update.

3) **Update on status of plant upgrades/source water transition (surface water to ground water)** - As was mentioned in the last report (a copy of which is attached for ease of reference), an extensive investigation of an alternate water source has been ongoing. Twelve test borings have been performed and preliminary water quality and quantity data has been obtained. The draft briefing memorandum of that effort is also attached with this report.

Concurrent with that wellfield evaluation was the development of a Request for Proposals (RFP) for Advanced Facility Planning (AFP) which was issued in November 2018 and proposals were received in January of this year. Responders to the RFP were subsequently interviewed and a professional team headed by AECOM was recently selected. The scope of that agreement is being finalized and fees are being negotiated as of this writing. The formal agreement is expected to be executed at any time. For information and reference, a copy of that RFP is also attached to this report

A subsequent update will be provided when the review of that draft report is completed and the next steps are decided upon or within nine (9) months as outlined above. In the interim, please feel free to contact me or the individuals copied below with any questions or if any additional information is needed.

Sincerely,

Patrick Keepes
Water Superintendent

Cc: Richard Glover – EWSU Water Production Manager
Timothy Hall – EWSU Water Quality Manager
File

Attachments

INFLUENT (RIVER) AND EFFLUENT (OUTFALLS 002, 004 & 005) FLOW DATA

	Oct-18				Dec-18			
	Influent (MG)	Effluent (MG)			Influent (MG)	Effluent (MG)		
Daily	River (Low Service Meter Readings)	Outfall 002	Outfall 004	Outfall 005	River (Low Service Meter Readings)	Outfall 002	Outfall 004	Outfall 005
Min.	19.58	1.2710	0.2730	0.6700	20.51	0.1273	0.0050	0.7980
Ave.	25.71	1.2918	0.7870	0.7999	24.27	1.2355	0.3148	0.8151
Max.	30.01	1.3010	1.8530	0.8780	29.88	1.2780	0.6710	0.8260
1st	27.12	1.2950	0.3170	0.8760	21.72	1.2780	0.0550	0.8210
2nd	27.33	1.2960	0.4200	0.8780	25.12	1.2780	0.0412	0.8230
3rd	28.99	1.2710	0.7680	0.7910	26.52	1.2770	0.0379	0.8210
4th	28.17	1.3010	0.4610	0.7500	26.11	1.2750	0.4340	0.8220
5th	27.06	1.3000	0.3260	0.7500	29.88	1.2750	0.5590	0.8200
6th	28.97	1.2960	0.5690	0.7500	22.38	1.2740	0.4220	0.8160
7th	28.66	1.2970	0.8580	0.7510	24.30	1.2740	0.5120	0.8190
8th	28.01	1.2970	1.1110	0.7510	25.65	1.2730	0.1020	0.8210
9th	28.95	1.2970	1.1640	0.7190	24.01	1.2740	0.0110	0.7980
10th	30.01	1.2970	0.9500	0.6970	25.66	1.2730	0.1510	0.8260
11th	25.70	1.2970	1.1290	0.6700	26.29	1.2740	0.3570	0.8250
12th	24.65	1.2960	0.6800	0.8190	26.68	0.1273	0.6660	0.8240
13th	23.55	1.2960	0.3750	0.8170	24.70	1.2740	0.5770	0.8240
14th	24.86	1.2960	0.2730	0.8180	25.11	1.2750	0.2480	0.8250
15th	24.46	1.2940	0.6440	0.8170	23.94	1.2730	0.3670	0.8240
16th	25.04	1.2910	0.6100	0.8160	22.81	1.2750	0.0920	0.8250
17th	28.79	1.2900	1.6630	0.8170	25.26	1.2730	0.1010	0.8210
18th	26.04	1.2900	1.6510	0.8190	24.64	1.2730	0.0670	0.8250
19th	23.70	1.2870	1.8530	0.8190	27.06	1.2700	0.0050	0.8200
20th	23.60	1.2880	0.7120	0.8190	25.38	1.2690	0.1540	0.8160
21st	23.31	1.2890	0.7740	0.8220	23.82	1.2680	0.5740	0.8120
22nd	25.36	1.2860	1.6670	0.8220	21.87	1.2680	0.3060	0.8070
23rd	26.72	1.2880	0.8800	0.8220	22.98	1.2690	0.2030	0.8070
24th	27.13	1.2880	0.6760	0.8220	23.83	1.2690	0.5460	0.8060
25th	25.09	1.2880	0.4740	0.8220	21.88	1.2700	0.5050	0.8070
26th	23.19	1.2890	0.5180	0.8230	23.73	1.2700	0.5750	0.8060
27th	21.98	1.2890	0.4890	0.8240	23.72	1.2700	0.4310	0.8030
28th	19.58	1.2890	0.3470	0.8240	20.51	1.2720	0.3810	0.8040
29th	23.89	1.2890	0.6850	0.8240	22.45	1.2700	0.3810	0.8010
30th	24.13	1.2890	0.7050	0.8240	21.32	1.2700	0.2260	0.8020
31st	22.82	1.2890	0.649	0.8240	23.10	1.2700	0.6710	0.7980

	Feb-19				Apr-19			
	Influent (MG)	Effluent (MG)			Influent (MG)	Effluent (MG)		
Daily	River (Low Service Meter Readings)	Outfall 002	Outfall 004	Outfall 005	River (Low Service Meter Readings)	Outfall 002	Outfall 004	Outfall 005
Min.	21.09	1.1040	0.0016	0.6030	11.95	1.2171	0.0843	0.5007
Ave.	24.37	1.2003	0.2949	0.6787	23.86	1.2938	0.3081	0.6207
Max.	28.03	1.2700	1.0770	0.8246	28.12	1.2997	0.6654	0.7251
1st	21.17	1.2700	0.5180	0.7042	25.06	1.2934	0.3429	0.6524
2nd	28.03	1.2690	0.6790	0.7058	25.40	1.2938	0.4358	0.7251
3rd	24.72	1.2660	0.0337	0.7069	26.85	1.2935	0.3709	0.6712
4th	25.90	1.2630	0.1044	0.7076	22.92	1.2946	0.1625	0.6359
5th	27.08	1.2640	0.2697	0.6579	24.67	1.2948	0.3222	0.6126
6th	27.50	1.2640	0.2510	0.6400	24.00	1.2952	0.1566	0.6110
7th	26.25	1.2630	0.0435	0.6417	11.95	1.2937	0.0953	0.6142
8th	23.87	1.2630	0.0560	0.6390	16.27	1.2951	0.3922	0.6136
9th	25.40	1.2600	0.4590	0.6210	26.54	1.2946	0.4398	0.6153
10th	25.30	1.2590	0.3110	0.6030	16.21	1.2956	0.3441	0.6403
11th	26.26	1.2580	0.3961	0.6466	25.95	1.2967	0.2074	0.7185
12th	26.87	1.2340	0.3397	0.6596	26.63	1.2969	0.2032	0.7126
13th	26.71	1.1830	0.2546	0.6585	24.19	1.2971	0.1610	0.7094
14th	23.80	1.1450	0.2537	0.6567	22.97	1.2966	0.0965	0.7063
15th	21.77	1.1250	0.2718	0.6589	26.23	1.2964	0.3944	0.6965
16th	22.66	1.1150	0.2106	0.7098	26.50	1.2983	0.3907	0.6549
17th	21.38	1.1180	0.1336	0.7155	28.12	1.2997	0.4006	0.5519
18th	22.68	1.1280	0.3076	0.7177	26.04	1.2995	0.2322	0.5967
19th	22.37	1.1470	0.1982	0.7176	21.84	1.2981	0.2453	0.5947
20th	26.00	1.1650	0.2535	0.7198	23.41	1.2969	0.0843	0.5660
21st	23.26	1.1890	0.3163	0.7191	23.25	1.2963	0.1105	0.5472
22nd	21.09	1.2020	1.0770	0.8246	23.96	1.2960	0.6654	0.5007
23rd	23.46	1.1990	0.4992	0.6393	26.32	1.2964	0.5538	0.5756
24th	23.34	1.1880	0.0016	0.7217	27.00	1.2971	0.5060	0.5813
25th	24.19	1.1720	0.2858	0.6860	22.87	1.2973	0.1763	0.5866
26th	23.54	1.1040	0.2013	0.6393	25.16	1.2972	0.2611	0.5859
27th	22.61	1.1400	0.2490	0.6425	23.46	1.2978	0.3840	0.5866
28th	25.21	1.1550	0.2816	0.6431	24.16	1.2984	0.0864	0.5859
29th					23.66	1.2996	0.4092	0.5855
30th					24.09	1.2171	0.6137	0.5855
31st								

GROUNDWATER INVESTIGATION AND TEST DRILLING BRIEFING MEMORANDUM MARCH 2019 UPDATE

DRAFT

INTRODUCTION

Over the last 20 months, HNTB and the Ranney Collector Wells (Ranney) division of Layne Christensen (Layne), completed a test drilling program to explore the possibility of replacing the current surface water supply with groundwater. This effort included the installation of 12 test borings along Waterworks Road from the north side of the Water Treatment Plant (WTP) to the point where the road intersects the Ohio River as can be seen on Figure 1. Figure 2 provides a closer look at the locations of the most recent borings 11 and 12.

The goal of this phase of the test drilling program was to identify potential locations with a sufficient aquifer to produce 15 million gallons per day (MGD) each from three or four collector wells to provide a total of 45 to 60 MGD groundwater. Test drilling consisted of completing borings to bedrock while taking continuous formation samples. If a promising zone was found, a 4-inch diameter casing and screen were installed, the temporary well was developed and a pumping test was completed to measure the specific capacity and estimate the aquifer transmissivity and hydraulic conductivity. These values are then utilized to predict the capacity of a collector well installed at the location of the test boring.

RESULTS TO DATE

The following table summarizes the results of the test boring program to date:

Table No. 1 – Boring Results

Boring #	Screened Internal	Transmissivity GPD/FT	Hydraulic Conductivity GPD/FT	Specific Capacity GPM/FT	Potential Yield MGD
1	90'-100'	116,000	1,400	14	5.0
2	90'-100'	113,000	1,600	11	6.0
3	69'-76'	94,000	1,400	8	3.4
4	65'-75'	102,000	1,900	13	3.2
5	90'-100'	240,000	3,800	44	11.0
6	75'-80'	143,000	3,000	20	5.3
7	85'-95'	33,000	500	4	1.6
8	60'-70'	90,000	2,000	14	2.2
9	80'-90'	113,000	1,600	13	6.2
10	No pump test due to shallow depth to bedrock				
11	90'-100'	110,000	1,400	10	8.5
12	80'-90'	111,000	1,500	10	8.7

As can be seen in Table No. 1, the potential yield of collector wells installed in the sample area ranged from 1.6 MGD to 11.0 MGD, with borings #11 and #12 producing a combined total of an estimated 17 MGD. While less than the original stated goal, the boring results from #11 and #12 are promising and could be a good choice for a blending option at the plant replacing 70% of the average daily demand.

RECOMMENDED NEXT STEPS

To confirm the potential capacity of the area along the river in the area of borings #11 and #12, it is recommended that the test drilling program be continued to the next phase including completing a test production well located near the WTP and additional borings south of the marina in Kentucky. Earlier this year, approval was given by the EWSU to investigate completing additional borings along the Ohio River in Kentucky. As part of this effort, HNTB was tasked with and obtained access to the Staub property immediately south of the marina to allow the installation of additional test borings and possibly a test production well. With the extensive flooding along the river this winter, access to the Staub property was not possible at the time #11 and #12 were completed. It is recommended additional test borings located within the Staub property be completed during the test production well installation near the WTP.

HNTB still has $136,000 remaining in the original test drilling budget. To complete the additional borings, the test production well and their analysis, Layne's estimated total cost is $175,000. In addition to Layne's cost, HNTB expects to expend some time to plan and oversee their efforts and allowing for contingency, the EWSU should budget $200,000 to finalize the drilling program. Given that there is still $136,000 remaining in the original test drilling budget, an amendment of $64,000 will be required to complete the remainder of the program.


LOCATION M
EVANSVILLE, INDI
FILE NAME:
44768-01
DATE:
02/21/20
Layne
A GRANITE COMPANY
NORTH
1"=3200'
0 1600 3200 6400 9600
TB2018-10
TB2018-9
S Weinbach Ave
TB2018-8
HWY 41
41
TB2017-6
TB2017-5
TB2017-4
TB2018-7
TB2017-3
TB2017-2
TB2017-1
TB2019-12
TB2019-11
EVANSVILLE WATERWORKS
Evansville
S Green River Rd
Vann Ave
S Boeke Rd
Lincoln Ave
Washington Ave
S Governor St
S Garvin St
E Riverside Dr
SE Riverside Dr
SE 2nd St
S Barker Ave
S Tekoppel Ave
69
164

SCALE IN FEET

0 250 500 1000 1500

NORTH

Layne
A GRANITE COMPANY

6360 HUNTLEY RD
COLUMBUS, OHIO 43229
(614) 888-6263 / FAX (614) 888-9208

TEST BORING LOCATIONS
EVANSVILLE, INDIANA

PROJECT NUMBER	DATE	FILE NAME	SCALE	FIGURE
44768	02/21/2019	44768-05	1" = 500'	2

LLOYD WINNECKE
MAYOR

EVANSVILLE WATER & SEWER UTILITY

ALLEN R. MOUNTS
DIRECTOR

1 NW Martin Luther King Blvd. Room 104 • Evansville, Indiana 47708
P O Box 19, Evansville, Indiana 47740-0001
(812) 436-7846 • FAX (812) 436-7863

November 29, 2018

Re: RFP 2018-11
Advanced Facility Planning
Water Filtration Plant

mdl

The Evansville Water and Sewer Utility (EWSU) is seeking proposals for professional engineering services to perform Advanced Facility Planning for its Water Filtration Plant at 1301 Waterworks Road.

Your firm had previously expressed interest in EWSU Anticipated Service Needs in Filtration Plant Component Design, Task 2.42. As part of the continuing water supply management program, EWSU is seeking advanced facility planning services that will consist of:

- Evaluation of Master Plan, existing asset inventory, existing Plant processes and capability, planned short term improvements (based on existing asset inventory results), groundwater study results, and potential operational cost savings related to needed plant upgrades to ensure water quality and resilience
- Development of treatment alternatives ranging from use of all surface water to blended surface and groundwater to all groundwater
- Treatment alternatives to address maintaining water production through sequencing, decommissioning, and constructability during development of alternatives
- Examination and presentation of alternatives to provide information to allow the Utility management to select a preferred alternative, including opportunity for public input, evaluation by Plant Operations and engineering evaluation
- Survey
- Geotechnical Investigation
- Preparation of preliminary engineering report, opinion of probable cost and 20 percent level construction set for selected alternative
- Coordination of Permitting and Land Use with following potential agencies:
  - City of Evansville Transportation and Service Department
  - City of Evansville Engineering Department

  - o Evansville-Vanderburgh County Levee Authority
  - o US Army Corps of Engineers (USACE)
  - o Indiana Department of Environmental Management
  - o Indiana Department of Natural Resources
  - o Kentucky Energy and Environment Cabinet
- Identification of additional property needs as indicated by selected option.

Please submit your firm's proposal, identifying your project team qualifications for this type of work. Proposals will be evaluated with the following criteria:

1. Relevant Experience
2. Staff Resumes
3. Project Approach
4. Anticipated Project Schedule

All projects identified under Relevant Experience shall be projects that were completed within the last 5 years, and include contact names and direct phone numbers of client references. Please do not include any EWSU projects under Relevant Experience. The quality of service and value of service from your team to the EWSU on past projects will be evaluated internally by the selection committee. Please only show staff resumes of team members that you anticipate will have billable hours on this project.

Additional items that may be taken into consideration during the evaluation process include:

1. Typical Percent of work completed in Evansville
2. Typical Percent of work completed in Indiana
3. Typical Percent of work to WBE and MBE team members

Please be aware that there is a 7 percent WBE and 12 percent MBE goal established by the City of Evansville Purchasing Department, and the EWSU is eager to meet or exceed these goals whenever possible.

Proposals shall not exceed forty single-sided pages, including appendices. Proposals should include four separate sections, as identified under the evaluation criteria. Please include the three additional items for consideration, listed above, in a summary box within the proposal. Please include the office location(s) where the work will be completed, company history, team history, or any other information that you feel would be beneficial to the selection committee.

All firms submitting a proposal are welcome to interview and discuss proposal contents with Utility staff prior to the submission date. Once submission is complete, all proposing firms shall observe a "black out" period of communication with members of the selection committee for this proposal until a final selection is made.

Please submit one electronic version of your proposal to:

J. Cris Cottom, P.E.
Water Capital Projects Manager
1931 Allens Lane
Evansville, IN 47720

jcottom@ewsu.com

All digital proposals are due no later than 3 P.M. Thursday, January 10, 2019. It is the submitter's responsibility to ensure electronic delivery of the proposal in a timely manner. Digital proposals will not be accepted if received after the time and date specified above, even if a delivery problem existed within a Sharepoint, FTP, or Dropbox delivery method. The EWSU will send a confirmation email to the submitter once the proposal is downloaded into the EWSU system. If the proposal is delivered by email, please note the maximum attachment size is 10 MB. Proposal copy delivered by hand are due no later than 3 P.M. Friday, January 11, 2019.

The EWSU selection process will be used to select the successful professional service providers. All companies that submit a proposal will receive notification of the results upon completion of the selection process. It is expected that a shortlist will be created and proposal team interviews will be scheduled at a later date. If you have any questions, please feel free to contact J. Cris Cottom at 812-421-2120, Ext: 2203.

Sincerely,

Michael D. Labitzke, P.E.
Deputy Director of Utilities, Program Management Office

	Primary Characteristic	*Secondary Characteristic*			
ESTIMATE CLASS	**LEVEL OF PROJECT DEFINITION** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical variation in low and high ranges [a]	**PREPARATION EFFORT** Typical degree of effort relative to least cost index of 1 [b]
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgment, or Analogy	L: -20% to -50% H: +30% to +100%	1
Class 4	1% to 15%	Study or Feasibility	Equipment Factored or Parametric Models	L: -15% to -30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, Authorization, or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: -10% to -20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or Bid/ Tender	Detailed Unit Cost with Forced Detailed Take-Off	L: -5% to -15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Take-Off	L: -3% to -10% H: +3% to +15%	5 to 100

Note: From the AACE (Association for Advancement of Cost Estimating) International Recommended Practice No. 18R-97