



INNOVATIVE IDEAS
EXCEPTIONAL DESIGN
UNMATCHED CLIENT SERVICE

May 8, 2023

Clayton Whitson
CEO/President
Madison County Chamber of Commerce
1106 Meridian St #109
Anderson, IN 46016

RE: Central Indiana Water Study Evaluation Proposal

Dear Mr. Whitson

DLZ Indiana, LLC and its subconsultants (DLZ TEAM) is pleased to have the opportunity to submit this proposal for professional engineering services for the Central Indiana Water Study Evaluation. Since first envisioned, this scope has been refined as the next step in this process toward a long term solution for water supply.

DESCRIPTION OF THE PROJECT

The primary intent of the Central Indiana Water Study, commissioned in 2019, was to provide a better understanding of the supply and demand of water resources in the Central Indiana region. As part of this project, a Phase I Water Supply Needs study and a Phase III Water Availability study were completed in 2020 and 2021, respectively. Both studies were published by INTERA and funded by the Indiana Finance Authority (IFA). While these studies were vast and achieved its general goal of better understanding the demand and supply of water in the region under current and future conditions, they should be considered as an initial or first step, as there is a significant degree of uncertainty in the analyses within the reports and much additional work is required. For instance, certain types of analyses, such as a thorough drought analysis, a detailed climate assessment, and/or a drought risk characterization, have yet to be fully incorporated into the evaluation of the region's water supply-demand. Moreover, there are several key assumptions and analytical approaches within these reports which require careful consideration since slight variations in some of the assumptions made and approaches used could significantly alter the findings.

Given the small margin for error and potential severe human-life and economic consequences if water shortages do occur, an in-depth review of the Phase I and Phase III studies is warranted to ensure that future water supply projects are properly informed and based on conservative assumptions. An accurate understanding of the water supply and demand situation is critical for both the current and future population and economic interests. Consequently, the following proposed scope of work outlines the tasks needed to conduct an initial evaluation of the Phase I and Phase III studies.

SCOPE OF SERVICES

The DLZ TEAM proposes the following engineering services:

Task 1 - Initial Climate Change Review (\$38,000)

The DLZ TEAM will:

1. Review climate change assumptions made in computing long-term projections of demand and supply.
2. Conduct an initial literature review to compare the Phase I/III climate change assumptions and methodologies to the latest findings of the scientific community.
3. Evaluate the potential consequences and implications of any identified weakness or shortcomings in the current Phase I/III climate change analyses.

Task 2 - Initial Water Quality Review (\$24,000)

The DLZ TEAM will:

1. Review the assumptions, data, and mapping related to potential and known contaminant sources and plumes to demonstrate impact on access to available water.
2. Conduct an initial, more detailed mapping of potential and known contaminant sources and plumes in Marion County to demonstrate the impact on access to water availability as compared what was assumed in the Phase III study. The CONSULTANT will use new/different analyses, data sources, and/or utilize previous experience with tracking potential sources of contamination within the study area. The CONSULTANT may utilize previously developed and up-to-date databases of all past and present potential sources of contamination based upon a compilation of online regulatory databases along with conducting drive surveys of the area.
3. Evaluate the potential impact of the groundwater quality contamination on the potential groundwater supply for current and future conditions.

Task 3 - Initial Water Budget Review (\$45,000)

The DLZ TEAM will:

1. Review assumptions used in calculating natural streamflow and subsequently natural baseflow, which is the main driving component of water availability in the region.
 2. Evaluate the potential consequences and implications of any identified weakness or shortcomings in the current Phase I/III water budget analysis.
 3. Review assumptions used in computing excess water availability (i.e., water which can be used for future economic growth).
 4. Conduct an initial analysis to assess the sensitivity of water availability and excess water availability in the region to historical drought and demand patterns.
 5. Consider the impact of major return flows such as wastewater treatment plants and how they may impact excess availability analyses and conclusions.
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Task 4 - Initial Drought Characterization Evaluation (\$38,000)

The DLZ TEAM will:

1. Conduct an initial data analysis to estimate rainfall deficiency and characterize historical drought periods.
2. Evaluate if Phase I/III properly considered periods of droughts and/or characterized the risk of droughts in the future.
3. Evaluate the potential consequences and implications that drought of record conditions, including seasonal variability, may have on the water demand and/or supply.

Task 5 – Miscellaneous Items (\$40,000)

The DLZ TEAM will:

1. Conduct a study to evaluate the wellfield capacity in Morgan County and its relationship to water availability (water supply) in the Central Indiana Region. The evaluation will also consider normal and drought conditions along with water quality impacts in its groundwater supply characterization.
2. Evaluate flood control benefits to the City of Indianapolis/Hamilton/Marion/Madison Counties if an online storage reservoir for water supply purposes is constructed on the White River in Madison County.

Task 6 - Report & General Project Management (\$25,000)

The DLZ TEAM will:

1. Provide a report in written format summarizing the main findings.
2. Include contextual explanations with detail, figures, and/or tables sufficient to illustrate and substantiate the main findings and conclusions.
3. Provide a summary of its conclusions and recommendations based on the initial review.
4. Communicate as needed for general project management responsibilities.

DELIVERABLES

DLZ will deliver up to three electronic copies as necessary of the completed report.

SCHEDULE

Upon written notice to proceed, DLZ will complete the report and finalize those tasks that have additional effort needed. The remaining work described in the Scope of Services section will be completed within sixty (60) calendar days of final notice to proceed.

COMPENSATION

The above estimates are for breakdown purposes only. The total fee may require shifting of some funds within all six tasks resulting in the following total contract summation. DLZ proposes to be compensated a lump sum amount of Two Hundred Ten Thousand One Hundred Dollars and No Cents (\$210,100.00) for completion of the six above tasks. Additional services must be approved in writing prior to the commencement of that work and will require additional compensation as mutually agreed to.



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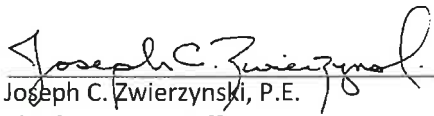
Central Indiana
Water Study Proposal
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STANDARD TERMS AND CONDITIONS

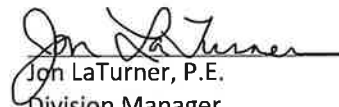
The Standard Terms and Conditions, as set forth in **Exhibit A**, are incorporated here into and made part of this proposal. The Owner referred to in the Standard Terms and Conditions means the Madison County Funding Group.

DLZ Indiana, LLC trusts that this proposal meets with your approval. We look forward to continued work with you on this project and appreciate the opportunity to submit this proposal for engineering services. If for any reason you should have any questions, please do not hesitate to contact Jon LaTurner at 317-532-8231.

Sincerely,

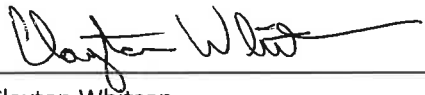


Joseph C. Zwierzynski, P.E.
Chief Operating Officer



Jon LaTurner, P.E.
Division Manager

APPROVED AND ACCEPTED



Clayton Whitson
CEO/President
Madison Co Chamber of Commerce

Exhibit A: DLZ Standard Terms and Conditions

Central Indiana Water Study Evaluation

Governmental units within Madison, Hamilton, Marion, and Morgan counties came together in 2023 to fund a regional study. Water use and supply, alternative supply options, and flooding impacts on the White River corridor were the focus. It was thought to be the next step forward from the State IFA Central Indiana Water Study 2020/2021 Phase 1 and Phase 3, for a regional plan of water security.

In review, while the State IFA reports were comprehensive and contained a significant amount of meteorological, hydrologic, demographic, and water-related data and analyses for the Central Indiana Region, a number of assumptions were made in the studies which require careful consideration. Slight variations to some of these assumptions could significantly alter the conclusions regarding the amount of excess water availability for the region. There were so many questions that we had to refocus our scope. So, this report addresses those questions and recommends the next steps.

Two examples:

As the final version of the State IFA reports were released, the data reported to have 180 million gallons a day (MGD) surplus of water. A 35 MGD water need in Lebanon surfaced which then led to the search for water outside our watershed to the Wabash River for a solution. With just a 17% increased need, it was determined the Indianapolis Metro could not supply the needed water.

The State IFA reports additional future supply available in the Morgan County River Corridor. This area currently supports Marion, Morgan, and Johnson counties with water. It will be demonstrated in this report the vulnerability of that current well-field, under a historically wet period.

The State IFA reports are statistical averaging data over a selected period of time to formulate its assumptions. It focused on the 3rd quarter of the year. A drought study would have modeled the drought of record against the demands (needs) of the region. In the Indy Metro, that time period is approximately 770 days before normal rainfall returns.

An alternative study would then evaluate possible solutions. Some work has been done by the State on the Wabash River at 35 MGD but hadn't factored drought or downstream impacts to this point. Mounds Lake has been modeled at 80 MGD during

the drought of record and adds new water into the Indy Metro without taking it from a community supply. There are other options of differing size and impact both in and outside the White River watershed that would be considered.

The next step is to fund a drought study and alternative study for the Indy Metro Region. This would allow this region to assess risk and create a regional water plan. Lebanon, which is outside the watershed, yet within the Indy Metro region, could be addressed by the fall of 2024 with a plan. Central Indiana Regional Development Authority (CIRDA) could lead these efforts assisted by the State of Indiana.

Collaborating Partners

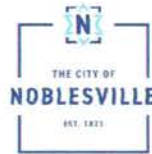
Anderson, IN



Morgan County EDC



Noblesville, IN



Indianapolis, IN



Madison County ED



Morgan County, IN

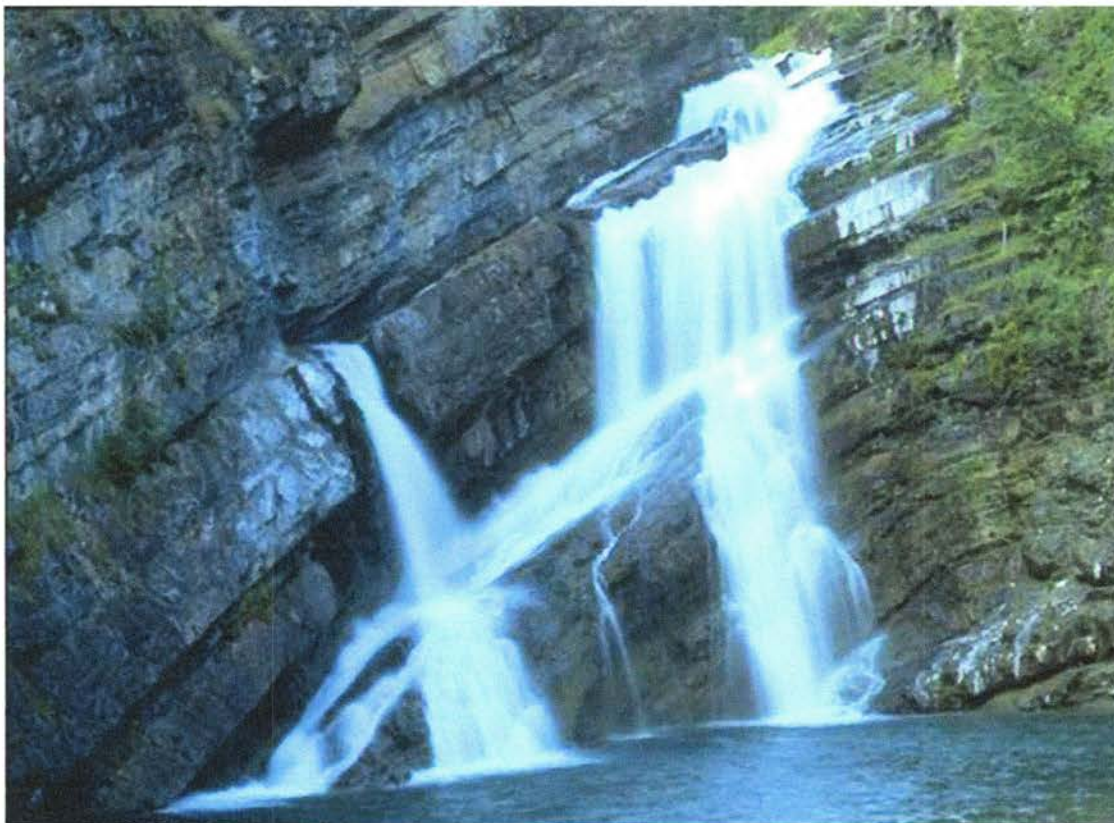


Madison County Chamber of Commerce



CENTRAL INDIANA WATER STUDY EVALUATION

CENTRAL INDIANA
MUNDELL PROJECT NO. M22032
FEBRUARY 28, 2023



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info@MundellAssociates.com*

CENTRAL INDIANA WATER STUDY EVALUATION

CENTRAL INDIANA

Prepared for:

Mr. Jonathan LaTurner, P.E.
Division Manager
DLZ
138 North Delaware Street
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February 28, 2023

Prepared by:

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EXECUTIVE SUMMARY

The Central Indiana Water Study was commissioned in 2019 for water supply planning with the primary intent “...to provide a better understanding of the supply and demand of water resources in the Central Indiana region” (Indiana Finance Authority, IFA, 2020; IFA, 2021b). This Central Indiana Region consists of the 9-county Central Indiana Planning Region: Boone, Hamilton, Hancock, Hendricks, Johnson, Madison, Marion, Morgan, and Shelby Counties. As part of the Central Indiana Water Study project, a Phase I Water-Supply Needs study (herein referred to as ‘Phase I Study’) and a Phase III Water Availability study (herein referred to as ‘Phase III Study’) were completed in 2020 and 2021, respectively. Both studies were published by INTERA and funded by the Indiana Finance Authority (IFA). The Phase III Study used a mass balance approach to quantify the current water availability. Then, the Phase III Study used the results from the Phase I Water Demand Study to predict the water availability in the year 2070 (IFA, 2021a).

The scope of each study was vast and achieved its goal of providing a better understanding of the supply and demand in the region. Based on these initial studies, recommendations were given to increase the resiliency of the regional water supply and allow for future growth (IFA, 2021a). While providing valuable insight into the challenges of water supply and possible solutions to increase resiliency, the studies also were only an initial, or first step, in understanding the water availability situation in the region. While these reports were comprehensive and contained a significant amount of meteorological, hydrologic, demographic and water-related data and analyses for the Central Indiana Region, a number of assumptions were made in the studies which require careful consideration. In particular, slight variations to some of these assumptions could significantly alter the conclusions regarding the amount of excess water availability for the region. In general, assumptions which require further characterization include the following concerns:

- the potential impacts of drought conditions on water demand and availability;
- the potential impacts of climate change on water availability over the next 50 years;
- the potential impacts of extreme localized weather events (*i.e.*, flash droughts) on the sub-basin water dynamics and the implications these have on the regional water budget; and
- the potential impacts from both potential and known sources of contamination pertaining to groundwater resources in the region.

As a result of this, this current evaluation is being conducted to further assess the above-referenced assumptions and further characterize the potential impact with the excess water availability in the Central Indiana Region. The findings related to each of the concern areas are summarized in the following sections.



Drought Considerations

Properly characterizing possible drought conditions is essential when evaluating the water in a region to be available for future economic growth. This type of risk characterization or consideration of various possible drought scenarios in the Central Indiana region will provide the further clarity needed for future water resource planning. When projecting future demand patterns, the Phase I Study has not yet incorporated drought scenarios such as the drought-of-record for the region or the possibility of extended dry periods. Extended dry periods, such as multi-year periods of drought, are a key consideration for planning purposes, as they are most impactful to a water supply. In addition, when quantifying the excess water available in the region, which is key to defining the available water in the region for future economic growth, the Phase III Study has not yet considered alternative drought conditions. In particular, the Phase III Study identified the excess available water based on hydrologic conditions observed only between 2007-2017, which was a relatively wet period, and thus the likelihood of a more severe drought occurring is high based on past observations. As this current review illustrates, the studies have not yet considered potential drought scenarios, and thus the results could be misleading without better characterization. For instance, the gap between water supply and demand during periods of droughts are likely underestimated. Moreover, there will likely be significant deficits throughout the region during drought periods which in some cases, could be relatively common.

Climate Change Impacts to Water Demand

Relative to predicting future water demand, the Phase I and Phase III Studies have thus far only conducted an initial climate change analysis which does not even consider the full range of potential climate variations. Results of initial climate change evaluations during the current study indicate that per capita demand predictions have potentially been significantly underestimated by the Phase I Study. Specifically, the multiple regression equation and elasticity constants used to predict the future per capita use in the Phase I Study do not adequately capture the correlation between temperature and demand for future warm months (e.g., April, October), nor do they account for the complexities within the hydrologic network. Moreover, initial review demonstrates the multiple regression analysis used in the Phase I study has a high degree of sensitivity, with subtle, even small changes to assumed variables resulting in large differences in projected demand (often leading to large increases to the projected future water demands). As such, it appears the Phase I Study likely underestimated the effect of climate change on projected demands, and further review and better characterization of climate change impacts to projected future demand is highly recommended.

Climate Change impacts to Future Water Availability

When projecting future water availability, the Phase III Study assumed that the natural baseflow (i.e., the amount of groundwater, which is a driving component of water availability in the region) will increase in the future based on observations during the short 2007-2017 timeframe considered. The Phase III Study readily admitted that further investigation of climate change's potential impact to natural baseflow is needed, indicating it is unclear if its assumption will remain valid in the future while simultaneously



recognizing the major impact climate change could have on water availability in the region. An initial, further review included in this report indicates this is likely an unconservative, inaccurate assumption as the dynamics of climate change will likely lead to a decrease in groundwater recharge, which will result in decreasing water availability in the region. In particular, in order for the Phase III Study's assumption of increased natural baseflow to be valid, it must be assumed that future precipitation storm events, which ultimately drive future water availability budgets, behave in a similar fashion as the historically observed events between 2007 – 2017. Careful consideration of climate change impacts and the effects of urbanization with regards to precipitation and aquifer recharge appears to indicate that the contribution of these storm events to the natural base flow (*i.e.*, the available water) will be different. As such, an underlying assumption employed in the Phase III Study's characterization of future water availability would be affected and further investigation is needed to explore the impacts of this changing hydrologic dynamic.

Intra-Drainage-Basin Dynamics and Their Impact on Excess Water Availability

Cumulative Excess Water Availability and Possible Conditions

In order to assess the potential excess water availability, The Phase III Study relied on the conditions observed in Central Indiana between 2007 to 2017 to assess whether enough water is present during dry periods. Their analysis indicated a potential total cumulative water surplus of 184 million gallons per day (MGD) within the three major drainage systems in Central Indiana. This was based on a 'single year' (seen mainly in 2012) worst case analysis that did not consider the potential for individual sub-basins to undergo their historical 'dry condition' at the same time. The results of this current review indicate that, even using the 2007-2017 time period (which is not the critical time period based on historical records of precipitation), there is the potential for a significant water deficit to occur "if" the sub-basins are allowed to experience their worst-case condition simultaneously. This water deficit ranged from - 35 MGD if only the 3rd Quarter data are considered each year, to -126 MGD if all Quarters (1st through 4th) are considered. This straight-forward consideration for alternate, observed 'worst case' conditions to occur simultaneously is reasonable for planning purposes, and indicates the need for further evaluation of 'worst case' conditions, along with better characterization of possible drought scenarios to be expected in the future.

Water Availability - Overestimation

The Phase I and III Studies did not conservatively (or accurately) estimate the available groundwater in the region which can be used as a sustainable supply for future water planning. As the Phase III Study indicates, the quantity of groundwater is the driving quantity for assessing water availability in the region (IFA, 2021a). To determine this value, the Phase III Study made a key assumption that all significant groundwater withdrawal wells are directly hydraulically-connected to nearby surface waters (*i.e.*, streams and rivers). This assumption is invalid for a portion of significant groundwater withdrawal wells which in 2018 accounted for a demand of about 29 MGD (IFA, 2020). As such, the Phase III likely overestimated the water available in the region by at least



this amount (*i.e.*, 29 MGD), but potentially more. This water demand needs to be accounted for in future water planning since these wells are likely withdrawing from isolated aquifers at unsustainable yields. As such, further investigation is needed to ensure the water available and excess water available is determined via conservative assumptions and is better characterized.

Water Budget Dynamics

For the purposes of regional planning and quantifying future water availability, the Phase III Study mischaracterized the Region's ability to re-use the return flows such as those from wastewater treatment plants to meet future demand. For instance, the Phase III Study concluded that "*...increases in future demand in the Public Supply sector are largely offset by increases in discharge from wastewater treatment plants*" to the streamflow (IFA, 2021a, p. 203). This is problematic considering the wastewater treatment plants discharge to *surface water*, while the Phase III Study assumed the Public Sector would meet its future demand primarily from groundwater wells (IFA, 2021a). Moreover, capturing these return flows can be logistically challenging in urbanized regions, where impoundments (*e.g.*, low flow dams) are often required to retain a portion of the water.

This issue has potential monumental ramifications considering wastewater treatment plants accounted for a combined annual average return flow of 208 MGD in 2018 in the areas beginning in Hamilton County and extending through Marion County alone (*i.e.*, highly urbanized regions). This issue is compounded when you consider the Phase III Study's method of quantifying water balances within each sub-basin is based on a total aggregate scale (*i.e.*, looking at each sub-basin as a whole), which can be misleading without careful consideration. As such, further evaluation of this issue is necessary to better characterize the accessible water available for future planning purposes.

Potential Water Quality Impacts from Pollution

The Phase III Study completed an initial assessment of the probable area of the Central Indiana sand and gravel outwash aquifer impacted by contamination from potential and known contaminant sources, resulting in an estimate of 11.3% of the outwash aquifer suffering impacts in Marion County. Further evaluation completed by the current study indicates that up to 30.8 % of the outwash aquifer area in Marion County could be impacted by potential and known contaminant sources. This percentage was arrived at by considering additional sources not noted in the Phase III Study, along with calculating plume areas for several likely contaminants present (for example, petroleum hydrocarbons and chlorinated organic solvents). This points to the need for a more complete mapping of known impacted areas and potential sources to understand the portions of the aquifer that should not be considered available for future use. Moreover, this issue is particularly pressing considering groundwater is essential for future water availability, as the Phase I Study indicated, "*...use of groundwater from aquifers along the White River, will likely increase to accommodate growth*" (IFA, 2020, p. iv).



MORGAN COUNTY WATER SUPPLY PRELIMINARY EVALUATION

CENTRAL INDIANA WATER STUDY EVALUATION
CENTRAL INDIANA

Prepared for:

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DLZ
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November 9, 2023

Prepared by:

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EXECUTIVE SUMMARY

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The MUNDELL/DLZ Team was asked to conduct an initial, more focused review of the water supply for Morgan County which is the furthest downstream county in the White River drainage system of the 9-county Central Indiana Planning Region. This initial review focused on information that is readily available, including data from the Phase III Study which is relevant to Morgan County. Based on this initial review, it can be concluded that:

The water available in Morgan County appears to be limited, especially when considering its use for regional planning. For example, water availability in Sub-basin 13 (as defined in the Phase III Study), which encompasses a large portion of the County, often had net negative deficits in the fourth quarter and limited excess water available in the fourth quarter during the relatively wet time period of 2007 to 2017.

In addition, Sub-basin 13 is extremely reliant on upstream return flows from human sources to maintain positive excess water availability. As such, there is significant variability in this flow. In addition, the ability to capture excess water in this portion of the County may be limited, and this reliance on return flows must be carefully considered when characterizing the water availability in the region.

More comprehensive studies are needed to better understand the observed trends, quantify water availability, explore the impact of drought, assess the water demand in the region, and characterize regional water supply solutions.



The following summarizes the results of this assessment which form the basis for this conclusion.

Hydrogeologic Setting

The highly transmissive outwash aquifer unit present along the White River valley in Morgan County constitutes the primary aquifer system that is capable of meeting the demands of high-capacity water users in the County. This aquifer system's primary source of recharge is through precipitation.

Water Budget

Water Availability: Sub-Basin 13 (Northeast Portion of Morgan County)

Deficits of water availability on a quarterly basis were observed throughout the 2007 to 2017 timeframe investigated, with the largest observed **quarterly deficit of -64.5 million gallons per day (MGD)**. On an annual basis, a decreasing trend of water availability was observed with the largest observed **annual deficit of -10 MGD**.

Using a less detailed analysis, stable trends of baseflow (*i.e.*, groundwater in the region, without accounting for human withdraws/return flows) were observed during 2018 to 2022. When reviewing baseflow from 2007 to 2022, a stable trend was also observed. However, the impacts of annual or multi-year wet periods did not appear to have lasting effects on the baseflow quantities in the region.

Excess Water Availability: Sub-Basin 13 (Northeast Portion of Morgan County)

Deficits of excess water availability (*i.e.*, the quantity of water that can be used for future planning purposes) were observed during multiple quarters in the 2007 to 2017 timeframe, with the largest observed **quarterly deficit of -36.7 MGD**. This deficit was mitigated as compared to the water availability deficit due to Sub-basin 13's reliance on upstream return flows from human sources to maintain excess water availability. Without these return flows, the total surface/groundwater withdrawal rate in Sub-basin 13 exceeded water availability during seven (7) of the eleven (11) years analyzed, with the **largest observed exceedance of 176.7 MGD**.

Climate Conditions

The observed water availability and excess water availability deficits observed in Sub-basin 13 during the 2007 to 2022 timeframe occurred during a relatively wet time period (above normal) in the Central Indiana Region, and in some cases, a historically wet time period (*e.g.*, multiple years with average annual precipitation within the top ten (10) wettest on record). To plan for future water supplies, a detailed drought and climate impact analysis is necessary to properly quantify the water supply source in Morgan County to be used for future planning purposes.

Water Availability: Southwest Portion of Morgan County (Downstream of Sub-Basin 13)

A brief evaluation of the southwest portion of Morgan County was conducted based on limited data availability. The analysis indicated that water availability in this area of the county may be limited especially when considering instream flow requirements. However, further data collection and analysis of this area is necessary.



Limitations of Collector Wells in Morgan County

A water yield and demand study completed by Black and Veatch in 2008 indicated that the capacity of future collector wells at the Waverly and Paragon Wellfields (in Morgan County) to induce streamflow from the White River may be limited, especially in comparison to the observed deficits noted in this evaluation. This indicates that quantities of excess available water in the White River supplied by upstream basins and return flows from human sources may not be able to be fully captured prior to washing downstream.

Potential Water Quality Impacts from Pollution

An initial assessment indicated that up to 7.6% of the White River Outwash aquifer in Morgan County may be impacted from contamination from potential and known contaminant sources. In addition, portions of the aquifer near Martinsville and Mooresville appear to have a higher relative concentration of potentially impacted areas. This points to the need for more complete mapping of known impacted areas and potential sources to understand which portions of the aquifer may have limited availability for future use.

Regional Solutions

Given the observed limitations of the water supply in Morgan County, regional water supply solutions could be developed to address both Central Indiana Regional needs and the local needs of Morgan County. A comprehensive alternative solution evaluation has not been completed for the Central Indiana Region. Further characterization of the water supply and demand in Morgan County along with the Central Indiana Region is needed to properly evaluate potential water supply solutions. Subsequently, a comprehensive review of potential solutions comparing and contrasting the economic, environmental, and social issues (*i.e.*, the "Triple Bottom Line") would be needed to assure the optimal solution(s) are chosen.

