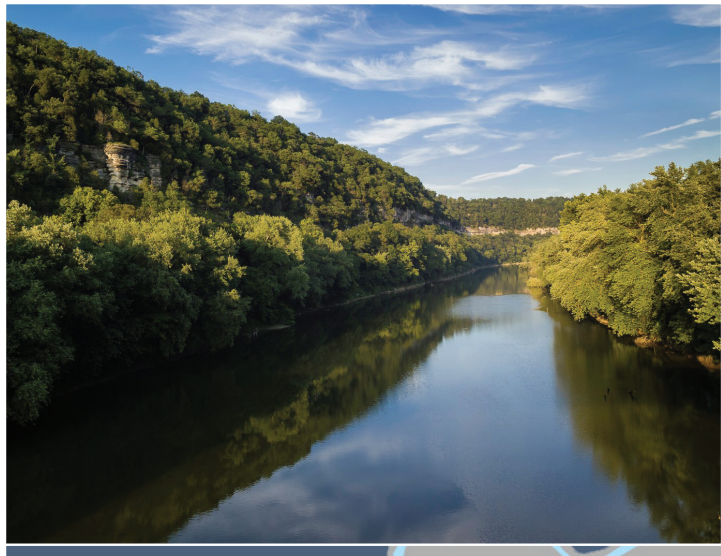


DRAFT COPY - NOT FOR PUBLIC RELEASE

2022 WATER SOURCE ASSESSMENT

Georgetown Municipal Water and Sewer Service

Georgetown, KY

December 2022

GRW PROJECT NO. 4909

engineering | architecture | geospatial

GRW | 801 Corporate Drive | Lexington, KY 40503 | 859.223.3999

December 2022 GMWSS Water Source Assessment – Changes since August 2022, draft document

The following summary describes the changes made to the text of the August 2022, document. These changes are highlighted in yellow in the body of the document.

1. Chapter 1 changes:
    a. The bases for construction cost inflation to 2025, purchased water costs in 5-year increments to 2045, and an explanation for why a a future water rate analysis is not included in this Assessment are provided. **Page 3**
2. Chapter 3 changes:
    a. New Figure 3-2 (GMWSS WTP Site) is added to the description of the GMWSS Water System Service Area. **Page 10**
    b. Figures 3-2 (GMWSS WSSA Population Projection, 2020 -2045) and 3-3 (GMWSS Average Daily Water Demand Projections, 2020-2045) are renumbered as Figures 3-3 and 3-4. **Pages 13, 16**
3. Chapter 4 changes:
    a. Second paragraph describing the Ohio River as a Surface Water Source is revised to include a description of the river pool upstream of Louisville. **Page 20**
    b. New paragraph titled "Water Availability from Viable Sources" is added to description of viable water sources for GMWSS. **Page 23**
    c. New Figure 4-6 (Frankfort WTP Site) is added to the description of Alternative B and Figure 4-6 (Alternative B Transmission Main Route) is renumbered as Figure 4-7. **Pages 27, 28**
    d. Figure 4-7 (Alternative C - KAW WTP Site) is renumbered as Figure 4-8. **Page 29**
    e. New Figure 4-9 (Alternative C1 Transmission Main Route) is added to description of Alternative C. **Page 30**
    f. Figure 4-8 (Alternative C2 Transmission Main Route) is revised and renumbered as Figure 4-10. **Page 31**
    g. Paragraphs describing Alternative D replaced with revised text, new Figure 4-11 (LWC Crescent Hill WTP Site) is added, and Figure 4-9 (LWC Clark Station Road Water Tank) is renumbered as Figure 4-12. **Page 32**
    h. Figure 4-10 (Alternative D Transmission Main Route) is revised and renumbered as Figure 4-13. **Page 33**
    i. Figure 4-14 (VMU WTP Site) is added to the description of Versailles Municipal Utilities. **Page 34**
4. Chapter 5 changes:
    a. In the section discussing costs for Transmission Mains, the paragraph describing river crossings is replaced with a new paragraph. **Page 38**
    b. The section discussing Annual Water Production and Purchase Cost is replaced with a new section titled Annual Water Production, Purchase and Distribution Costs. New Table 5-1 (Costs for Water Production, Purchase and Distribution per 1000 Gallons, for GMWSS Alternatives A-D) is added. **Pages 39-40**

c. A new paragraph titled Water System Improvements and Expansion Costs is added. **Pages 41-42**
d. Table 5-1 is revised and replaced with new Table 5-2 (Summary of 2025 Total Present Worth Costs, in $Millions, for GMWSS Alternatives A-D). **Page 43**
e. Table 5-2 is revised and replaced with new Table 5-3 (Summary of Water Sources, Suppliers, and 2025 Total Present Worth Costs, in $Millions, for GMWSS Alternatives A-D). **Page 43**
f. Table 5-3 is revised and replaced with new Table 5-4 (Summary of FPB, KAW and LWC 2025 Capital Costs, in $Millions, for GMWSS Alternatives A-D). **Page 44**
g. Tables 5-4 and 5-5 are revised and replaced with new Tables 5-5 and 5-6 (Scoring of Alternatives, "Low Range" and "High Range" Water Demands). **Pages 48-50**
h. In the section discussing Construction Costs for FPB, KAW and LWC to Supply GMWSS, the estimated capital costs for each utility to supply water to GMWSS are compared to costs GMWSS will pay to purchase water from the utility over the planning period. **Pages 44-45**

5. Appendix changes:
   a. The TPWC spreadsheets for each alternative in Appendix B are revised to include the annual costs for water treatment at the existing GMWSS WTP, the annual costs for water treatment at a new GMWSS WTP, and the annual costs for water distribution, operating and managing of the existing GMWSS water system. These spreadsheets also compare the total cost of purchasing water from each utility to the construction cost for the utility to provide water to GMWSS
   b. The section describing the Comparison of Offers from Utilities in Appendix C is replaced with a new section. **Pages 141-143**

Acknowledgements

Georgetown Municipal Water and Sewer Service

Chase Azevedo, P.E., General Manager

Alan Bryan, P.E. Capital Projects Manager

Kentucky Division of Water

Bill Caldwell, Acting Manager,
Watershed Management Branch

Jory Becker, P.E., Manager,
Water Infrastructure Branch

Frankfort Water and Electric Plant Board

Gary Zheng, P.E., Ph.D., General Manager

Louisville Water Company

Spencer Bruce, P.E., President, CEO

GRW Engineers

Joe Henry, P.E., Vice President

Joe Pavoni, P.E., LEED AP, Assoc. DBIA, Vice President

Mary Beth Robson, P.E.

Pete Johnson, P.E., LEED AP (retired)

Ruth Ann Combs

Table of Contents

Tables:

Figures:

Abbreviations:

AC	Annual Cost
ADD	Average Daily Demand
AWWA	American Water Works Association
CC	Capital Cost or Construction Cost
FPB	Frankfort Water and Electric Plant Board
GMWSS	Georgetown Municipal Water and Sewer Service
gpcd	Gallons per capita per day
GRW	GRW Engineers
KAW	Kentucky American Water Company
KDOW	Kentucky Division of Water
KSDC	Kentucky State Data Center
LWC	Louisville Water Company
MDD	Maximum Daily Demand
MGD	Million Gallons per Day
NSPE	National Society of Professional Engineers
O&M	Operation and Maintenance
PHD	Peak Hourly Demand
PWC	Present Worth Cost
RC	Replacement Cost
SV	Salvage Value
TPWC	Total Present Worth Cost
VMU	Versailles Municipal Utilities
WSSA	Water System Service Area
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

Chapter 1

Summary of 2022 Water Source Assessment

Assessment Approach

The Water System Service Area (WSSA) served by the Georgetown Municipal Water and Sewer Service (GMWSS) comprises the area west of Interstate 75 in Scott County, Kentucky. This area includes Georgetown, a community of residential and small commercial/industrial customers, the small town of Stamping Ground and a large area of agricultural land use. The WSSA has a 2022 population of approximately 56,000.

Water for this area has been historically provided from Royal Spring in Georgetown and it is treated by a Water Treatment Plant (WTP) located next to the spring. The limited available supply from the spring during droughts, coupled with periods of contamination due to non-permitted discharges within its recharge area, are of concern with regard to its water quantity and quality, limiting its reliability as a dependable water source. The WTP, which was last upgraded to a capacity of 4 million gallons a day (MGD) in 1973, is operating at 95% capacity and cannot alone produce enough drinking water to meet current demands. GMWSS relies on purchased water from the Frankfort Water and Electric Plant Board (FPB), which is supplied to the GMWSS distribution system via a pair of water transmission mains. Kentucky American Water Company (KAW) periodically provides water supply to GMWSS under emergency conditions.

This Assessment developed two projections for the future water demand of the WSSA to the year 2045. The first (or “Low Range”) projection was based on the demographics and land use of the area continuing to remain with the current profile of residential, agricultural and small commercial/industrial customers. Under this projection, the service area’s population will grow to approximately 101,400 by 2045, with an average daily demand (ADD) for water of 7.5 MGD and a maximum daily demand (MDD) of 11.25 MGD.

Under the second (or “High Range”) projection, it is assumed that one or more large water-consuming industries will move to the area. While the population will remain as projected in the “Low Range” scenario, the increase in industrial water demand is expected to require a 2045 ADD of 10.0 MGD and a MDD of 15.0 MGD. These two projections will require a water source that produces a larger quantity of water than Royal Spring and a treatment capacity beyond that of the existing WTP.

Throughout this Assessment, the term ADD has been used to evaluate the projected costs for alternatives considered for future GMWSS water demands. This has allowed the Assessment to be completed based on the normal daily production by, or purchase of, water for the WSSA. This Assessment, however, also recognizes that the facilities needed to meet this demand must also have capacity to meet, and shall be designed for, the MDD.

A review of potential water sources was completed in this Assessment. It was found that the most reliable sources included Pool 3 of the Kentucky River, Pool 4 of the Kentucky River and the Ohio River at Louisville. Concurrent with the water source review, an appraisal was made of the potential suppliers of water from these sources. The most viable suppliers were GMWSS (producing its own water from a new WTP) or purchasing water from FPB, Kentucky American Water Company (KAW) or the Louisville Water Company (LWC). This led to the development of five alternatives to serve the future water needs of the WSSA. In each alternative, the use of the existing spring and WTP will be phased out of use by 2028 when the new facilities are in operation. These alternatives are:

- **Alternative A.** GMWSS will build a new river water intake and raw water pump station to supply water from Pool 3 of the Kentucky River, as well as a new raw water transmission main to a new WTP located on the western side of the existing water distribution system. GMWSS will pay for all improvements under this alternative.

- **Alternative B**. GMWSS will purchase drinking water from the FPB, who will in turn expand the production capacity of their plant (which is supplied water from Pool 4 of the Kentucky River). FPB will build a new treated water transmission main to the Scott County line. GMWSS will build the continuation of this main in Scott County to connect to the existing water distribution system. Under this alternative, FPB will pay for all improvements outside of Scott County and GMWSS will repay for the FPB improvements based on a wholesale water rate negotiated between FPB and GMWSS. GMWSS will pay for all improvements in Scott County.

- **Alternative C1.** GMWSS will purchase drinking water from KAW, which has a WTP south of Owenton on Pool 3 of the Kentucky River and an existing treated water transmission main along Ironworks Pike. KAW will expand its Owenton WTP and continue to convey drinking water via its existing main to a tee at the intersection of Ironworks Pike and US 62, from which GMWSS will connect a new transmission main to the existing water distribution system. KAW will pay for all improvements outside of Scott County and GMWSS will repay KAW for these improvements based on a wholesale water rate negotiated between KAW and GMWSS. GMWSS will pay for all improvements in Scott County.

- **Alternative C2**. This alternative is similar to Alternative C1, except in the event the existing main along Ironworks Pike cannot meet GMWSS's water demands, a new

treated water transmission main will be built from the KAW Owenton WTP along Ironworks Pike. Under this alternative, GMWSS will be responsible for the cost of all improvements. In addition to paying KAW a wholesale rate for the water supplied by KAW, GMWSS will also be responsible for paying for the expansion of the KAW WTP and the new KAW water transmission main to the Scott County line.

- **Alternative D.** GMWSS will purchase drinking water from the LWC, which draws water from the Ohio River in Louisville. LWC has available treatment capacity to serve GMWSS without expanding its WTP. LWC will build a treated water transmission main to the Scott County line, including a crossing of the Kentucky River. GMWSS will be responsible for the continuation of this main into Scott County to the existing water distribution system. GMWSS will repay for LWC's transmission main based on a wholesale rate negotiated between LWC and GMWSS. GMWSS will pay for all improvements in Scott County.

Costs for construction of new water treatment, storage, pumping, and transmission facilities were developed in 2021 and 2022, then increased due to inflation to 2025, the year that contractor bids are to be taken and construction will begin. Annual costs for purchasing water or providing treatment and distribution of water were also developed in 2021 and 2022, then increased in 5-year increments during the period from 2028 (when the new facilities are to begin operation) to 2045 (the end of the planning period of this Assessment). These annual cost increases account for anticipated routine rate increases for water purchased from other utilities as well as for the cost of water distribution within the GMWSS Service Area and the cost for GMWSS to manage, operate, and maintain the water system.

Because the cost estimates in this Assessment are opinions of cost developed at the time the Assessment was prepared, rather than costs based on actual construction cost of new facilities and negotiated water purchase rates, a future water rate analysis cannot be provided in this Assessment. This Assessment does indicate, however, that GMWSS will be undertaking a significant financial burden (including debt service to retire construction costs and increases in water purchase or production costs) if either of the alternatives described in this Assessment is completed.

A Total Present Worth Cost (TPWC) analysis was completed in this Assessment to compare the construction cost, annual cost, equipment replacement cost and salvage value for these five alternates. This analysis included the TPWC for the 7.5 MGD ADD scenario and the 10.0 MGD ADD scenario for each alternative. Each alternative was also evaluated based on a series of non-monetary criteria.

The conclusion of these analyses indicated the most reliable and cost-effective alternative is Alternative B, which calls for purchasing water from FPB. Alternative D was a close second choice, but the risk associated with the potential for failure of the Kentucky River crossing would leave GMWSS without water for an extended period, a drawback to this alternative. Alternative C2 was not cost-effective due to the need for GMWSS to pay for

the expansion of the KAW WTP and the new transmission main to Scott County. Alternative A was not cost-effective either due to the cost for building and operating a new WTP, in addition to the cost of a raw water intake and raw water pump station on the Kentucky River. Alternative C1 was not recommended because its present worth cost was almost 40% more than that for Alternative B.

In addition, it was determined that the TPWC of Alternatives B/L, the "Low Range" option of Alternative B for supplying an ADD of 7.5 MGD (11.25 MGD MDD) in 2045, and Alternative B/H, the "High Range" option of Alternative B for supplying an ADD of 10.0 MGD (15 MGD MDD) in 2045 are approximately $40 million apart, even though the GMWSS share of construction cost for each alternative is almost the same. This difference was primarily due to the higher annual cost of Alternative B/H for purchasing more water during the planning period for industrial demand than Alternative B/L, which has no significant industrial water demand. If a water-consuming industry were to locate to the WSSA late in the planning period, instead of as soon as 2030 (as considered in the water demand projection for the "High Range" scenario), then the annual costs of AlternativeB/H would be closer to that of Alternative B/L, as would the TPWC. It will likely be necessary to negotiate a water use rate with industrial customers that is different than the rate for current customers so that GMWSS may recover the increased cost of purchasing water under Alternative B/H.

It is significant to recognize that the capability of GMWSS to supply enough water for a water-consuming industry early in the planning period will provide an excellent marketing tool as opposed to attempting to attract one before sufficient water is available for the industry's immediate use. This makes Alternative B/H a more logical option since it will ensure that an adequate water supply is available for industrial needs at any time after 2028.

Recommendation

Alternative B/H is recommended for the future GMWSS water supply needs. This calls for FPB to supply the 2045 ADD of 10.0 MGD as well as the 2045 MDD of 15.0 MGD.

This recommendation includes the operation of the existing GMWSS WTP at a lower production rate (2.5 MGD over two, 8-hour shifts a day) than it currently operates (3.8 MGD, or 95% of full capacity, over three 8-hour daily shifts). This will ensure that time is available each day for the plant to increase production, as needed, to match higher daily demands. While this will require an increase in the annual cost of purchased water from FPB until the new facilities are available, it will also provide needed time during the day for maintenance of the WTP. The cost of treatment and pumping will be reduced if the plant operates two 8-hour shifts a day rather than three as it does now. This "down time" is vital so that the WTP may continue to produce high quality drinking water until it is permanently taken out of operation.

To implement this Alternative B/H, the following schedule is recommended.

- 2022 to 2023:
  - Approve this Water Source Assessment; modify it as needed if conditions change.
  - Continue purchasing water from FPB to match GMWSS demands through 2023 in addition to operating the existing GMWSS WTP at a reduced level (2.5 MGD).
  - Finalize a new Water Purchase Agreement with FPB.
  - Hire a Consulting Engineer for design of GMWSS system improvements.
- FPB to hire Consulting Engineer for design of FPB system additions.2023 to 2025:
  - Continue purchasing water from FPB to match GMWSS demands through 2025 (year 0 of the planning period) in addition to operating the existing GMWSS WTP at a reduced level (2.5 MGD).
  - Complete final route selection for water transmission main in Scott County.
  - Complete topographic surveys, geotechnical investigations, environmental and cultural resources surveys.
  - Complete design of new transmission main and booster pump station
  - Secure financing for construction of new facilities.
  - Prepare construction bid package (s) and advertise for bids.
  - Complete a water rate study to determine revised customer water rates after construction bids are taken and FPB wholesale water rates are negotiated.
- 2025 to 2027, years 0 to 2 of the planning period:
  - Continue purchasing water from FPB to match GMWSS demands through 2027 (year 2 of the planning period) in addition to operating the existing GMWSS WTP at a reduced level (2.5 MGD).
  - Build new transmission main from Scott County line to Lancaster tank
  - Build new booster pump station in Scott County.
  - Expand FPB WTP
  - Build new FPB transmission main from FPB WTP to Scott County line.
- 2028, year 3 of the planning period:
  - Begin operation of new GMWSS and expanded FPB facilities.
  - Begin purchasing water from FPB at newly negotiated purchase agreement rate.
  - Take existing GMWSS WTP out of operation.
- 2029 to 2045, years 4 to 20 of the planning period:
  - Continue purchasing water from FPB to match GMWSS projected 2045 ADD of 10.0 MGD and MDD of 15.0 MGD.
  - Re-assess customer water service rates on a regular basis.

Chapter 2

Assessment Criteria and Methodology

The goal of this Assessment is to identify a long-term source and supplier of water that best meets the needs of GMWSS and its customers. In this chapter, a series of criteria selected by GMWSS and GRW are identified for the selection of water sources and suppliers. The methodology used in the analysis of these sources and suppliers is also presented in this chapter.

General Criteria

Royal Spring will not be considered as a reliable water source for the future. Even though ample water supply has been normally available, the spring is subject to drought-driven reductions in water quantity. The spring has also been susceptible to contamination by pollutants from agricultural field run-off, environmental hazards and wastewater discharges that enter the aquifer supplying the spring.

It is preferred that the selected alternative be capable of providing a single source of raw water to GMWSS through 2070 and beyond. A robust sole source is desired to prevent numerous separate capital improvement projects, resulting in higher operation and maintenance efforts over the years. Since smaller water sources are more susceptible to drought conditions, they are not desirable. Partial source supply and combinations of water source supplies will not be considered as viable options.

GMWSS desires to produce its own drinking water or purchase treated water supplied from another municipal utility. Since publicly owned utilities are profit-driven and water purchase rates are subject to negotiation with the Kentucky Public Service Commission (not the utility's customers), purchasing water from a publicly traded water supplier is not as desirable as purchasing water from a municipal utility. Since a publicly owned water system is available nearby (i.e., KAW), however, this Assessment will include an analysis of purchasing water from KAW.

All selected water supply alternatives will have the capacity to be stand-alone alternatives in 2045 (the end of the 20-year planning period for this Assessment) and be capable of providing the projected 2045 ADD and MDD.

Water Treatment Plants, Pump Stations, Water Transmission Mains, and other infrastructure will be designed for MDD requirements. The ratio of MDD to ADD will be taken into account in the design and operation of the water system. The basis of the MDD to ADD ratio for the GMWSS water system will be confirmed by the review of historic plant operating records and the recommended standards of professional engineering water system planning and design organizations such as the American Water Works Association (AWWA) and the National Society of Professional Engineers (NSPE).

Methodology

Alternatives for water sources and suppliers will be developed in this Assessment. A monetary and a non-monetary comparison of each alternative will be made.

The monetary comparison of the alternatives will be based on their Total Present Worth Cost (TPWC) at the start of the planning period (2025), and will include the sum of the construction cost for improvements, the present worth cost of annual costs for water production or purchase over the duration of the planning period (2025 to 2045) and the present worth cost of equipment replacement during the planning period, less the present worth cost of the salvage value of the improvements at the end of the planning period (2045).

The non-monetary comparison of each alternative will be based on a series of weighted parameters such as relative cost, water source, production or purchase cost, reliability, relationship to GMWSS, potential environmental impact and implementation complexity.

After considering the monetary and non-monetary comparison of the alternatives, as well as other benefits and disadvantages of the alternatives, a recommendation of the alternative for future water source and supply for GMWSS will be made. A preliminary schedule for implementing the recommended alternative will also be provided.

Chapter 3

Water System Service Area Description, Population Forecast and Water Demand Projections

In this chapter, the area of Scott County served by the GMWSS water system is described, including land use and demographics. The current sources of drinking water are discussed, followed by projections of population and water demand until 2045. The end of this chapter presents two scenarios that are further examined in the following chapters: one is based on water demand for the service area if it remains residential and light industrial/commercial in use until 2045; this is referred to as the "Low Range" scenario. The other is based on water demand for the service area if a water-consuming industry (or two) locates within the area by 2045; this is referred to as the "High Range" scenario.

GMWSS Water System Service Area

Figure 3-1 shows that the WSSA for the GMWSS water system lies to the west side of I-75 and encompasses the western portion of Scott County. This area, which is shown with blue diagonal lines, includes the City of Georgetown, the City's immediate suburbs on the west side of I-75, and a large rural area that extends to the northern, western, and southern boundaries of Scott County. The portion of the county to the east of I-75 is not part of the WSSA; the eastern portion of the county receives water service by the KAW distribution system, including the Toyota Motor Manufacturing America automobile plant located to the east of I-75. The Harrison County Water Association provides water service to a small area in northeastern Scott County.

Legend

- CityLimitStampGrnd_Nov2017
- CityLimitSadieville_Nov2017
- CityLimitGeorgetown_Oct2018
- Scott County
- GMWSS Water Service Area
- GMWSS Sewer Service Area

N
W E
S

GMWSS Water & Sewer Service Area

Figure 3-1

Date: 6/20/2019

GEORGETOWN GIS SCOTT COUNTY

Georgetown Municipal Water and Sewer Service

The City of Georgetown and its surrounding area contain most of the higher intensity urban land use both in the county within the WSSA. Based on development patterns over the period of 2007 to 2016 as shown in the 2017 Scott County/Georgetown Comprehensive Plan, an increasing percentage of the population in the county will reside in urban areas, especially in and near Georgetown. GMWSS will provide water and sewer services as the urban areas expand.

The only other urban area within the WSSA is the small town of Stamping Ground, a community of approximately 650, located near the western edge of the county. The balance of the land in the WSSA is light commercial/industrial and rural, primarily for agricultural use. In fact, the rural area within the WSSA represents approximately 70 percent of all the rural land in the county.

Historically and currently, water demand in the WSSA is primarily for residential use, with a small portion used by commercial establishments and small industrial companies. As of this writing, there are no large water-consuming industrial or commercial customers in the WSSA.

Figure 3-2
GMWSS WTP Site

Drinking water provided by GMWSS to the WSSA is currently supplied from three sources. GMWSS owns and operates a WTP located in downtown Georgetown (see Figure 3-2) which treats water drawn from Royal Spring before it is discharged into the distribution system. Built in 1956 with a capacity of 1.5 MGD and upgraded in 1974 to treat 4.0 million MGD, this plant is currently providing an average of 3.8 MGD (or 95% of its design capacity).

The WTP draws raw water from Royal Spring located next to the plant. The origin of the spring extends below Georgetown and to the south where it lies beneath South Elkhorn Creek in Fayette County. This creek receives treated wastewater from the Lexington/Fayette County Town Branch WWTP and is subject to drought conditions during which up to 13 MGD of treated plant effluent represents a significant percentage of the total stream flow. When this occurs, contaminates in the wastewater treatment effluent, while meeting the limitations of the plant's discharge permit, flow into the creek, seep into the spring and are then conveyed below ground to Royal Spring. This results, in turn, in contaminants in the water drawn into the GMWSS WTP. At this time, the GMWSS WTP meets the drinking water quality standards required

by KDOW. The possibility of an accidental chemical spill into the spring or an unintended pollutant discharge in excess of the Town Branch WWTP discharge permit, however, are of significant concern to GMWSS. Also of concern is the spring's capacity to provide the volume of raw water needed to meet future demand requirements during short-term drought periods.

The WTP was the sole potable water supply to the WSSA until 1990, when GMWSS entered into a water purchase agreement with the FPB for the purchase of potable water.

That agreement guaranteed GMWSS 1.0 MGD and an additional 1.3 MGD subject to the demand needs of FPB. For several years GMWSS has been purchasing water from FPB to supplement the production of the WTP.

In addition to the water purchased from FPB, GMWSS also has an option of purchasing potable water from KAW via emergency connections to the KAW distribution system.

To meet the needs of its customers, more than 90 percent of the WSSA's water demands are now being met by operating the WTP at 95% of capacity, 24 hours a day, while also purchasing additional water from FPB. This has resulted in a significant loss in time needed by plant staff for routine maintenance, equipment servicing and other normal plant management functions. Additional discussions of the spring and WTP are provided in Chapter 4.

Population Forecast

The use of population data from federal and state agencies is vital to the reliable prediction of future population projections. In Kentucky, the Kentucky State Data Center (KSDC) bases its projections on U.S Census data and is the accepted agency for state-wide population forecasting. KSDC projections were used in the 2017 Scott County/Georgetown Comprehensive Plan, the 2018 Georgetown/ Scott County Community Profile, and are also used in this Assessment.

Table 3-1 and Figure 3-3 illustrate the population projections to 2045 for Scott County, Georgetown and the GMWSS WSSA. While the county and city population forecasts were available from KSDC, the WSSA population projections were completed as part of this Assessment. The WSSA projections are calculated by adding the Georgetown urban area population projections to estimates of the rural population in the WSSA. The latter is calculated on the basis that approximately 70 percent of Scott County is rural. For example, the 2030 WSSA population is calculated as follows:

WSSA Population = Georgetown + 0.70 x (Scott County – Georgetown), or

for 2030: WSSA 2030 Population = 52,093 + 0.70 x (76,607 – 52,093) = 69,250

Table 3-1
Population Forecast, Scott County, Georgetown and GMWSS WSSA, 2000-2045

Year	Scott County Population	Georgetown City Population	GMWSS WSSA Population
2000	33,061	18,080	28,570
2010	47,173	29,098	41,750
2020	57,589	40,745	53,880
2030	76,607	52,093	69,250
2040	97,745	70,376	89,500
2045	110,000	81,400	101,400

Figure 3-3
GMWSS WSSA Population Projection
2020-2045

Water Demand Projections

Average Daily Demand (ADD)

The ADD is defined as the total annual flow (in million gallons) divided by 365. The 1997–2020 records of water demand by the WSSA were reviewed to determine the historic production of the WTP in addition to the purchase of water from FPB and other potable water suppliers. These records indicate that the water system ADD increased from 1.82 MGD in 1997 to 3.50 MGD in 2020. During this period, the ADD on a population basis (expressed in gallons per capita per day, or gpcd) averaged approximately 74 gpcd. In some years during this 23-year span the ADD was lower (e.g., 65 gpcd in 2020) and in some years the ADD was higher (e.g., 84 gpcd in 2000), but on average the ADD has been approximately 74 gpcd since 1997.

Compared to larger water systems, an average per capita demand of 74 gpcd is low. Municipal water systems may often require average daily demands of 100 to 150 gpcd. The higher rate of water demand in such systems, however, usually reflects a higher percentage of the demand from water-consuming industries, such as those requiring large volumes of water for product production (bottling plants, food processing plants, etc.) or for cooling or wash-down of production processes. Other factors that affect the per capita use of water include unmetered use, leakage in the distribution system, the size and customer base of the community, and climatic conditions.

Professional engineering organizations such as the AWWA and the NSPE have documented, in lieu of historic data, that a per capita demand of 100 gpcd should be used to conservatively estimate average daily water demand in planning of future water service for communities. There are currently no significant water-consuming industries in the WSSA, therefore it is understandable why the historic water demand of the GMWSS has been on the order of 74 gpcd, as opposed to closer to 100 gpcd.

Based on the continuation of land use and water demand as in the period of 1997-2020 and the estimated WSSA population shown in Table 3-1 and the historic per capita water demand of 74 gpcd, Table 3-2 provides a “Low Range” ADD estimate of 7.5 MGD by 2045.

Table 3-2
Projection of WSSA
"Low Range" and "High Range" ADD,
2020-2045

Year	WSSA Population	Low Range ADD, gpcd	Low Range ADD, MGD	High Range ADD, gpcd	High Range ADD, MGD
2020	53,880	74	4.00	-	-
2025	62,000	74	4.60	-	-
2030	69250	74	5.10	88.5	6.10
2035	78,375	74	5.80	92.5	7.25
2040	89,500	74	6.60	94.3	8.40
2045	101,400	74	7.50	98.6	10.00

The projections shown in Table 3-2 are illustrated in Figure 3-3.

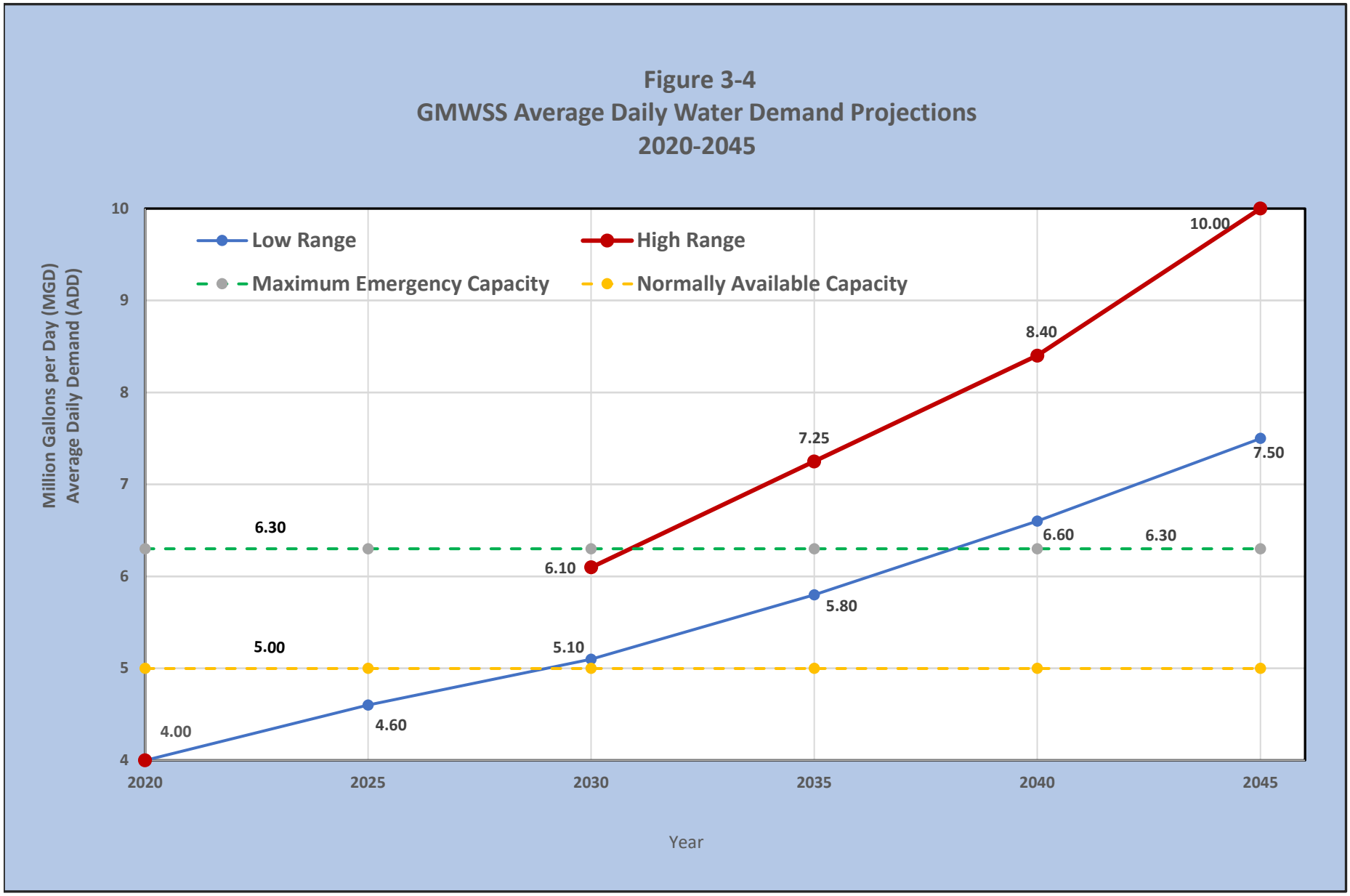
In the following chapters of this Assessment, evaluations of water sources and suppliers are provided based on a 2045 ADD of 7.5 MGD. It should be noted that this projection of water demand will meet the needs of the WSSA if the future customer base continues to consist of residential and light industrial/commercial water users, but it does not provide sufficient water volume to meet the future demand of significant water-consuming industries.

To provide another projection of estimated water demand for the WSSA, this Assessment has considered the potential future increase in demand if a significant water-consuming industry (or two) were to locate to the WSSA by 2030. If this were to occur, the equivalent per capita water demand will increase in proportion to the industrial water demand. It is not possible at this writing to predict this industrial demand or when the demand might occur. For planning purposes, however, this Assessment has estimated that by 2030 an industry requiring a daily demand of 1.0 MGD will be served by the GMWSS and its demand for water will increase to 2.5 MGD by 2045, or a second industry will locate in the WSSA requiring a combined new industrial demand of 2.5 MGD by 2045.

An increasing industrial water demand (1.0 MGD in 2030 to 2.5 MGD in 2045) establishes a baseline for potential industrial growth in the WSSA. It is recognized that the actual water demand will be a function of the industries involved; however, for the purpose of this Assessment, this range has been evaluated for comparison with the current demographics and land use for the area.

Table 3-2 and Figure 3-4 also provide the "High Range" estimated future ADD in the event of the industrial demand described in the preceding paragraph. As this table indicates, it is estimated that the 2045 demand (ADD) will be 10 MGD and the equivalent per capita demand will increase to 98.6 gpcd. This "High Range" 10 MGD ADD scenario is also evaluated in the following chapters.

Figure 3-4
GMWSS Average Daily Water Demand Projections
2020-2045



Maximum Daily Demand (MDD)

The MDD is defined as the flow needed to meet the 24-hour period of maximum demand in a year. It is not uncommon that the MDD will take place over extended periods of time. The historic GMWSS WTP records indicate this has occurred for several days (and weeks) during parts of the year. This demand is used in evaluating water sources, as well as the design of mains, storage tanks, pumping and treatment facilities.

A treatment plant is usually designed to operate part of the day to produce the required demand, which allows the remainder of the day for maintenance activities. For example, a plant is normally designed to produce the ADD during an 8-hour period and produce the MDD during a part of the second 8-hour period, giving the remainder of the day for plant personnel to perform maintenance. While the plant is not delivering water to the distribution system, the system's water storage tanks meet the demand, thus allowing turn-over time for these tanks and permitting them to re-fill with fresh water when the plant resumes operation. This third 8-hour period also allows time for the plant to meet peak hourly demands (PHD) as needed to supplement the supply available in the distribution system during extremely high, short-term demand periods. Water treatment plants are traditionally designed and rated based on their MDD.

A review of design guidelines provided by AWWA, NSPE and other organizations indicates a MDD in the range of 1.4 to 1.8 times the ADD should be considered for the planning and design of water systems and treatment facilities. The Kentucky Infrastructure Authority published a Water Use Map that indicates the historic ratio of MDD (3.87 MGD) to ADD (3.13 MGD) is 1.24 for the Royal Spring WTP (this does not include water purchased from FPB to meet demands beyond that produced by the WTP).

For planning purposes, a MDD of 1.5 times the ADD will be used for the "Low Range" MDD demand projection, in which no major water-consuming industries will be served by GMWSS during the planning period. The same ratio will be used for the "High Range" MDD demand projection, in which GMWSS will serve new water-consuming industries needing up to 2.5 MGD by 2045.

Table 3-3 indicates the projected ADD and corresponding MDD for the WSSA to the year 2045 under the "Low Range" and "High Range" scenarios.

Table 3-3
Projection of WSSA
"Low Range" and "High Range" ADD and MDD,
2020-2045

Year	Low Range ADD, MGD	Low Range MDD, MGD	High Range ADD, MGD	High Range MDD, MGD
2020	4.00	6.00	-	-
2025	4.60	6.90	-	-
2030	5.10	7.65	6.10	9.20
2035	5.80	8.70	7.25	10.88
2040	6.60	9.90	8.40	12.60
2045	7.50	11.25	10.00	15.00

Based on these ADD and MDD estimates for the period until 2045, two levels of water supply could be needed to serve GMWSS water customers by 2045:

1. A 2045 average daily supply of 7.5 MGD and a maximum daily supply of 11.25 MGD if no significant water-consuming industries locate within the WSSA before 2045; and
2. A 2045 average daily supply of 10.0 MGD and a maximum daily supply of 15.0 MGD if industries locate within the WSSA requiring an average of 2.5 MGD ADD and 5.0 MGD MDD by 2045.

Figure 3-4 illustrates that for the "Low Range" ADD projection, the normally available GMWSS water supply capacity of 5.0 MGD (4.0 MGD from the WTP, plus 1.0 MGD under the existing FPB purchase agreement) will be exceeded by 2028. In addition, for the "Low Range" ADD projection, the maximum "emergency" capacity of 6.3 MGD (5.0 MGD plus an emergency supply of 1.3 MGD from FPB) will be exceeded by 2038.

For the "High Range" ADD projection, the 6.3 MGD "emergency" capacity will also be exceeded by 2031 if a significant water-consuming industry locates to the WSSA by 2030.

These projections further indicate that the existing purchase agreement needs to be amended to purchase more water from FPB (or KAW, or both) for several more years until new facilities to supply the future water demands of GMWSS customers are available.

The following chapters of this Assessment will present and analyze alternatives for the "Low Range" and "High Range" levels of water demand.

Chapter 4

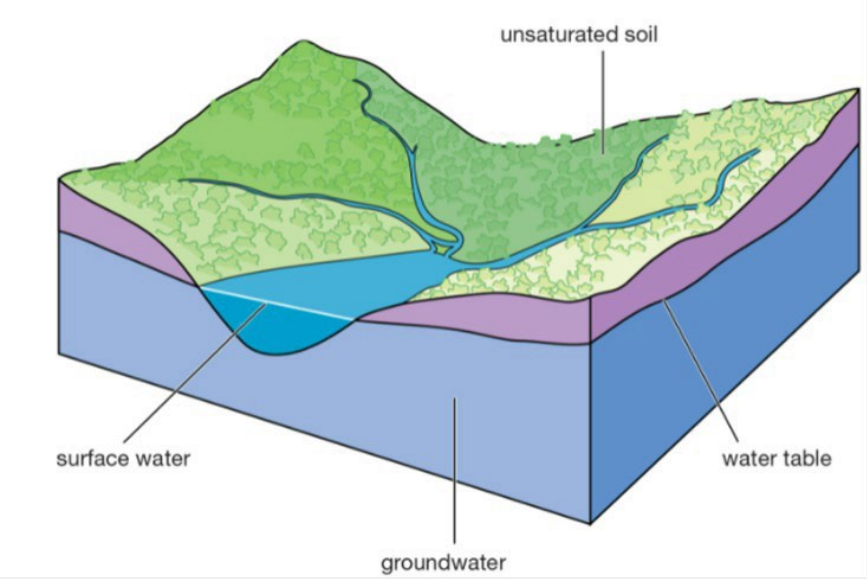
Description of Water Sources and Suppliers

In this chapter, a summary is provided of water sources available to GMWSS. This summary represents the results of various discussions and determinations made between representatives of GMWSS, KDOW, GRW and several water suppliers during the preparation of this Assessment. Some sources were initially considered, then later discarded due to factors described in this chapter. Other sources were determined to be viable and are presented in more detail. This chapter concludes with a list of the most viable sources that can serve as GMWSS water system sources for the future. The viable water sources were those that could not only be capable of meeting the 2045 GMWSS water demands but also the demands to 2070 and beyond, thus ensuring a long-term reliable water supply for the customers of GMWSS.

Types of Water Sources

Figure 4-1 provides a graphical representation of the difference between a groundwater source and a surface water source.

Figure 4-1
Typical Water Sources



A surface water is any body of water above ground, including streams, rivers, lakes, wetlands, reservoirs, and creeks. The ocean, despite being saltwater, is also considered surface water. Surface water participates in the hydrologic cycle, or water cycle, which involves the movement of water to and from the Earth's surface. Precipitation and water runoff feed bodies of surface water. Kentucky is predominantly a surface water supply region with the exception of some areas of groundwater supply along the Ohio River, Mississippi River, and a few locations with available water springs.

Groundwater is found underground in the cracks and spaces in soil, sand, and rock. Groundwater is stored in, and moves slowly through, geologic formations of soil, sand and rocks called aquifers. Precipitation and surface waters provide water supply for groundwater as it seeps into the soil, sand, and rock. Limited groundwater supply sources exist in Kentucky for municipal use. Aquifers near the Ohio River and the Mississippi River are the predominant regions for groundwater supply in the state. The limestone bedrock characteristics of central Kentucky do not provide ample supply for groundwater use as a viable supply source.

A spring often exists at the juncture of surface water and groundwater. A spring water source is also very characteristic of karst-like channels in limestone or flow at the interface of limestone bedrock and shale. Very few springs for reliable municipal water source exist in Kentucky.

Water Sources Available to GMWSS

Surface Water Sources

Ohio River

With its vast drainage basin - more than 90,000 square miles - the water supply in the Ohio River provides a water source with the lowest concern for water quantity during drought periods of any source available to GMWSS. Even with numerous communities (Louisville, Cincinnati, Huntington, Pittsburgh, etc.) withdrawing raw water from, as well as discharging treated wastewater to, this river, the quality of the water in the Ohio River remains excellent. The Ohio River is the most drought-proof option available to GMWSS.

The nearest location for supplying water to GMWSS from the Ohio River is Louisville. The McAlpine Locks and Dam create a 73-mile pool between Louisville and the Markland Locks and Dam near Warsaw.

Kentucky River

Many Central Kentucky communities derive their water supply from the Kentucky River. This river is not susceptible to drought and its water quality is excellent. Discussions with KDOW concluded that this river – though it is not as drought-proof as the Ohio River - has ample raw water supply for the previously described“Low Range” and “High Range” future demands of GMWSS. The location of withdrawal, whether from Pool 3 or Pool 4, is not a concern to KDOW.

Pool 3 on the Kentucky River begins at Lock and Dam 3 (River Mile 39) near Monterey and runs south to Lock and Dam 4 (River Mile 63) in Frankfort. Tributaries include Cedar Creek, Elkhorn Creek, and Stony Creek. Pool 4 runs from Lock and Dam 4 to Lock and Dam 5 (River Mile 80), located between Lawrenceburg

and Versailles. Benson Creek, Cedar Run, Buck's Run and Glenn's Creek are tributaries to Pool 4. Appendix A includes a water source assessment prepared by GRW.

Pool 5 extends from Lock and Dam 5 (River Mile 80) south to Lock and Dam 6. This pool serves as the water source for Versailles. This pool has a significantly smaller drainage area than Pools 3 or 4, is much further away from GMWSS, and may not contain a sufficient supply for GMWSS's demands. It is therefore not considered as a viable water source for GMWSS, thus also eliminating Versailles as a potential water supplier for GMWSS.

Figure 4-2 illustrates the appearance of Pool 4 on the Kentucky River.

Figure 4-2 Kentucky River at Lock and Dam 4 in Frankfort

North Elkhorn Creek, South Elkhorn Creek, and Elkhorn Creek

These moderate-sized creeks are nearby but are all susceptible to droughts. Stretches of North Elkhorn Creek are not viable as a water source because there are WWTP discharges to the creek within 5 miles of potential water withdrawal points. This "Five-Mile Rule" is emphasized by KDOW to protect raw water quality for communities on streams downstream of WWTP discharges. This distance allows the stream water quality to recover from the impact of such discharges before the water may be withdrawn for potable water production.

South Elkhorn Creek is not considered as a viable water source either. This is due to the average daily discharge of 13 MGD of treated wastewater from Lexington's Town Branch WWTP, which represents a sizable portion of the creek's total flow during droughts. These contaminants, although within the limits of the plant's discharge permit, have been found to migrate further than 5 miles downstream of the plant during droughts. A previous water quality study found that elevated

levels of fecal coliform bacteria (E. Coli) were also present in this creek. The KDOW indicated the estimated quantity of raw water available from South Elkhorn Creek (up to 5 MGD) is not sufficient to meet the future demand of GMWSS, and additional studies would be needed to verify this estimate.

Elkhorn Creek does not provide enough water for GMWSS's needs either, especially during droughts. Further, this would also violate one of the GMWSS criteria for the water supply source: using a sole source rather that multiple sources of raw water. Appendix A includes a discussion of these creeks as a water source for GMWSS.

Reservoirs

There are no reservoirs of sufficient size in the vicinity of the WSSA to supply the future water demand for 2045. In addition, the use of a reservoir may result in formation of an unacceptable level of disinfection by-products due to warm-weather algae growth. Communities such as Williamsburg, Bardstown and Shelbyville combat this major problem every year.

Scott County pursued the construction of a new water supply reservoir in the 1990's and early 2000's, which ultimately resulted in denial of a construction permit by the U.S. Army Corps of Engineers.

The combination of low water quality, insufficient water quantity, timeframe, construction cost and permitting requirements are reasons that a reservoir is not considered a viable water source for GMWSS.

Groundwater Sources

Springs and wells are supplied water from groundwater stored in aquifers. There are no aquifers in the region with the quality and quantity of water required for the future by GMWSS. As previously discussed, the continued use of Royal Spring as a source of water is of concern due to the presence of contaminants, as well as a lack of capacity.

Viable Water Sources for GMWSS

Based on the description and evaluation of possible water sources, the following summarizes the most suitable water sources for further consideration in this Assessment:

Kentucky River – Pool 3
Kentucky River – Pool 4
Ohio River at Louisville

Water Availability from Viable Sources

For either Pool 3 or Pool 4 of the Kentucky River or the Ohio River at Louisville to serve as a GMWSS water source, a water withdrawal permit must be issued by the KDOW in accordance with Kentucky Revised Statutes 151.140. In reviewing the application for this permit, KDOW will account for other existing permitted withdrawals so that it may determine the availability of the water requested by the permit applicant. If GMWSS were to build a water intake on the Kentucky River for treating water at its own WTP, GMWSS would be responsible for submitting a withdrawal permit application directly to KDOW. If another utility were to provide water to GMWSS from their own Kentucky River water intake and treatment facility, that utility would need to submit an amendment to its existing water withdrawal permit for the additional quantity of water needed for GMWSS's requirements. For water supplied to GMWSS from the Ohio River, a KDOW water withdrawal permit would also be required.

In preparing this Assessment, GRW contacted Bill Caldwell (Watershed Management Branch Acting Manager) and Jory Becker (Water Infrastructure Branch Manager) of the KDOW to ascertain the availability of water to meet GMWSS's future demands from Kentucky River Pools 3 and 4 and from the Ohio River. For Pool 3, a water withdrawal permit is currently in place for Kentucky American Water Company (a 20 MGD WTP), and for Pool 4, a water withdrawal permit has been issued to Frankfort Plant Board (an 18 MGD WTP). For the Ohio River at Louisville, the Louisville Water Company's 123 MGD Crescent Hill WTP also withdraws water under a KDOW permit.

The KDOW officials indicated that the most significant concern is for extended periods when the flow in the river is significantly low. Any permit or amended permit would need to include withdrawal restrictions when the flow is lower than 75 cubic feet per second (approximately 48 MGD) for 7 consecutive days, which is the definition of a "regulatory drought". To review such conditions, KDOW directed GRW to a US Geological Survey web site that provides daily data from flow gauges in each pool. This site indicated there have never been seven consecutive days of regulatory drought recorded for Pools 3 or 4. Accordingly, it is concluded that either of these pools can provide an adequate quantity of water for withdrawal to supply GMWSS. KDOW also concluded the same for the Ohio River.

Figure 4-3 – Viable Water Suppliers for GMWSS

Water Suppliers Available to GMWSS

During the preparation of this Assessment, several water supply utilities, both publicly and privately owned, were considered as potential suppliers of water to GMWSS. See Figure 4-3. These include:

GMWSS – Alternative A

The continued use of Royal Spring as a water source and the Royal Spring WTP for production were evaluated and eliminated from further consideration due to the concern for the quality and quantity of raw water available for future demand, as well as the age and cost of upgrading and expanding the plant. The limited available space on the plant site eliminates the concept of building a new plant on the site even if the supply was provided by one of the other viable sources identified above.

Under this Alternative A, the future water demand of the WSSA will be met by supplying raw water from Pool 3 of the Kentucky River (see Figure 4-4) to a new WTP located in Georgetown (see Figure 4-5). The existing WTP and spring will no longer be used, and the plant site will be re-purposed as a park or similar use.

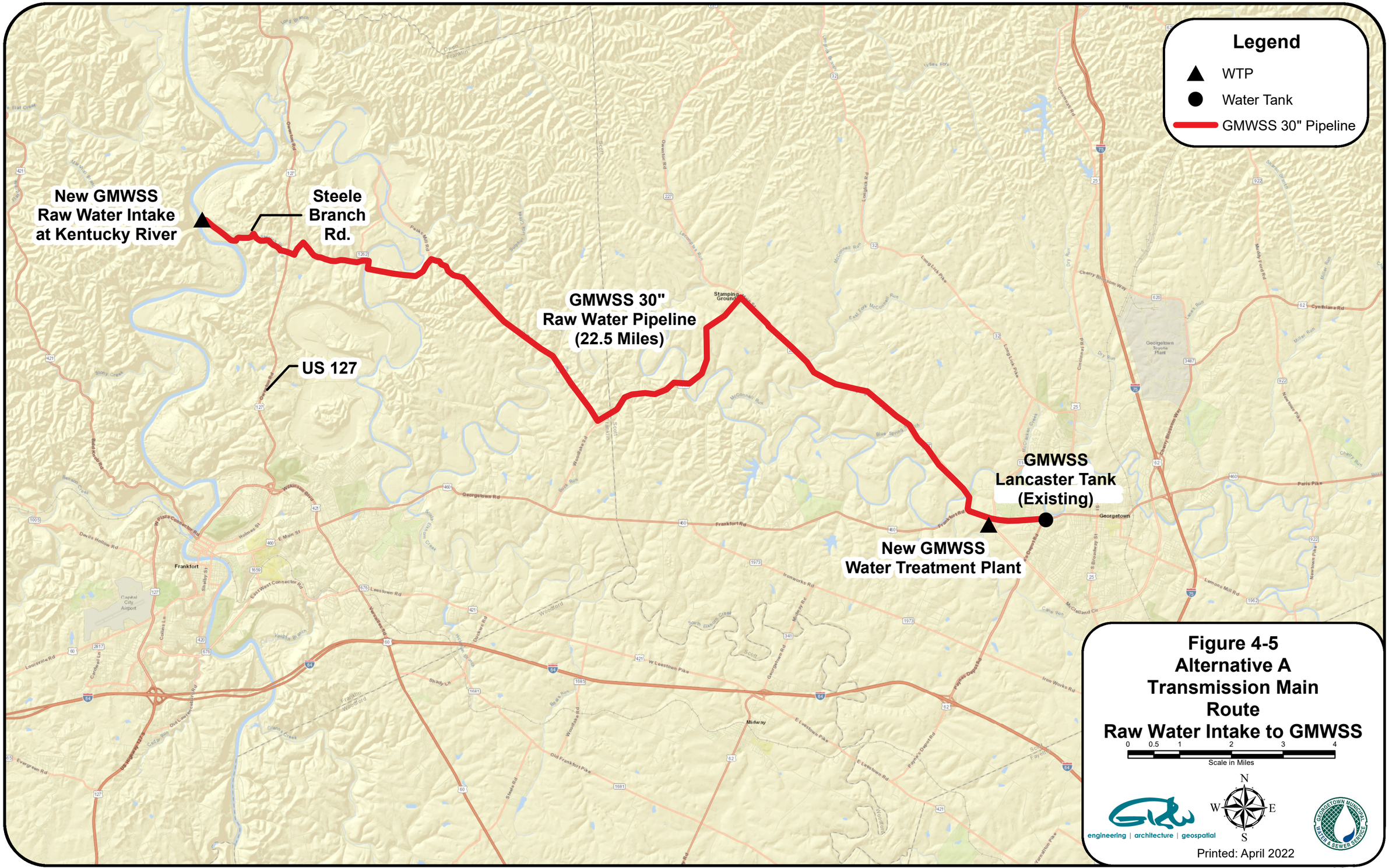
Figure 4-4 – Alternative A
GMWSS Raw Water Intake Site
Steel Branch Road, Franklin County

This alternative calls for GMWSS to provide a raw water intake and pumping station on Steel Branch Road in Franklin County to withdraw water from Pool 3 of the Kentucky River, construct a 22.5-mile-long, 30-inch raw water transmission main to the Lancaster water storage tank on West Main Street in Georgetown, provide an intermediate booster pump station and elevated water storage tank along the route of the transmission main, and build a new WTP on the western side of Georgetown where it can transmit treated water a short distance to the GMWSS water distribution system. A preliminary review of potential sites selected an area near Frankfort Pike (US 460) and the US 460/US 62 Bypass.

The route of the raw water transmission main will follow Steele Branch Road, across US 127 and Elkhorn Creek, continue along Rocky Branch Road, traverse Sulphur Lick Creek Road (a very narrow and hilly road), thence along Cedar Road and Owenton Road (KY 227), through Stamping Ground, to the old railroad bed parallel to Frankfort Pike, across the US 460/US 62 Bypass and will terminate at a booster pump station and the Lancaster tank.

Right-of-way corridors along existing roads will be largely followed, while some cross- county paths will be taken to avoid areas of difficult construction and to reduce the length of the main. This main will be difficult and expensive to build due to narrow roads, which restrict construction access and available right-of-way space for the installation of the main, in addition to creek and highway crossings and the purchase of many miles of easement on private property.

This alternative calls for GMWSS to provide a raw water intake and pumping station on Steel Branch Road in Franklin County to withdraw water from Pool 3 of the Kentucky River, construct a 22.5-mile-long, 30-inch raw water transmission main to the Lancaster water storage tank on West Main Street in Georgetown, provide an intermediate booster pump station and elevated water storage tank along the route of the transmission main, and build a new WTP on the western side of Georgetown where it can transmit treated water a short distance to the GMWSS water distribution system. A preliminary review of potential sites selected an area near Frankfort Pike (US 460) and the US 460/US 62 Bypass.


Legend
WTP
Water Tank
GMWSS 30" Pipeline
New GMWSS
Raw Water Intake
at Kentucky River
Steele
Branch
Rd.
US 127
GMWSS 30"
Raw Water Pipeline
(22.5 Miles)
GMWSS
Lancaster Tank
(Existing)
New GMWSS
Water Treatment Plant
Frankfort
Georgetown
Midway
Georgetown Toyota Plant
Capital City Airport
Figure 4-5
Alternative A
Transmission Main
Route
Raw Water Intake to GMWSS
0 0.5 1 2 3 4
Scale in Miles
N
W E
S
engineering | architecture | geospatial
GEORGETOWN MUNICIPAL WATER & SEWER SERVICE
Printed: April 2022