3.0 Required Wastewater Treatment Plant Improvements

This section describes the primary wastewater treatment plant improvements required for alternatives 1, 2, and 3. The improvements include facilities to meet capacity expansion for growth as well as anticipated future regulatory requirements. All alternatives are based on 2025 population and land use projections for the study area. A 2025 population of 150,000 people was used as the basis of design for the study area. The design population for the existing Kansas River WWTP, including the expansion currently under construction, is 100,000 people.

Anticipated future regulatory requirements for the Kansas River and the Wakarusa River were received from KDHE. The requirements were based on the National Nutrient Strategy developed by the Environmental Protection Agency (EPA). The strategy presents recommended water quality on an Ecoregion basis, which for Region IX, includes the Kansas and Wakarusa Rivers. In order to meet the new EPA nutrient strategy, biological nutrient removal facilities will be required for wastewater treatment at both the Kansas and Wakarusa Rivers. In addition, the wastewater treatment requirements will be the same for discharges to either the Kansas River or the Wakarusa River. KDHE has indicated facilities for both the Kansas and Wakarusa Rivers must meet the following biological nutrient removal requirements:

Biological Nutrient Removal Requirements
Total Phosphorous < 1.5 mg/L
Total Nitrogen < 10.0 mg/L
Ammonia Nitrogen < 1.0 mg/L

An additional requirement for a Wakarusa River discharge is that an anti-degradation review process must be completed before a National Effluent Discharge Elimination (NPDES) permit is issued for the Wakarusa River. KDHE has indicated that this review process will most likely not prevent an NPDES permit from being issued to the City of Lawrence for the Wakarusa River. Therefore, it appears that wastewater treatment plant discharges to the Wakarusa River are viable from a regulatory standpoint.

3.1 Alternative 1 – All Flow to Existing Kansas River WWTP

All wastewater flow for the entire study area would be conveyed to the existing Kansas River WWTP for Alternative 1. The current design population and average flow capacity for the WWTP are 100,000 people and 12.5 mgd. The 2025 design population for Alternative 1 is 150,000 people, and therefore, would involve a capacity expansion as well as a biological nutrient removal (BNR) upgrade. Proposed design criteria for Alternative 1 are as follows:

Design Criteria for Alternative 1

- Design population = 150,000
- Average flow = 18.8 mgd
- Max month flow = 26.3 mgd
- Peak hydraulic flow = 37.6 mgd
- Provide capacity expansion
- Upgrade for BNR per KDHE limits

A summary of wastewater treatment process improvements required for Alternative 1 is shown in Table II-2

Table II-2
Alternative 1 Process Improvements at Kansas River WWTP

WWTP Modification	Alternative 1 – All flow to Kansas River WWTP	
	Circular Aeration Basin Train	Rectangular Aeration Basin Trains
New Primary Clarifier	Add 1 @ 100 ft. dia.	
Modify Flow Split to Process Trains	25% of total flow (1 train)	75% of total flow (3 trains)
New BNR Basins	1 basin per existing circular aeration basin (includes pre-anoxic, anaerobic, and anoxic zones). Total volume of each BNR basin = 36,560 cf.	1 basin w/ 3 trains to serve all rectangular AB's (includes pre-anoxic and anaerobic zones, total vol. = 137,080 cf) Anoxic zone incorporated into AB's, vol. ea. AB = 27,420 cf.
New Aeration Basin (AB)	N.A.	1 identical to existing rectangular (189,000 cf). Anoxic zone included, as above.
New Final Clarifier	N.A.	Add 1 @ 110' dia.
MLSS recycle	Provide flexibility for 2-4 Q	Provide flexibility for 2-4 Q
New Anaerobic Digesters	Use existing 80' primary and 55' secondary as primary digesters and add 1 primary @ 50 ft. dia. (51,375 cf). Convert 55' sludge storage basin to a secondary digester.	
New Fermentation Basin	1 @ 55' dia.	
Additional chlorine contact volume	Add 1 basin (17,000 cf)	
Additional dechlorination volume	Add 1 basin (1,500 cf)	

Note: AB = Aeration basin, Q = Ave. WWTP flow, N.A. = Not applicable

The BNR treatment zones were sized for the following detention times:

- 15 minutes for pre-anoxic zone
- 60 minutes for anaerobic zone
- 45 minutes for anoxic zone

Wastewater treatment plant improvements required for Alternative 1 – All Flow to Existing Kansas River WWTP are shown in Figure II-4.

3.2 Alternative 2 – Wakarusa River WWTP (Site A) and Kansas River WWTP

Alternative 2 involves dividing the study area and conveying part of the flow to the Kansas River WWTP and the remaining flow to a proposed Wakarusa River WWTP (Site A). Proposed design criteria and plant improvements for each WWTP are summarized below.

Kansas River WWTP Design Criteria and Improvements

Proposed design criteria for the Kansas River WWTP would be as follows:

Alternative 2 Design Criteria at Kansas River WWTP

- Design population = 95,000
- Average flow = 11.9 mgd
- Max month flow = 16.6 mgd
- Peak hydraulic flow = 23.8 mgd
- Upgrade for BNR per KDHE limits
- Capacity expansion is not required
- Remaining flow is to Wakarusa River WWTP

A summary of Kansas River wastewater treatment process improvements required for Alternative 2 is shown in Table II-3.

Table II-3
Alternative 2 Process Improvements at KS River WWTP

WWTP Modification	Alternative 2 – Partial flow to Kansas River WWTP	
	Circular Aeration Basin Train	Rectangular Aeration Basin Trains
New Primary Clarifier	N.A.	N.A.
Modify Flow Split to Process Trains	Stays at 40% of total flow (1 train)	Stays at 60% of total flow (2 trains)
New BNR Basins	1 basin per existing circular aeration basin (includes pre-anoxic, anaerobic, and anoxic zones). Total volume of each BNR basin = 36,990 cf.	BNR vol. (pre-anoxic, anaerobic, and anoxic zones) incorporated into existing AB's. Total BNR vol. per AB = 55,480 cf.
New Aeration Basin (AB)	N.A.	N.A.
New Final Clarifier	N.A.	N.A.
MLSS recycle	Provide flexibility for 2-4 Q	Provide flexibility for 2-4 Q
New Anaerobic Digesters	Use existing 80' primary and 55' secondary as primary digesters. Convert 55' sludge storage basin to a secondary digester.	
New Fermentation Basin	1 @ 45' dia.	
Additional chlorine contact volume	N.A.	
Additional dechlorination volume	N.A.	

AB = Aeration Basin, N.A. = Not applicable, Q = Ave. WWTP flow

Wastewater treatment plant improvements required for the Kansas River WWTP with Alternative 2 are shown in Figure II-5.

Wakarusa River WWTP Design Criteria and Improvements

Proposed design criteria for the Wakarusa River WWTP would be as follows:

Alternative 2 Design Criteria at Wakarusa River WWTP

- Design population = 55,000
- Average flow = 6.9 mgd
- Max month flow = 9.7 mgd
- Peak hydraulic flow = 13.8 mgd
- Provide BNR per KDHE limits
- Allow for future filtration

The Wakarusa River WWTP would include the following treatment units and support facilities:

- Influent pumping and screening
- Grit removal
- Primary clarification
- Aeration and biological nutrient removal
- Secondary clarification
- Effluent disinfection
- Excess flow handling facilities
- Fermentation basin
- Anaerobic digestion facilities
- Biosolids dewatering facilities
- Administration building

3.3 Alternative 3 - Wakarusa River WWTP (Site B) and Kansas River WWTP

Wastewater flow for the study area with Alternative 3 would be conveyed to both the Kansas River WWTP and a proposed Wakarusa River WWTP (Site B), similar to Alternative 2. Proposed design criteria and plant improvements for each treatment plant would be identical to Alternative 2 with the exception of the following:

- The influent pumping station for the Wakarusa WWTP (Site B) would be larger than the influent pumping station for Wakarusa WWTP (Site A). This is due to less flow being pumped to the Site B plant by a remote pumping station than would be pumped to the Site A plant. (Refer to collection system figures.)

- More provisions for future odor control facilities would likely be included with Wakarusa WWTP (Site B) than with Wakarusa WWTP (Site A) due to the probable proximity to future City development.