



EPA Region 7 TMDL Review

TMDL ID:KS-SS-07-540_5

State: KS

Document Name: BIG CREEK

Basin(s): SMOKY HILL/SALINE RIVER

HUC(s): 10260007

Water body(ies): BIG CREEK

Tributary(ies): CHETOLAH CREEK (8), MUD CREEK (9), NORTH FORK BIG CREEK (4),
OGALLAH CREEK (6), WALKER CREEK (2)

Pollutant(s): NITRATE

Submittal Date:7/16/2010

Approved:Yes

Submittal Letter

State submittal letter indicates final Total Maximum Daily Load(s) (TMDL) for specific pollutant(s)/water(s) were adopted by the state, and submitted to EPA for approval under section 303(d) of the Clean Water Act [40 CFR § 130.7(c)(1)]. Include date submitted letter was received by EPA, date of receipt of any revisions, and the date of original approval if submittal is a phase II TMDL.

This TMDL document was formally submitted by the Kansas Department of Health (KDHE). The United States Environmental Protection Agency (EPA) received this TMDL document by email on July 16, 2010.

Water Quality Standards Attainment

The water body's loading capacity (LC) for the applicable pollutant is identified and the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources is described. TMDL and associated allocations are set at levels adequate to result in attainment of applicable water quality standards (WQS) [40 CFR § 130.7(c)(1)]. A statement that WQS will be attained is made.

Based on the nitrate (as nitrogen) data collected at Stream Monitoring Station SC540 (Munjor) from 1998 to 2007 (2008 Kansas 303(d) List), Big Creek is impaired by nitrate. More than 10% of the nitrate samples exceeded the domestic water supply standard, 10 milligrams per liter (mg/L).

The nitrate LC is set at 10 mg/L and nitrate concentrations shall always be below this criterion. Since nitrate impairment occurs at low flow conditions (or no violation appears during high runoff events) and is closely associated with effluent from wastewater treatment facilities (WWTFs), this TMDL is developed to target these critical flow conditions for not only the area between monitoring sites SC540 and SC541 but also the entire watershed. This LC will result in the achievement of nitrate WQS in the targeted segments and fully protect the designated use of domestic water supply.

Although this TMDL includes the endpoints of total nitrogen (TN) for protecting the additional designated uses of aquatic life and contact recreation, this particular TN TMDL is not reviewed nor approved by EPA.

Numeric Target(s)

Submittal describes applicable WQS, including beneficial uses, applicable numeric and/or narrative criteria. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, site specific if possible, was developed from a narrative criterion and a description of the process used to derive the target is included in the submittal.

The WQS for the impaired segment directly covered by the monitoring site SC540 is given below.

Segment ID	Designated Uses	Impaired Uses	Nitrate Standard
Big Creek (5)	Expected Aquatic Life support, Food Procurement, Domestic Water Supply, Industrial, Irrigation and Livestock Watering, Groundwater Recharge, Primary Contact Recreation	Domestic Water Supply	10 mg/L

This segment is given High Priority for TMDL development in the State's 303(d) list.

The following table lists the segments that, although not impaired, are included for further ensuring that the water quality goal of this TMDL meets the requirement of the Clean Water Act.

Main stem	Tributary
Big Creek (1)	Walker Creek (2)
Big Creek (3)	Ogallah Creek (6)
Big Creek (7)	North Fork Big Creek (4)
	Mud Creek (9)
	Chetolah Creek (8)

Pollutant(s) of concern

An explanation and analytical basis for expressing the TMDL through surrogate measures (e.g., parameters such as percent fines and turbidity for sediment impairments, or chlorophyll-a and phosphorus loadings for excess algae) is provided, if applicable. For each identified pollutant, the submittal describes analytical basis for conclusions, allocations and margin of safety (MOS) that do not exceed the LC. If submittal is a phase II TMDL there are refined relationships linking the load to WQS attainment. If there is an increase in the TMDL there is a refined relationship specified to validate the increase in TMDL (either load allocation (LA) or waste load allocation (WLA)). This section will compare and validate the change in targeted load between the versions.

The numeric nitrate target of 10 mg/L is set to address the pollutant causing the impairment. The linkage of the nitrate impairment to the WWTFs is direct, wastewater effluent is attributable to the impairment, based on the stream monitoring data (SC540, SC541, and SC715) and load duration curve analysis. As a result, WLA are assigned to the WWTFs to mitigate the impairment. Although these WLA calculations are based on the domestic drinking water criterion of 10 mg/L nitrate as nitrogen, this TMDL uses 8 mg/L as the implementation endpoint for the WWTFs in compliance with the Kansas Surface Water Nutrient Reduction Plan.

LA is analyzed but not targeted by this TMDL because the nitrate impairment is triggered by the WWTFs.

Source Analysis

Important assumptions made in developing the TMDL, such as assumed distribution of land use in the watershed, population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources, are described. Point, nonpoint and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered. If this is a phase II TMDL any new sources or removed sources will be specified and explained.

There are six National Pollutant Discharge Elimination System (NPDES) permitted facilities that discharge or can potentially discharge effluent to Big Creek. Two of these facilities are dry batch, ready mix concrete plants (KSG110186 and KSG110018). Although their wastewater is directed toward the City of Hays wastewater collection and treatment system, neither of these two plants discharged over the period 2003 to 2009. The city of Wakeeney (KS0099309) operates a three-cell lagoon wastewater system (0.25 million gallons per day or MGD). The effluent from Wakeeney does not often flow down channel toward Ellis. Observations made during use attainability analysis (UAA) found the channel of Big Creek dry in Trego County where the Wakeeney WWTF is located. The city of Ellis (KS0094145) operates a low volume activated sludge treatment plant (0.3 MGD), whose effluent typically does not reach Hays according to observations by Division of Water Resources field personnel. The city of Gorham (KSJ000327) has a non-discharging system that is now being updated to discharge (0.0478 MGD) to Walker Creek in late 2010. The city of Hays (KS0036684) discharges its effluent (2.8 MGD) to Big Creek and significantly impacts its water quality, causing nitrate impairment. Besides these six NPDES facilities, there are an additional eight non-discharging facilities (KSJ000118, KSJ000316,

KSJ000116, KSJ000311, KSJ000331, KSJ000332, KSJ000329, and KSJ000330) that do not influence the quality of Big Creek.

No nitrate violations have occurred during high flows at monitoring site SC540 for the last two decades. In addition, there are no nitrate violations identified at an upstream monitoring site (SC541). These two pieces of information indicate that nitrate loads from nonpoint sources do not contribute to the nitrate impairment observed at the downstream monitoring site (SC540). In addition, a monitoring station (SC715) on the North Fork Big Creek that flows into Big Creek's Segment 3 is not cited for nitrate impairment.

Cropland is the predominant land use in the watershed, comprising 62% of the total area. Row crop production in the vicinity of Big Creek can contribute nitrogen to the surface water via overland flow or ground water discharge. While some nitrate may be discharged to the stream systems, it is easily taken up by in-stream biota and does not present a cause for elevated nitrates seen at monitoring site SC540.

There are 44 certified, permitted or registered animal feeding operations in the watershed. All of these livestock facilities have waste management systems designed to minimize runoff entering their operations and detain runoff emanating from their facilities. These facilities are designed to retain a 25-year, 24-hour rainfall/runoff event as well as an anticipated two weeks of normal wastewater from their operations. Typically, this rainfall event coincides with streamflow that occurs less than 1-5% of the time. Though the total potential number of animals is approximately 47,600 animal units, the actual number of animals at these feedlot operations is typically less than the allowable permitted number. Based on Kansas Agricultural Statistics, most cattle are located in Gove and Ellis Counties as are the cattle in the confined feeding operations. There are livestock present in Russell County but no regulated facilities in the Big Creek drainage portion of the county. The contribution of these non-regulated feeding facilities to the impairment is minimal.

Permitted concentrated animal feeding operations (CAFOs) identified in this TMDL are part of the assigned WLA. Animal feeding operations (AFOs) and unpermitted CAFOs are considered under the LA because we do not currently have enough detailed information to know whether these facilities are required to obtain NPDES permits. This TMDL does not reflect a determination by EPA that such facility does not meet the definition of a CAFO nor that the facility does not need to obtain a permit. To the contrary, a CAFO that discharges or proposes to discharge has a duty to obtain a permit. If it is determined that any such operation is an AFO or CAFO that discharges, any future WLA assigned to the facility must not result in an exceedance of the sum of the WLAs in this TMDL as approved.

Any CAFO that does not obtain an NPDES permit must operate as a no discharge operation. Any discharge from an unpermitted CAFO is a violation of Section 301. It is EPA's position that all CAFOs should obtain an NPDES permit because it provides clarity of compliance requirements, authorization to discharge when the discharges are the result of large precipitation events (e.g., in excess of 25-year and 24-hour frequency/duration) or are from a man-made conveyance.

Based on the 1990 census data, about 13% of the households in Ellis County, 39% of the households in Trego County, 37% of the households in Gove County and 19% of the households in Russell County utilize septic or other on-site systems. Because of their small flows, failing on-site septic systems would be a minor source of nitrate loadings within the watershed and would not significantly contribute to the nitrate impairment.

Nitrate naturally appears in small concentrations as biological processes transform organic nitrogen through ammonification and nitrification. In general, biological uptake and de-nitrification processes control nitrate levels under 0.5 mg/L. Atmospheric deposition of nitrogen and ground water discharge of nitrate will contribute loadings to Big Creek, but once in the stream systems, the biological processes will readily transform most of that nitrate into forms best suited to support the life functions of the micro- and macro-biota of the stream.

In the absence of an NPDES permit, the discharges associated with sources were applied to the LA, as opposed to the WLA for purposes of this TMDL. The decision to allocate these sources to the LA does not reflect any determination by EPA as to whether these discharges are, in fact, unpermitted point source discharges within this watershed. In addition, by establishing these TMDLs with some sources treated as LAs, EPA is not determining that these discharges are exempt from NPDES permitting requirements. If sources of the allocated pollutant in this TMDL are found to be, or become, NPDES-regulated discharges, their loads must be considered as part of the calculated sum of the WLAs in this TMDL. WLA in addition to that allocated here is not available.

All known sources of nitrate have been considered.

Allocation - Loading Capacity

Submittal identifies appropriate WLA for point, and load allocations for nonpoint sources. If no point sources are present the WLA is stated as zero. If no nonpoint sources are present, the LA is stated as zero [40 CFR § 130.2 (i)]. If this is a phase II TMDL the change in LC will be documented in this section.

A load duration curve is developed to identify the LC at all flows and the entire LC analysis is given to WLA because the WWTFs are responsible for the nitrate excursions observed at monitoring site SC540. To comply with the Kansas Surface Nutrient Reduction Plan, the WLA for these WWTFs are set at 8 mg/L (see WLA section below).

WLA Comment

Submittal lists individual WLAs for each identified point source [40 CFR § 130.2(h)]. If a WLA is not assigned it must be shown that the discharge does not cause or contribute to WQS excursions, the source is contained in a general permit addressed by the TMDL, or extenuating circumstances exist which prevent assignment of individual WLAs. Any such exceptions must be explained to a satisfactory degree. If a WLA of zero is assigned to any facility it must be stated as such [40 CFR § 130.2(i)]. If this is a phase II TMDL any differences in phase I and phase II WLAs will be documented in this section.

This TMDL is developed to primarily control point source-orientated nitrate violations occurring during the low flow conditions. Based on the Kansas Surface Water Nutrient Reduction Plan, the endpoint of this TMDL is 8 mg/L of nitrate for all of the WWTFs, assuming that total nitrogen is all nitrate. Though the city of Hays has a municipal separate storm sewer system (MS4) permit, no attempt is given to establish urban storm water nitrate loads since runoff loads from urban storm water do not violate the nitrate WQS. As a result, this TMDL only targets nitrate loads related to the WWTFs during the critical flow condition - low flows or baseflow conditions.

The Big Creek watershed covered by this TMDL has 44 certified, permitted or registered animal feeding operation sites. Because these feeding operation sites are non-discharging facilities, their WLA is assigned zero.

The following table lists individual NPDES WLA.

NPDES Number	KS Permit Number	Facility Name	Design Flow (MGD)	WLA (lbs/day)
Discharging Facilities				
KS0036684	M-SH16-0002	city of Hays WWTF	2.8	187.1
KS0094145	M-SH06-0002	city of Ellis WWTF	0.3	20.2
KS0099309	M-SH38-0002	city of Wakeeney WWTF	0.25	16.7
KSG110186	I-SH16-PR02	Ellis County Concrete	0.0	0.0
KSG110018	I-SH16-PR01	APAC-KS-Shears (Hays Plant #601)	0.0	0.0
KS0096610	M-SH10-NO01	city of Gorham	0.0	0.0
Non-Discharging Facilities				
KSJ000118	M-SH37-NO01	city of Victoria	0.0	0.0
KSJ000316	M-SH50-NO01	Munjoy Improvement District	0.0	0.0
KSJ000116	I-SH16-NP05	APAC-KS-Shears (Hays Plant #921)	0.0	0.0
KSJ000311	M-SH38-NR02	KDOT – Trego Co Rest Area	0.0	0.0
KSJ000311	M-SH12-NR02	KDOT – Gove Co Rest Area	0.0	0.0
KSJ000332	M-SH14-NO01	city of Grinnell	0.0	0.0
KSJ000329	M-SH12-NO01	city of Grainfield	0.0	0.0
KSJ000330	M-SH12-NO02	USD#292 Grainfield-Wheatland School	0.0	0.0
MS4				
KSR044008	M-SH16-SN01	Hays Storm water	0.0	0.0

The upgrade of Gorham's wastewater treatment facility (0.0478MGD) is not included the calculation of this WLA.

LA Comment

Includes all nonpoint sources loads, natural background, and potential for future growth. If no nonpoint sources

are identified the LA must be given as zero [40 CFR § 130.2(g)]. If this is a phase II TMDL any differences in phase I and phase II LAs will be documented in this section.

The LA is set through the use of a load duration curve. Since nitrate concentrations do not exceed the criterion value of 10 mg/L during wet weather (runoff events or high flows), the LA simply is the area under the TMDL (LC) curve that lies above the total WLA (see Figure 28 in the TMDL document). As indicated earlier, this TMDL directly focuses on regulating WLA because all of the nitrate excursions occur at low flows. After the nitrate impairment is addressed and if there is a cause (e.g., biological impairment associated with aquatic and/or recreational uses) to address reductions in total nitrogen, the LA will be re-calculated and placed on abating nonpoint source nitrogen loadings to Big Creek (see Appendix B - TN TMDL development and Implementation in the TMDL document). For this TMDL, EPA neither reviews nor approves the TN TMDL provided in Appendix B.

Margin of Safety

Submittal describes explicit and/or implicit MOS for each pollutant [40 CFR § 130.7(c)(1)]. If the MOS is implicit, the conservative assumptions in the analysis for the MOS are described. If the MOS is explicit, the loadings set aside for the MOS are identified and a rationale for selecting the value for the MOS is provided. If this is a phase II TMDL any differences in MOS will be documented in this section.

This TMDL uses an implicit MOS, based on several conservative assumptions to assure that future WLA will not violate the nitrate criterion. First, design flows are used for the three point source dischargers (or facilities) to set WLA, in despite demographic trends indicating Wakeeney is likely to decline in population in the near future. Second, the effluent from Ellis and Wakeeney are assumed to travel the course of Big Creek and arrive at Munjor (SC540). Third, the endpoint of this TMDL, based on the Kansas Surface Water Nutrient Reduction Plan, is to reach 8 mg/L of nitrate (assuming TN is all nitrate) for these WWTFs, which will result in nitrate levels far below the 10 mg/L criterion.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s) [40 CFR § 130.7(c)(1)]. Critical conditions are factors such as flow or temperature which may lead to the excursion of WQS. If this is a phase II TMDL any differences in conditions will be documented in this section.

Seasonal variation is implicitly accounted for using load duration curve analysis. Because nitrate concentrations do not exceed the criterion value of 10 mg/L during wet weather, the LA will simply be the area under the TMDL curve that lies above the WLA. All of the nitrate excursions occur at low flows and are closely associated with the WWTFs. The assigned WLA will be used to directly address the effluent loads from the WWTFs and bring Big Creek to meet its nitrate WQS.

Public Participation

Submittal describes required public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s) [40 CFR § 130.7(c)(1)(ii)].

The Smoky Hill – Saline River Basin Advisory Committee met in Hays to discuss all TMDLs (including this TMDL) in the basin on July 7, 2009, October 1, 2009, and again on March 3, 2010. An active Internet Web site was established at www.kdhcks.gov/tmdl/ on January 28, 2010, to convey the TMDL information to the public. A Public Hearing on this TMDL was held on February 10, 2010 in Hays, to receive comments on this TMDL. During the public notice period, though no public comments received by the KDHE, EPA provided the comments to the agency. These comments were properly addressed and incorporated into the TMDL.

EPA agrees there had been ample opportunities for the public to participate and submit their comments to the KDHE for this TMDL.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies a monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of WQS, and a schedule for considering revisions to the TMDL(s) (where phased approach is used) [40 CFR § 130.7].

KDHE will continue to collect quarterly to bimonthly samples every year at Stations SC540 and SC541. Based on the sampling data, the priority status of the 303(d) listing will be evaluated in 2014. In order to assess the support of aquatic life, biological monitoring should commence on the lower reaches of Big Creek in 2012.

Reasonable Assurance

Reasonable assurance only applies when less stringent WLAs are assigned based on the assumption of nonpoint source reductions in the LA will be met [40 CFR § 130.2(i)]. This section can also contain statements made by the state concerning the state's authority to control pollutant loads.

No reasonable assurances apply because all of the permitted point sources have WLAs assigned to meet WQS. However, several reasonable assurances were identified in this TMDL including the state authorities used to control pollutant loads from the NPDES permitted facilities in the watershed (i.e., KSA 65-164, 65-165, and 65-171d).

KDHE has the authority to issue and enforce state operating permits. Inclusion of effluent limits into a state operating permit and requiring that effluent and instream monitoring be reported to KDHE should provide reasonable assurance that instream WQS will be met. Section 301(b)(1)(C) requires that point source permits have effluent limits as stringent as necessary to meet WQS. However, for WLAs to serve that purpose, they must themselves be stringent enough so that (in conjunction with the water body's other loadings) they meet WQS. This generally occurs when the TMDL's combined nonpoint source LAs and point source WLAs do not exceed the WQS-based LC and there is reasonable assurance that the TMDL's allocations can be achieved.

The episodes of excessive nitrate concentrations seen at the Munjor monitoring site (SC540) are linked to the wasteload from Hays WWTF. The appearance of elevated nitrate levels were due to ineffective use of aeration and altered staffing schedules at the WWTF. By March 2011, Hays will complete its facility modification studies that include the cost and feasibility of upgrading for nutrient removal to meet effluent goals for total nitrogen of 3, 5 and 8 mg/L. Therefore, the implementation activities required to establish the reasonable assurances are also provided in the TMDL for reduction in WLA as follows.

1. Install and operate enhanced wastewater treatment at Hays to induce denitrification and lower nitrate content of effluent.
2. Facilitate wastewater reuse for treated municipal wastewater
3. Renew state and federal permits, inspect permitted facilities, continue monitoring requirements and evaluate nutrient reduction study for Hays.