DIVISION OF ENVIRONMENT
QUALITY MANAGEMENT PLAN

PART III:

STREAM CHEMISTRY MONITORING PROGRAM
QUALITY ASSURANCE MANAGEMENT PLAN

Revision 4
02/07/2019

Kansas Department of Health and Environment
Division of Environment

Bureau of Water
Watershed Planning, Monitoring and Assessment Section

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Section 1

INTRODUCTION

1.1 Purpose of Document

This document presents the quality assurance (QA) management plan for the Kansas stream chemistry monitoring program. Quality assurance goals, expectations, organizational responsibilities, and program evaluation and reporting requirements are specifically addressed. Standard operating procedures (SOPs), describing sample collection, preservation, transport and analysis methods, equipment maintenance and calibration protocols, and other routine program activities, are provided in the appendices of the plan.

1.2 Historical Background

The Kansas Department of Health and Environment (KDHE) and its predecessor agency, the Kansas State Board of Health, have together monitored the quality of the state's streams and rivers for more than a century. Early monitoring efforts, from the middle 1890s to the early 1920s, focused primarily on the sanitary condition of water bodies serving as public water supplies and on the incidence of the typhoid bacterium (*Salmonella typhi*) in drinking water. These efforts were instrumental in the passage of several major sanitation and water pollution control statues and contributed to a dramatic reduction in the incidence of typhoid fever in Kansas.

Intensive river basin surveys were performed on an episodic basis from approximately 1922 to 1978. These surveys entailed a considerable commitment of staff and other resources. By 1978, individual surveys involved as many as twenty agency employees and fifteen field vehicles, including three mobile laboratory facilities. Employees remained in the field for eleven days at a time. Two days were required for laboratory set up and field reconnaissance and an additional two for laboratory take down, leaving seven consecutive days for field monitoring purposes. Staff were assigned specific sample collection and/or analytical duties. Sampling crews were dispatched each morning from a central "field" location, normally a small hotel or a public park facility with electrical and water hook-ups for the mobile laboratories. Water samples were collected from several dozen streams within the basin. Also, samples of treated wastewater were gathered from discharging sewage treatment plants, and semi-quantitative studies of benthic macroinvertebrate communities were performed at the stream chemistry monitoring locations (see stream biological program QA management plan).

Water and wastewater samples collected during the basin surveys were transported to the mobile laboratory facilities near the middle of each work day and analyzed for total suspended solids, total hardness, pH, total and phenolphthalein alkalinity, calcium, magnesium, biochemical oxygen demand (BOD), dissolved oxygen (DO), chloride, and total coliform, fecal coliform and fecal streptococcus bacteria. Additional samples were preserved in the field and ultimately transported to the KDHE environmental laboratory in Topeka, where they were analyzed for turbidity, specific

conductance, nutrients (ammonia, nitrate, total phosphorus), selected alkaline earth and alkali metals (sodium, potassium, magnesium, barium), selected transition metals and metalloids (total recoverable arsenic, cadmium, copper, iron, manganese, mercury, selenium, silver and zinc, and hexavalent chromium), polychlorinated biphenyls, phenols, and selected pesticides and pesticide degradation products (e.g., 2,4-D, 2,4,5-T, 2,4,5-TP, aldrin, alpha-BHC, atrazine, dacthal, DDE, DDT, dieldrin, endrin, heptachlor, heptachlorepoxide, lindane, methoxychlor, sencor, toxaphene).

From 1956 to 1961, the Kansas State Board of Health also collected water samples on a monthly basis from a network of 39 "permanent" stream monitoring stations. Almost all of these stations were located on major rivers, and many were located immediately downstream of large federal reservoirs. Grab samples were collected from bridges and analyzed for most of the inorganic parameters mentioned previously. In 1961, the agency entered into a cooperative agreement with the United States Geological Survey (USGS), an agency that had independently conducted water quality monitoring in the state from 1945 to 1960. This agreement created a joint state/federal network consisting of 67 monitoring stations. The terms of the agreement were such that most analytical work was conducted by the Kansas State Board of Health, whereas most field work and report writing activities were conducted by USGS. This cooperative program continues to evolve over the next decade. In 1967, approximately 35 "interstate" monitoring stations were added to the network and sampled on a bimonthly basis for most routine inorganic and bacteriological parameters. Approximately 37 "interior" monitoring stations were added to the network in 1973. Samples were collected from these stations on a monthly basis and analyzed for most of the inorganic, organic and bacteriological parameters mentioned previously.

The Kansas stream chemistry monitoring program underwent several major changes in October 1975. Specifically, the cooperative agreement with USGS was discontinued; all sample collection and analysis activities and data interpretation/report writing functions were transferred to KDHE; the number of monitoring stations in the network was reduced from approximately 140 to 115; and the collection of transition metal and pesticide samples was implemented at all stations. The monitoring program continued with essentially no further modification until March 1990. At that time, the number of permanent monitoring sites in the network increased to 148 and samples began to be collected on a bimonthly (rather then monthly) schedule. Nearly 140 "rotational" monitoring stations also were added to the sampling network. Water samples were collected from a given rotational station only one year out of every four years (i.e., about one-fourth the total number of rotational sites were sampled, on a bimonthly basis, in any given year). In all, approximately 175 monitoring stations, permanent and rotational, were sampled in any given year. The addition of these new stations in 1990 allowed the agency to obtain a much broader geographical perspective on water quality conditions within the state. Also, the placement of many of these stations on smaller order streams facilitated a more thorough analysis of rural and agricultural impacts on surface water quality.

From 1990 to 1995, several additional parameters were added to the list of monitored substances. Examples included fluoride, nitrite, ortho-phosphate, antimony, molybdenum and thallium. This expansion in the number of parameters was made possible through the procurement of new

analytical instrumentation by the KDHE Laboratory (KHEL). Examples of such instrumentation included an ion chromatograph, an intercoupled argon plasma emission spectrometer, and more sophisticated gas chromatographs and mass spectrometers. The microbiological parameters, fecal coliform bacteria and fecal streptococcus bacteria, were monitored at all permanent and rotational stations.

From 1995 to 2000, the inclusion of additional ecoregional reference sites and watershed integrator sites increased the number of permanent monitoring stations in the network to 158. The number of rotational sites increased to 148, primarily to accommodate the ongoing development and implementation of total maximum daily loads (TMDLs). These TMDL activities, and the Governor's Water Quality Initiative (1996-1998) and several other special studies, required more frequent (biweekly or monthly) collection of samples from selected sites around the state. In July 1998, a reorganization of the Division of Environment moved the stream chemistry monitoring program to the newly formed Bureau of Environmental Fields Services (BEFS) in the technical services section. In 1999, the monitoring program added mercury to the routine analyses and discontinued fecal streptococcus bacteria analyses.

From 2000 to 2005, the stream chemistry monitoring program continued to evolve by adding four chemical parameters (Kjeldahl nitrogen, total organic carbon, strontium, and hexachlorocyclopentadiene), two microbiological parameters (*Escherichia coli* and enterococci) and seven radiological parameters (actinium-228, americium-241, cesium-136, cobalt-57, iodine-132 and 133, and neodymium-147) and by collecting chlorophyll-a samples from selected monitoring stations (see section 4.4.2). The program discontinued three radiological parameters (chromium-51, gallium-67, gross uranium, radium-228, and total solids) and two parameters (fecal coliform bacteria and biochemical oxygen demand) during this same period. Additional analytical instrumentation was procured by KHEL, including an inductively coupled plasma mass spectrometer for metal analyses, a new ion chromatography unit for anion analyses, and a new flow chemistry analyzer for total Kjeldahl nitrogen, ammonia, and total phosphate analyses. Additional ecoregional reference sites and watershed integrator sites increased the number of active permanent monitoring stations in the network to 165. The number of rotational sites increased to 153.

Beginning in 2000, ongoing efforts to improve the program focused largely on quality assurance/quality control (QA/QC) and data management issues. Field container blanks and field-matrix spikes were implemented in an attempt to ascertain the combined effects of sample preservation, transportation, storage (containment), laboratory preparation, matrix interferences and other aspects of the water collection and analysis process on reported pollutant concentrations. In 2002, a data collection application, accessed in a Palm operated pen-notepad handheld computer, provided the platform for a unified lab number for all samples (inorganic, organic, bacteriological, and radiological) collected from a single monitoring station. This handheld computer incorporated a bar code data capture technology that prevented the transposition of bottle numbers by field staff and eliminated data discrepancies associated with the manual lab data entry process. Historically, to accommodate the transfer of data into the Kansas Water Database (KWD)

storage format, the laboratory data files with chemical and bacteriological analyses were electronically linked together by station, date, and time using Office of Information Technology (OIT) in-house conversion programs. However, this affiliation scheme was prone to transcription errors (misinterpretation of handwritten field collection sheets and/or data entry error) resulting in incomplete data transfers to the KWD. Now, for the first time, all of the physicochemical and microbiological measurements from a given monitoring station could be linked together by a single laboratory accession number, thereby insuring the complete transfer of this information to the laboratory database and KWD. Other benefits of the electronic tracking included: enhanced recording of all ancillary data (e.g., flow conditions and other field observations): greater flexibility to change scheduled QA/QC field activities; and an improved capacity to validate the completeness of the results reported by the laboratory.

Correspondingly in 2002, KDHE began replacing its IBM AS-400 mainframe computer with a Xiotech storage area network (SAN) and Hewlett Packard server-based system with Oracle client/server operation software. This conversion was deemed necessary to better harmonize with several federal databases (e.g., modern Storage and Retrieval (STORET) system) now operating on an Oracle database platform. By mid 2002, KDHE had purchased the new computer system, initiated the setup process, and completed the necessary in-house training. Testing of this new system was completed by the end of the year. In January 2003, OIT staff successfully migrated a portion of the stream chemistry monitoring data (1986-2003) to Oracle. By March 2003, KDHE was operating dual server platforms, updating both Oracle and the IBM AS-400 systems with stream chemistry data transferred directly from the laboratory's database. These simultaneous updates were performed until December 2003 when the IBM AS-400 system update was discontinued.

Utilizing the new software tools and programming knowledge gained in the test production of the new Oracle server system, OIT programming staff developed a water quality data evaluation program in late March 2003. This program generated outlier warning reports on a station-by station and parameter-by parameter basis by automatically comparing newly acquired data to the historical database and flagging any value that (a) exceeded the historical maximum value, (b) extended more than 2.0 standard deviations beyond the historical mean concentration, or (c) exceeded the established 95th percentile concentration. In December 2003, with technical input and guidance from BEFS data management staff and the stream chemistry program manager, OIT staff began developing a second-stage data validation system that performed 12 distinct QA/QC checks to accept, qualify or reject data for inclusion in the KWD and, ultimately, the modern STORET database system. This mathematically intensive application became fully functional in June 2004. It incorporated algorithms for checking cation:anion balances, total dissolved solids (TDS), specific conductance ratios, and elemental concentrations versus constituent concentrations (e.g., total phosphorus versus ortho-phosphate-P). In July 2004, additional constituent ratio calculations were added (e.g., sodium/chloride, specific conductance/sulfate). These additional ratio checks revealed physicochemical signatures for each of the state's water quality monitoring stations. Armed with this knowledge, new data could now be compared to historical, station-specific constituent ratios to identify and flag potential field and analytical

mistakes resulting from the application of erroneous dilution factors, misinterpretation of laboratory analytical instrumentation, switching of field and/or laboratory sample bottles, collection of water from the wrong stream locations, and other factors. All flagged calculations are now presented in the warning portion of the outlier/warning report. Once flagged, the suspect data are evaluated by program manager and verified, corrected or discarded, as appropriate (see section 4.9.2).

During the 2003 Session of the Kansas Legislature, K.S.A. 2002 Supp. 82a-2001 was amended to effectively redefine the meaning of "classified stream" and to create new subclasses of both primary and secondary contact recreational use (KDHE 2005b). In addition, the revised water quality standard for primary contact recreation was now based on *Escherichia coli* (*E. coli*), a single species in the fecal coliform group, with a numeric criterion concentration predicated on a geometric mean derived from at least five separate samples collected in separate 24-hour periods during a 30-day assessment period. Prior to this change in statute (July 1967 through June 2003), KDHE had assessed sanitary degradation relative only to measured concentrations of fecal coliform bacteria. In July 2003, the stream chemistry monitoring program was compelled by upper management to discontinue the routine monitoring of fecal coliform bacteria and substitute *E. coli* as the principal indicator organism for assessing the sanitary conditions of the state's rivers and streams. In 2004, the program initiated a new bacteriological project that met the aforementioned (geometric mean-based) requirements, with an initial focus on the Arkansas and Kansas rivers. Concurrently, a special comparative study was initiated to measure enterococci levels, chloride concentrations and specific conductance along with *E. coli* to determine which indicator organisms would afford the most robust measure sanitary condition in water of higher salt content.

In 2006, the stream chemistry monitoring program implemented a statewide geometric mean-based (GMB) monitoring program for *E. coli* that adhered to a seasonal schedule (cool-high, warm-high, warm-low, cool-low) consistent with current TMDL and NPDES permit development activities commissioned by the department. The bacteria monitoring data collected by KDHE involved quarterly *E. coli* sampling through the months of April-November, at designated TMDL sites. Specifically, samples were collected at five scheduled times that produce the measurements within each 30-day assessment window to calculate a geometric mean and accordingly meet the regulatory requirements to assess the state's bacteriological surface water quality. Specific to GMB monitoring, a weighted single bottle sampler (first used in 2008) with an inserted open bacteriological bottle is lowered beneath the stream surface to collect a representative sample. (The GMB monitoring program operations were suspended in 2014 following the completion of the first quarter sampling due to staffing shortages.)

Contemplated for several years, a probabilistic stream monitoring program (with a written quality management plan) was initiated in 2006 to complement the department's existing water quality monitoring and assessment programs. Staff from the traditional (targeted) stream monitoring program play a support role in obtaining physicochemical data from randomly selected stream reaches near existing targeted monitoring stations. The probabilistic program data is used to ascertain the state's overall level of compliance with the provisions of the Kansas surface water

quality standards for 305(b) reporting purposes. This monitoring approach allows the department to produce unbiased estimates of use support for the state as a whole, with accompanying measures of statistical confidence (see stream probabilistic monitoring program QA management plan). An additional field parameter (specific conductance) was added in January 2007. Specific conductance values recorded in the field are compared later to laboratory-derived values to confirm sample identity (i.e., validation). Two rotational sites were added to the network in the Spring River sub-basin to support ongoing TMDL activities, together with an additional six for expanded geographical coverage or ecoregional reference sites, increasing the total active rotational sites to 163. The permanent sites remained at 165 for a total of 328 permanent and rotational sites.

From 2009 to 2012, the stream chemistry monitoring program underwent significant operational changes to address the unprecedented financial strain on KDHE. Responding to budgetary reductions, KHEL proposed an immediate reduction in the number of surface water quality samples submitted by the stream chemistry monitoring program in June 2009. BEFS agreed to accommodate this request by temporarily reducing the sample collection frequency at all routine monitoring sites from bimonthly to quarterly, suspending all acid chlorinated pesticides analyses (eliminating one of two solvent extraction procedures), and perform all turbidity and dissolved oxygen measurements. These temporary changes were in effect from July 7 to October 28, 2009. The budgetary pressures on KHEL and BEFS persisted, in turn the program's routine ambient surface water quality sampling activities were permanently modified in 2010 by reducing (1) the sample collection frequency at all routine monitoring sites from bimonthly to quarterly, (2) terminating (post March 3, 2010) all acid chlorinated pesticide analyses (picloram, 2,4,5-TP, 2,4-D, 2,4,5-T), (3) reducing (three to two a year) the collection of pesticides for permanent monitoring stations, and (4) increasing (three to four a year) the collection of pesticides for all rotational monitoring stations. These reductions were coupled with an additional ten percent reduction (i.e., laboratory capacity) in the number of stations monitored in 2012. The stream chemistry monitoring program added one chemical parameter (uranium) and discontinued four pesticide parameters (picloram, 2,4,5-TP, 2,4-D, 2,4,5-T) and two radiological parameters (cobalt-58 and radium-226) during this period.

In August 2010, BEFS, at the request of the Bureau of Water (BOW), established a sub-watershed monitoring program (with a written quality management plan). The goal of the new program was to begin monitoring the conditions of surface waters at a 12-digit hydrological unit code (HUC) subwatershed scale. To date most stream monitoring activities implemented by KDHE had focused historically on the outlets of major watersheds (i.e., on an 8-digit HUC scale). Specifically, staff from the stream chemistry monitoring program would attempt to collect physicochemical water quality data from targeted sub-watershed streams and measure stream water height (stage) to later estimate stream discharge once a robust stage:discharge relationship had been established. As envisioned by BOW and BEFS, baseline data obtained from targeted sub-watershed would be ultimately compared to future monitoring results to document change in water quality coinciding with the implementation of Watershed Restoration and Protection Strategy (WRAPS) program plans, including best management practices (BMPs) and other environment improvement actions (see sub-watershed monitoring program QA management plan).

A major laboratory information laboratory management system (LIMS) computer software upgrade was initiated by KHEL in 2011. Although considered state-of-the art computer software twenty-five years ago, KHEL's aging INFORMIX laboratory database management system had progressively become outdated (and even obsolete). With several software patchworks to keep pace with ever-increasing demands, the still functional but stable computer system could no longer be updated to provide greater laboratory work process automation and perform complex quality control functions. Moreover, KHEL's ability to maintain a designated programmer for an almost defunct 4 GL programming and support and service for the aging computer system was beginning to be too cost prohibitive. In August 2011, with procurement of federal grant funding and following a competitive procurement process, KHEL contracted with ChemWare Inc. to replace INFORMIX with their HORIZON LIMS software system. Over the course of the next two years, ChemWare, KHEL, and KDHE's Division of Health and Environment staff held several meetings to discuss the technical aspects of development and implementation within the framework of the new HORIZON LIMS operating software. Beginning in late October 2013, testing was initiated for the new HORIZON LIMS and full implementation occurred the first week in December 2013. KHEL's INFORMIX database management system was officially shut down in late January 2014. In July 2012, a reorganization of the Division of Environment moved the stream chemistry monitoring program to the newly formed watershed planning, monitoring and assessment section (WPMAS) within BOW as part of the monitoring and analysis unit. Additionally and chiefly because of the importance of the pesticide monitoring to support ongoing TMDL efforts, the collection of pesticides was increased (two to three a year) for permanent monitoring stations and reduced (four to three a year) for all rotational monitoring stations in January 2013. A batch transfer of all historical radiological data occurred in April 2011, migrating all of the retained data in KHEL's INFORMIX to KDHE's KWD. Thereafter, radiological data would be electronically transferred along with the inorganic, organic, and microbiological water quality data.

In January 2014, WPMAS engaged a private consultant (a retired agency programmer) to assist in the development of a new electronic data interchange between KHEL's HORIZON LIMS and KDHE's KWD; whereby, to continue the exchange of analytical laboratory data electronically. The change in schema was necessary to enable the exchange of data between the HORIZON LIMS views (LIMS_DEM and LIMS_DAT) and the existing input table (SC_INFIN) format to actuate (when called) the in-house outlier flagging program and QA/QC checks. The checks are used to decide if the data is to be accepted, qualified or rejected. Testing of system occurred before implementing live and the computer programming update was operational by March 2014. Access to the virtual tables extracted from the lab's database (with read-only constraints) was used as a security mechanism to allow user access to the data without granting permissions to directly access the underlying base tables of the view. Data security followed the Department of Administration's Office of Information Technology Services (OITS) communication protocols to ensure a secure network for electronic transmission of the analytical data.

By September 2014, the stream chemistry monitoring program added two pesticide parameters (bromacil and prometon) to the routine organic analyses. In September 2015, staff shortages in KHEL's radiochemistry laboratory compelled the stream chemistry program to temporarily

suspend the collection of all ambient radiological samples (twenty-one samples) for the remainder of the year. By April 2016, KHEL contracted the State Hygienic Laboratory at the University of Iowa, Coralville, Iowa, to analyze the program's ambient radiological water quality samples. The State Hygienic Laboratory (SHL) provides an Excel spreadsheet of the analytical radiological data that is converted into the KWD's input table (SC_INFIN) format to enter the data electronically. After undergoing appropriate QA/QC checks, the data is accepted, qualified, or rejected. If rejected, consultation with SHL is initiated and reanalysis of the environmental sample is performed if warranted.

An executive directive in October 2015 by the Department of Administration's Human Resources abolished all five environmental scientist classifications and reclassified them as essentially environmental associates, environmental specialist or environmental program administrator positions. This reclassification occurred across multiple state agencies having primarily environmental state government jobs. Program staff now consist of environmental specialists and/or environmental program administrators. Starting in January 2017, the stream chemistry program began to collect single chlorophyll-a grab samples (previously collected in duplicate) to reduce the number of labor intensive extractions and analytical analyses performed by program staff. Ten percent (10%) of the chlorophyll-a samples are to be collected in duplicate to determine laboratory analytical variability and/or field collection technique. Currently, the stream chemistry monitoring program network is comprised of 331 active monitoring stations, 162 permanent and 169 rotational sites (Figure 1.2-1).

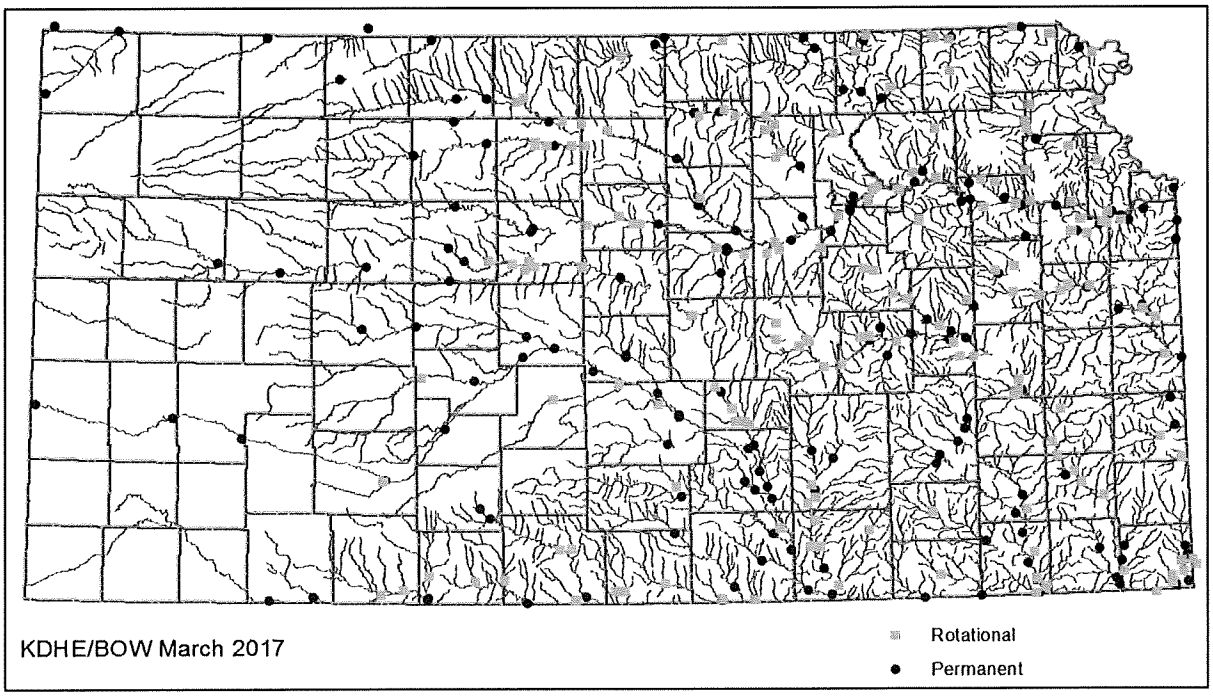


Figure 1.2-1. Current distribution of permanent and rotational stream chemistry monitoring stations.

1.3 Contemporary Program Objectives

The stream chemistry monitoring program endeavors to provide timely and scientifically defensible information on the physical, chemical and bacteriological condition of flowing waters in Kansas. This information is intended for use in:

(1) complying with the water quality monitoring and reporting requirements of 40 CFR 130.4 and sections 106(e)(1), 303(d), 305(b), and 319(h) of the federal Clean Water Act;

(2) evaluating water body compliance with the provisions of the Kansas surface water quality standards (K.A.R. 28-16-28b *et seq.*);

(3) identifying point and nonpoint sources of pollution contributing most significantly to documented water use impairments;

(4) documenting spatial and temporal trends in surface water quality resulting from changes in prevailing climatological conditions, land use and land cover, natural resource management practices, wastewater treatment plant operations, and other phenomena;

(5) developing scientifically defensible environmental standards wastewater treatment plant permits, and water body/watershed pollution control plans and TMDLs; and

(6) evaluating the effectiveness of pollution control efforts and water body remediation/restoration initiatives implemented by the department and other natural resource agencies and organizations.

Section 2

QUALITY ASSURANCE GOALS AND EXPECTATIONS

The foremost goal of this QA management plan is to ensure that the Kansas stream chemistry monitoring program produces data of known and acceptable quality. "Known quality" means that data precision, accuracy, completeness, comparability and representativeness are documented to the fullest practicable extent. "Acceptable" means that the data support, in a scientifically defensible manner, the informational needs and regulatory functions of the Bureau of Water (BOW), the Division of Environment, and the agency. The success of the program in meeting this general goal is judged on the basis of the following data performance criteria and requirements:

2.1 Data Precision and Accuracy

Where practicable, the reliability of program data shall be documented in a quantitative fashion. For routine water chemistry parameters, the precision of data shall be evaluated through the use of duplicate samples and the accuracy of data shall be evaluated through the use of field blanks and field spiked samples. The average relative percent difference (RPD) among duplicate samples shall, for all parameters, be less than twenty percent; spike recoveries shall average between 80 and 120 percent of the actual spike concentrations; background contaminant levels (determined primarily through the analysis of field blanks) shall constitute, on average, less than ten percent of the reported sample concentrations.

2.2 Data Completeness

Loss of physiochemical and microbiological data due to sample collection, transport or analytical problems, or to the subsequent mishandling of data, shall be limited to less than five percent of the data originally scheduled for generation. Where problems occur and a substantial quantity of data is lost, an effort shall be made to resample the stream(s) in question to maximize data completeness.

The previous requirement does not include circumstances where streams, which have been scheduled for sampling, are found to be in a pooled or de-watered state due to dry weather conditions. This is not considered to be a "lost data" condition. In such cases, flow conditions are noted in comments and a sampling shall be attempted during the next sampling quarter period.

2.3 Methodological Consistency

Changes in the methods used to obtain and analyze surface water quality samples shall be carefully documented through formal revisions to the standard operating procedures (SOPs) appended to this QA management plan. This requirement is intended to help maintain a reasonably consistent database over time, enhance knowledge of the effects of any procedural changes on reported

contaminant concentrations, and facilitate the identification and evaluation of long-term trends in surface water quality.

2.4 Data Comparison and Discrepancy

Water quality data generated through this program shall be compared and contrasted with other available monitoring data to examine the representativeness of program findings relative to other reported results. Staff shall attempt to ascertain the probable causes of any discrepancies observed between the various existing databases and describe, in end-of-year program reports, the magnitude and practical significance of such discrepancies (section 4.9).

Section 3

QUALITY ASSURANCE ORGANIZATION

3.1 Administrative Organization

The stream chemistry monitoring program is one of several statewide environmental monitoring programs administered by the Watershed Planning, Monitoring and Assessment (WPMAS) Section, Bureau of Water (see QMP, Part II, BOW QA Management Plan). Program offices are located in the Curtis State Office Building, 1000 SW Jackson St., Suite 440, in Topeka, Kansas.

The general administrative structure of the stream chemistry monitoring program is depicted in Figure 3.1-1, below.

Director
Division of Environment
|
Director
Bureau of Water
|
Assistance Director
Bureau of Water
|
Chief
Watershed Planning, Monitoring and Assessment Section
Environmental Program Administrator Supervisor
|
Unit Chief
Watershed Monitoring and Analysis Unit
Environmental Program Administrator
|
Program Manager
Stream Chemistry Monitoring Program
Environmental Program Administrator
|
Program Support
Stream Chemistry Monitoring Program
Environmental Specialist

Figure 3.1-1. Administrative hierarchy of stream chemistry monitoring program

3.2 Staff Responsibilities

Program staff includes one environmental program administrator (program manager) and one environmental specialist (program support), both affiliated with BOW watershed planning, monitoring and assessment section, monitoring and analysis unit. The program manager is accountable for most program planning, BOW laboratory chlorophyll-a analysis, data interpretation, and report writing activities. This employee also monitors program QC, apprises the section chief of any equipment needs or staff training needs, and participates in the annual review and revision of the program QA management plan. The program support is responsible for most traditional field activities, including nearly all sample collection, preservation, filtering chlorophyll-a samples, transport and chain-of-custody (sample documentation) functions and participates in the annual review and revision of the program QA management plan (see section 5). Other duties include the routine maintenance of field equipment, the scheduling of laboratory services, and the review and verification of laboratory data prior to transfer to the Kansas Water Database and United States Environmental Protection Agency (EPA) STORET database (section 4.8).

Staff of the BEFS Northwest District Office (operating out of Hays, Kansas) and the Southwest District Office (operating out of Dodge City, Kansas) also participate in the program by collecting samples from streams in the westernmost region of the state (Appendix B).

Personnel from other programs within BOW occasionally assist with stream chemistry sampling activities, especially in the event of staff absences or when additional people are needed to conduct work in a timely, safe and efficient fashion. Staff of the stream chemistry monitoring program provide reciprocal assistance to these other programs.

3.3 Staff Qualifications and Training

Minimum technical qualifications for program staff vary by position. The program manager must hold at least a four-year college degree in environmental chemistry, environmental microbiology, aquatic biology, hydrology or a related scientific field and have substantial experience in the performance of water quality studies and associated data analysis and statistical procedures. The program manager must also understand the basic principles of supervision, program administration and quality control and possess advanced computer skills and written and oral communication skills. Also, pursuant to Part I of the divisional quality management plan (QMP), the program manager must complete quality assurance training offered by EPA. The program's support (and all other employees routinely assisting with this program) must command a thorough understanding of the procedures used in the collection, handling and preliminary analysis of surface water samples and in the processing of associated paperwork and other documentation. The program's field staff travel extensively throughout the state, observing and obtaining samples from literally hundreds of streams. Hence, these individuals perform a valuable reconnaissance function and must be proficient in the visual identification and recognition of severe water quality problems warranting follow-up investigation and/or an emergency remedial response.

All individuals routinely participating in this program must possess a valid Kansas driver's license and current certifications in first aid, cardiopulmonary resuscitation (CPR), and the use of automated external defibrillators (AEDs). They must review the program's QA management plan and SOPs prior to assuming field/laboratory duties and repeat this review at least annually (QMP, Part I). All program staff receive in-house training in applicable work procedures and related safety requirements. As funding and other agency resources allow, the program manager and program support are encouraged to participate in technical workshops and seminars dealing with environmental monitoring operations and related field, analytical, data management and statistical procedures.

Section 4

QUALITY ASSURANCE PROCEDURES

4.1 Monitoring Site Selection

The monitoring program's network of permanent and rotational stations is designed around the objectives set forth in section 1.3 of this document. Specifically, an effort is made to evaluate water quality conditions in each of the state's major physiographic, geological and land use regions (objectives 1, 2 and 4) while providing data on individual water bodies needed to identify major sources of contaminants (objective 3), develop scientifically defensible permits, pollution control plans and/or TMDLs (objective 5), and assess the effectiveness of implemented pollution control and remediation efforts (objective 6). In selecting individual stations for inclusion (or retention) in the monitoring network, the following questions are posed:

(1) Would the candidate station materially enhance the spatial coverage of the monitoring network? That is, would the location coincide with a region of the state or a major river basin currently under represented in the network?

(2) Would the candidate station reflect water quality conditions throughout the entire watershed or stream segment, or would local phenomena (e.g., channelization projects, point sources, area cropping practices, livestock access, and riparian deforestation) create water quality conditions unrepresentative of the watershed or stream segment as a whole?

(3) Would the candidate station afford long-term access to the stream for monitoring purposes? Could access be curtailed at the discretion of a private landowner or limited during periods of heavy precipitation and/or high stream flow?

(4) Does historical water quality data exist for the candidate site? If so, does the available database provide a reliable indication of historical water quality conditions?

(5) Does other, ancillary data exist for the candidate site? Does the site coincide with any ongoing hydrological or biological data collection activities (e.g., KDHE stream biological monitoring station; USGS stream gaging)?

(6) Would the candidate station provide water quality data of unique interest? For example, does the site represent an unusually pristine location, suitable for use as a long-term ecoregional reference location? Does the stream segment potentially constitute an outstanding national resource water or a critical habitat for any state or federally listed threatened or endangered species? Is the candidate site located on an interstate stream in the vicinity of the state boundary, thereby constituting a potential interstate stream monitoring station?

Temporary monitoring stations also may be added to the network to support special studies conducted by KDHE or other cooperating agencies. Participation in such studies is ultimately contingent on the availability of staff and other resources. All monitoring stations, whether temporary, rotational or permanent, are subject to the same site documentation requirements: longitude and latitude are precisely determined through the use of global positioning system (GPS) techniques (see SOP No. SCMP-001); photographs are taken of all monitoring locations and periodically updated to track changes in the physical character of the monitoring sites; and narrative descriptions of the monitoring locations are prepared and maintained on a computer database to facilitate site identification/verification by new monitoring personnel and interested members of the general public.

4.2 Field Protocols

4.2.1 Sample Collection

The Kansas stream chemistry monitoring network is conveniently divided into twelve sampling routes or "runs." Program personnel perform one or two runs each week, or the entire set of runs every three months, thereby accommodating the quarterly sampling schedule described in section 1.2. Five of the network runs are completed in a single day. The seven remaining runs, which cover larger expanses of land and are farther removed from Topeka, require two to three days to complete. All program staff work closely with KHEL analysts to schedule sampling runs well ahead of time and ensure that the laboratory is prepared to receive incoming samples. On an annual basis, program staff provide KHEL a laboratory sample schedule of projected analytical needs at the beginning of the calendar year in advance of the network sampling runs. Prior to each scheduled sampling run, the electronic run sheet (Network Run Template, see Appendix C) is populated with the appropriate site descriptors, numeric collection index sequence, quality assurance/quality control samples, chlorophyll-a sample designated for collection (e.g., chl-a), and names of the participating field staff. This template is resaved as a network run file (e.g., Northeast Run; and date) on USB jump drive, uploaded onto a Palm data collection application, correctly structured using a Microsoft Excel analyzer add-in tool, and accessed in the field on a handheld computer.

A full-sized van with special safety accommodations is utilized for most field work with alternate vehicles (lease, rental, and district vehicles) used in network support activities or special studies commissioned by the department (Appendix A). Upon arrival at a monitoring station, flashing warning lights are engaged and the field vehicle is parked on the shoulder or far side of the road (rural areas) or in a nearby parking lot (urban areas). Staff activate the handheld computer and access the site information including station number, location, index number, field date, bottles to be scanned, temperature, pH, specific conductance, comments, and collector names. They then begin the barcode scanning process by directing the scanner beam onto the designated bottle barcodes for the station's entire suite of sample bottles. Each barcode label has a two-letter code at the end of the four digit number to insure the correct scanning of bottles (i.e., cubitainer "CM," total organic carbon "TC," heavy or trace metal "HM," dissolved oxygen "DO," nutrient "NT,"

bacteria "BC," pesticide "OC," rad health "RD," and tritium "TT"). After scanning the last bottle of the set for the station, staff enter the current date and time using an automated entry procedure (see SOP No. SCMP-013).

Upon completion of the above procedures, staff approach the bridge on foot wearing fluorescent orange safety vests or jackets. Water samples are collected from the comparative safety of the bridge deck with the aid of a rope and a specially fabricated and weighted stainless-steel bucket or, in the case of pesticide or radiological samples, a stainless-steel pail. Samples are collected from the downstream side of the bridge and from the apparent thalweg (the deepest appearing portion of the channel) to minimize entanglement with debris and resuspension of sediment. All samples are transferred to the field vehicle, where preliminary measurements are performed and recorded on the handheld computer along with any special comments. Samples are fractionated and preserved prior to delivery to KHEL, as discussed in sections 4.2.2, 4.2.3, 4.2.4 and 4.2.5, below.

4.2.2 Special Sample Collection Circumstances

Personnel engaged in a given stream sampling run visit all the stations included in said run, unless emergency conditions dictate otherwise or alternative arrangements have been approved in advance by the stream chemistry program manager or the section chief. Strict adherence to approved procedures may not always be possible due to safety considerations and varying field conditions (e.g., ice formation, woody debris accumulations, bridge repair work). If a bridge is not available, or if ice formation, shallow water or other conditions preclude collection of samples from a bridge, sampling personnel may attempt to access the stream from shore, within the road public right-of-way, or from private land if this can be done with the landowner's advance permission and without undue risk of personal injury or harm. Streams that are frozen over are sampled only if the ice cover can be safely broken using a concrete-weighted ice breaker provided for this purpose. Monitoring staff are not permitted to walk or drive on frozen streams during stream sampling or reconnaissance operations. When collecting samples from shallow streams, care is taken not to disturb the stream bottom sediments and inadvertently increase levels of particulate material within the water sample. When some disturbance of the bottom sediments is unavoidable, the sample is collected and the questionable nature of the sample is recorded in the comments section of the reporting form accessed via the handheld computer.

In most cases, streams that are obviously pooled and completely lacking in flow are not sampled by program staff. When doubt exists as to the presence or absence of stream flow, a sample is collected and the questionable nature of the sample is recorded in the comments section of the reporting form. All improvisations required during the collection of a particular sample are documented on the handheld computer and on the backup field sheet under the comments column (Appendix C).

Finally, when collecting water quality samples in streams known to contain live zebra mussels (*Dreissena polymorpha*), a dedicated rope for these sites is used and the weighted stainless-steel

sample bucket and stainless-steel pail are subsequently double rinsed with demineralized water before moving to sites outside the known range of this invasive species.

4.2.3 Sample Containers

Several types of samples are actually gathered by program staff, and each is transported and stored in its own specific kind of container with a barcode label that has a two-letter container code (Appendix B). The stainless steel bucket containing the sample is gently swirled between each of the poured fractions. The fraction reserved for physicochemical determinations is ultimately transferred to a new one-quart plastic cubitainer; the aliquot reserved for the total organic carbon bottle is transferred to two 40-ml amber glass bottles; the aliquot reserved for trace metal analysis is transferred to a new certified acid-washed 250-ml Nalgene bottle; the aliquot reserved for the dissolved oxygen bottle is transferred to a 200-ml glass bottle; the aliquot reserved for the nutrient analysis is transferred to a new 250-ml amber Nalgene bottle; the aliquot reserved for the bacterial analysis is transferred to a new 100-ml sterile IDEXX polystyrene bottle. The remaining portion of the sample provides water for pH, temperature and specific conductance measurements. Pesticide samples are transferred from the stainless-steel pail to a one-gallon dark glass bottle with a Teflon-lined plastic cap. Radiological samples are transferred to a one-gallon polyethylene jug, except for the tritium sample fraction which is transferred to a 100-ml glass bottle. Chlorophyll-a samples are transferred to one-quart plastic cubitainers.

4.2.4 Sample Preservation

Methods employed in the preservation of stream water samples are described in detail in Appendix B. In summary, mineral, nutrient, total organic carbon, pesticide and bacteriological samples are stored in the dark, on ice, pending transfer to KHEL; chlorophyll-a samples are likewise stored on ice and in darkness pending transfer to the BOW lab. Trace metal sample bottles and radiological sample jugs supplied by KHEL are pre-acidified with nitric acid, whereas nutrient sample bottles are pre-acidified with sulfuric acid and total organic carbon bottles are pre-acidified with phosphoric acid. Dissolved oxygen samples are analyzed by KHEL using the Winkler titration technique and are preserved in the field vehicle using appropriate additions of manganous sulfate, alkaline potassium iodide azide, and concentrated sulfuric acid (APHA 1998); once the sulfuric acid is added, the dissolved oxygen samples are stored in a deeply shaded area of the field vehicle pending transfer to KHEL (Appendix B). Chlorophyll-a samples must be filtered within 72 hours of collection. Filters are stored at the BOW laboratory in a freezer pending extraction and analysis, and a maximum holding time of 15 weeks is applied to all frozen filters, analyses are conducted at the BOW lab in the Curtis State Office Building in Topeka (see KDHE lake and wetland program QA management plan).

4.2.5 Preliminary Measurements

Temperature is measured to the nearest °C using a Fisher model 15-077B stainless-steel dial scale thermometer, which is placed directly in a 50-ml beaker following transfer of the sample to the

field vehicle. pH measurements are performed on the same 50-ml sample aliquot using an Industrial and Chemical Measurement (ICM) model #5996-70 portable pH meter or comparable instrument. For data validation purposes, specific conductance is measured using a Fisher model 09-328 meter or comparable instrument. All measurements are recorded on the handheld computer and the field recording sheet along with other pertinent information (see Appendix B).

4.3 Sample Transport, Chain-of-Custody and Holding Times

All samples must be handled and stored in a fashion which minimizes contamination, leakage and damage during transport. Samples collected during one-day sampling runs are delivered to KHEL that same day, prior to the close of business. Samples gathered on three-day sampling runs are delivered to the laboratory on the last day of the sampling run, prior to the close of business. In the event field staff are unavoidably detained, every effort is made to contact KHEL by telephone to arrange for the late afternoon or evening transfer of samples. As a rule, no sample arrives at KHEL later than 72 hours after collection. Only those samples collected during three-day runs and submitted for dissolved oxygen (DO), turbidity, *E. coli* bacteria, nitrate, nitrite and/or ortho-phosphate analysis routinely exceed the maximum holding times established by KHEL. Quality control studies conducted by BOW have shown no short-term holding time effect for DO once the samples are acidified. However, reported concentrations of some parameters such as fecal coliform and *E. coli* bacteria, nitrate, nitrite and ortho-phosphate may be somewhat less than actual ambient levels owing to bacteriological die-off, microbial assimilation of phosphorus and nitrogen, or other processes occurring within the samples. The magnitude of any change in concentration is ascertained through the use of field spikes (section 4.6.6) or through special QC (time-course) studies conducted by BOW and KHEL. A standardized electronic sample submission (chain-of-custody) form accompanies all samples submitted to KHEL and the HORIZON LIMS Lab Receipt assigns each sample a unique lab accession number to insure the correct tracking and processing of samples and analytical information (Appendix C). The form also identifies sampling location, date and time of sample collection, flow conditions and other field observations, personnel involved in the collection of the sample, and analytical parameters of interest. Staff involved with the collection and transfer of samples sign and date two copies of the sample submission form. Employees of KHEL sign both forms, record the date and time, and retain one form to acknowledge receipt of samples and return the other to the delivering field staff. This basic sign-off procedure also is performed if the sample changes hands prior to arrival at KHEL (e.g., when district staff transfer samples to program staff; see Appendix B).

4.4 Analytical Procedures Performed by BOW Program Staff

Staff of the stream chemistry water quality monitoring program perform several analytical measurements, as described in the following subsections. Analytical field methods and biological analyses employed by program staff are summarized in table 4.4-1

TABLE 4.4-1

ROUTINE PHYISOCHEMICAL OR BIOLOGICAL ANALYSES PERFORMED BY PROGRAM STAFF

Constituent or Physical Property	**Reporting Unit**	**Analytical Method[1]**	**Holding Time[2, 3]**
Chlorophyll-a	µg/L	APHA 10200H	72 hours
Pheophytin-a	µg/L	APHA 10200H	72 hours
pH (field)	pH unit	EPA 150.1	Immediate
Specific conductance (field)	µmhos/cm	EPA 120.1	Immediate
Temperature (field)	degrees C	APHA 2550B	Immediate

[1] Chlorophyll-a analysis method performed using a spectrophotometer (Weber et al. 1986) in conjunction with guidelines from Standard Methods (see APHA 1989).
[2] Indicated holding times assume samples are held under appropriate environmental (e.g., pH, temperature) conditions (see APHA, 1989).
[3] Chlorophyll-a samples must be filtered and frozen within 72 hours of collection and analyzed within 6 months of extraction.

4.4.1 pH Analyses

Measurements of pH are performed in the field with an ICM portable pH meter and combination electrode. The meter is standardized using pH 4.0, 7.0 and 10.0 buffer solutions traceable to the National Institute of Standards and Technology (NIST). Once standardized, and between each measurement, the electrode is rinsed thoroughly with demineralized water. After use, the barrel and bulb of the electrode are carefully rinsed with demineralized water, and a storage cap containing pH probe storage solution is fitted over the end of the electrode (Appendix B).

4.4.2 Specific Conductance Analyses

For monitoring station verification (signifying a normal, expected value) and data validation (comparing to lab measured conductance) purposes, specific conductance measurements are performed in the field with a Fisher Scientific Traceable expanded range digital conductivity meter with a probe containing platinum electrodes and a solid-state thermistor (for automatic temperature compensation). The meter is standardized using a commercially available potassium chloride reference solution (1,408μmhos/cm) or standards provided by NIST. Once standardized, and between each measurement, the electrode is rinsed thoroughly with demineralized water. After use, the electrode is carefully rinsed with demineralized water, and allowed to dry in an empty 50-ml beaker between sampling activities. (Appendix B).

4.4.3 Temperature

Temperature is measured using a stainless-steel dial scale thermometer. It measures temperature in degrees Celsius within the range –10 to 110 degrees. Thermometer calibration is accomplished by comparing instrument to an NIST traceable reference thermometer on a yearly basis. If adjustment is required, carefully turn adjusting nut located on back of dial until correction is completed. Procedures for thermometer maintenance include a thorough inspection at each new calendar year to ensure instrument is properly calibrated and operating within manufacturer's specifications.

4.4.4 Chlorophyll-a Analyses

At designated monitoring stations, staff collect a grab sample in a single cubitainer for chlorophyll-a and pheophytin-a analyses and also record on the handheld computer and sample collection form the estimated periphyton cover (filamentous algae) growing on the stream bottom. Selecting a cross-section of the streambed, either upstream or downstream of the sampling point, staff visually estimate the percent cover of filamentous algae (e.g., < 5% "none," > 5% but < 33% as "low," > 33% but < 67% as "moderate," > 76% as "high") growing on the underwater substrate (i.e., not the typical brownish diatom scum on rocks) within an area five meters on either side of the cross-section. The cubitainers containing the samples are placed on ice pending arrival at the BOW laboratory, where they are refrigerated until ready for processing. Samples are filtered within 72 hours of collection through a Gelman (Type A/E) glass-fiber filter. Filters are folded, wrapped in a paper blotter, labeled, packed in plastic bags with desiccated dry-rite compound, and placed in a freeze. After a minimum of three weeks of freeze-drying, the filters are pulverized in 90 percent acetone using a tissue grinder. The pulverized material is centrifuged, and the decanted, clarified extract is transferred to a quartz cuvette and measured spectrophotometrically for chlorophyll-a and pheophytin-a content (APHA, 1998).

4.5 Laboratory Analytical Parameters and Procedures

Analytical methods employed by Kansas Health and Environmental Laboratory (KHEL) and the State Hygienic Laboratory (SHL) at the University of Iowa (with associated parameter reporting limits) are summarized in tables 4.5-1 through 4.5-6, below.

TABLE 4.5-1

ROUTINE INORGANIC ANALYSES PERFORMED BY KHEL

Constituent or Physical Property	**Reporting Limit**	**Reporting Unit**	**Analytical Method**	**Holding Time**
Alkalinity, total (as $CaCO_3$)	20	mg/L	APHA 2320B	14 days
Aluminum, total recoverable	0.05	mg/L	EPA 200.7	6 months
Ammonia, total (as N)	0.1	mg/L	EPA 350.1	28 days
Antimony, total recoverable	0.05	mg/L	EPA 200.7	6 months
Arsenic, total recoverable	1	µg/L	EPA 200.8	6 months
Barium, total recoverable	0.02	mg/L	EPA 200.7	6 months
Beryllium, total recoverable	0.001	mg/L	EPA 200.7	6 months
Boron, total recoverable	0.05	mg/L	EPA 200.7	6 months
Bromide	0.2	mg/L	EPA 300.0	28 days
Cadmium, total recoverable	1	µg/L	EPA 200.8	6 months
Calcium, total recoverable	0.05	mg/L	EPA 200.7	6 months
Chloride	1	mg/L	EPA 300.0	28 days
Chromium, total recoverable	1	µg/L	EPA 200.8	6 months
Cobalt, total recoverable	0.01	mg/L	EPA 200.7	6 months
Copper, total recoverable	1	µg/L	EPA 200.8	6 months
Dissolved oxygen	0.1	mg/L	APHA 4500-OC	8 hours
Fluoride	0.15	mg/L	EPA 300.0	28 days
Hardness, total ($CaCO_3$)	Calc.	mg/L	EPA 2340B	N/A
Iron, total recoverable	0.01	Mg/L	EPA 200.7	6 months
Kjeldahl nitrogen	0.2	mg/L	EPA 351.1	28 days
Lead, total recoverable	1	µg/L	EPA 200.8	6 months
Magnesium, total recoverable	0.05	mg/L	EPA 200.7	6 months

TABLE 4.5-1 (Continued)

ROUTINE INORGANIC ANALYSES PERFORMED BY KHEL

Constituent or Physical Property	**Reporting Limit**	**Reporting Unit**	**Analytical Method**	**Holding Time**
Manganese, total recoverable	0.005	mg/L	EPA 200.7	6 months
Mercury, total	0.5	µg/L	EPA 245.1	13 days
Molybdenum, total recov.	0.02	mg/L	EPA 200.7	6 months
Nickel, total recoverable	1	µg/L	EPA 200.8	6 months
Nitrate (as N)	0.1	mg/L	EPA 300.0	48 hours
Nitrite (as N)	0.05	mg/L	EPA 300.0	48 hours
Phosphate, ortho- (as P)	0.25	mg/L	EPA 300.0	48 hours
Phosphorus, total (as P)	0.02	mg/L	EPA 365.1	28 days
Potassium, total recoverable	0.05	mg/L	EPA 200.7	6 months
Selenium, total recoverable	1	µg/L	EPA 200.8	6 months
Silica, total recov. (as SiO_2)	0.11	mg/L	EPA 200.7	28 days
Silver, total recoverable	1	µg/L	EPA 200.8	6 months
Sodium, total recoverable	0.05	mg/L	EPA 200.7	6 months
Specific conductance	35	µmhos/cm	EPA 120.1	28 days
Strontium, total recoverable	0.1	mg/L	EPA 200.7	6 months
Sulfate	0.5	mg/L	EPA 300.0	28 days
Thallium, total recoverable	0.05	mg/L	EPA 200.7	6 months
Total dissolved solids	Calc.	mg/L	USGS I-1751-85	N/A
Total organic carbon	0.5	mg/L	APHA 5310C	28 days
Total suspended solids	10	mg/L	EPA 160.2	7 days
Turbidity	0.15	NTU	EPA 180.1	48 hours
Uranium, total recoverable	1	µg/L	EPA 200.8	6 months
Vanadium, total recoverable	0.005	mg/L	EPA 200.7	6 months
Zinc, total recoverable	0.005	mg/L	EPA 200.7	6 months

TABLE 4.5-2

ROUTINE ORGANIC ANALYSES PERFORMED BY KHEL

Constituent or Physical Property	**Reporting Limit**	**Reporting Unit**	**Analytical Method**	**Holding[1] Time**
Acetochlor	0.1	µg/L	EPA 608	7 days
Alachlor	0.1	µg/L	EPA 608	7 days
Aldrin	0.025	µg/L	EPA 608	7 days
Atrazine	0.3	µg/L	EPA 608	7 days
Bromacil	2	µg/L	EPA 608	7 days
Butachlor	0.5	µg/L	EPA 608	7 days
Carbofuran	0.5	µg/L	EPA 608	7 days
Chlordane	0.2	µg/L	EPA 608	7 days
Cyanazine	0.5	µg/L	EPA 608	7 days
DCPA	0.05	µg/L	EPA 608	7 days
p,p'-DDD	0.04	µg/L	EPA 608	7 days
p,p'-DDE	0.02	µg/L	EPA 608	7 days
p,p'-DDT	0.1	µg/L	EPA 608	7 days
Dieldrin	0.05	µg/L	EPA 608	7 days
Endosulfan I	0.02	µg/L	EPA 608	7 days
Endosulfan II	0.02	µg/L	EPA 608	7 days
Endosulfan sulfate	0.1	µg/L	EPA 608	7 days
Endrin	0.1	µg/L	EPA 608	7 days
alpha-BHC	0.025	µg/L	EPA 608	7 days
beta-BHC	0.05	µg/L	EPA 608	7 days
delta-BHC	0.05	µg/L	EPA 608	7 days
gamma-BHC	0.025	µg/L	EPA 608	7 days

[1] Pesticide samples must be extracted within 7 days of collection and analyzed within 40 days of extraction.

TABLE 4.5-2 (Continued)

ROUTINE ORGANIC ANALYSES PERFORMED BY KHEL

Constituent or Physical Property	**Reporting Limit**	**Reporting Unit**	**Analytical Method**	**Holding[1] Time**
Heptachlor	0.02	µg/L	EPA 608	7 days
Heptachlor epoxide	0.02	µg/L	EPA 608	7 days
Hexachlorobenzene	0.1	µg/L	EPA 608	7 days
Hexachlorocyclopentadiene	0.1	µg/L	EPA 608	7 days
Methoxychlor	0.2	µg/L	EPA 608	7 days
Metolachlor	0.25	µg/L	EPA 608	7 days
Metribuzin	0.1	µg/L	EPA 608	7 days
PCB-1016	0.5	µg/L	EPA 608	7 days
PCB-1221	1	µg/L	EPA 608	7 days
PCB-1232	0.5	µg/L	EPA 608	7 days
PCB-1242	0.5	µg/L	EPA 608	7 days
PCB-1248	0.5	µg/L	EPA 608	7 days
PCB-1254	0.5	µg/L	EPA 608	7 days
PCB-1260	0.5	µg/L	EPA 608	7 days
Prometon	0.2	µg/L	EPA 608	7 days
Propachlor	0.25	µg/L	EPA 608	7 days
Propazine	0.3	µg/L	EPA 608	7 days
Simazine	0.3	µg/L	EPA 608	7 days
Toxaphene	2	µg/L	EPA 608	7 days

[1] Pesticide samples must be extracted within 7 days of collection and analyzed within 40 days of extraction.

TABLE 4.5-3

NONROUTINE ORGANIC COMPOUNDS

Constituent or Physical Property	**Reporting[1] Limit**	**Reporting Unit**	**Analytical Method**	**Holding[2] Time**
Deethyl atrazine	N/A	µg/L	EPA 608	7 days
Deisopropyl atrazine	N/A	µg/L	EPA 608	7 days

[1] No reporting limit quantified levels are reported.
[2] Pesticide samples must be extracted within 7 days of collection and analyzed within 40 days of extraction.

TABLE 4.5-4

ROUTINE RADIOLOGICAL ANALYSES PERFORMED BY SHL

Constituent or Physical Property	**Reporting Limit**	**Reporting Unit**	**Analytical Method**	**Holding[1] Time**
Actinium-228	variable	pCi/L	EPA 901.1	6 months
Americium-241	variable	pCi/L	EPA 901.1	6 months
Antimony-125	variable	pCi/L	EPA 901.1	6 months
Barium-140	variable	pCi/L	EPA 901.1	6 months
Beryllium-7	variable	pCi/L	EPA 901.1	6 months
Cerium-141	variable	pCi/L	EPA 901.1	6 months
Cerium-144	variable	pCi/L	EPA 901.1	6 months
Cesium-134	variable	pCi/L	EPA 901.1	6 months
Cesium-136	variable	pCi/L	EPA 901.1	6 months
Cesium-137	variable	pCi/L	EPA 901.1	6 months
Cobalt-57	variable	pCi/L	EPA 901.1	6 months
Cobalt-60	variable	pCi/L	EPA 901.1	6 months

[1] Radiological samples collected with acid preservation at the time of sampling. Radiological samples collected without preservation must be acidified within 5 days of collection and held in original sample container for a minimum of 16 hours between acidification and analysis (APHA 1989). The holding time of 6 months is not cited in reference.

TABLE 4.5-4 (Continued)

ROUTINE RADIOLOGICAL ANALYSES PERFORMED BY SHL

Constituent or Physical Property	**Reporting Limit**	**Reporting Unit**	**Analytical Method**	**Holding[1] Time**
Gross Alpha (including uranium)	variable	pCi/L	EPA 900.0	6 months
Gross Beta	variable	pCi/L	EPA 900.0	6 months
Indium-111	variable	pCi/L	EPA 901.1	6 months
Iodine-123	variable	pCi/L	EPA 901.1	6 months
Iodine-131	variable	pCi/L	EPA 901.1	6 months
Iodine-132	variable	pCi/L	EPA 901.1	6 months
Iodine-133	variable	pCi/L	EPA 901.1	6 months
Iron-59	variable	pCi/L	EPA 901.1	6 months
Lanthanum-140	variable	pCi/L	EPA 901.1	6 months
Manganese-54	variable	pCi/L	EPA 901.1	6 months
Molybdenum-99	variable	pCi/L	EPA 901.1	6 months
Neodymium-147	variable	pCi/L	EPA 901.1	6 months
Neptunium-239	variable	pCi/L	EPA 901.1	6 months
Niobium-95	variable	pCi/L	EPA 901.1	6 months
Potassium-40	variable	pCi/L	EPA 901.1	6 months
Ruthenium-103	variable	pCi/L	EPA 901.1	6 months
Ruthenium-106	variable	pCi/L	EPA 901.1	6 months
Silver-110m	variable	pCi/L	EPA 901.1	6 months
Technetium-99m	variable	pCi/L	EPA 901.1	6 months
Thorium-228	variable	pCi/L	EPA 901.1	6 months
Tritium	variable	pCi/L	EPA 906.0	6 months

[1] Radiological samples collected with acid preservation at the time of sampling. Radiological samples collected without preservation must be acidified within 5 days of collection and held in original sample container for a minimum of 16 hours between acidification and analysis (APHA 1989). The holding time of 6 months is not cited in reference.

TABLE 4.5-4 (Continued)

ROUTINE RADIOLOGICAL ANALYSES PERFORMED BY SHL

Constituent or Physical Property	**Reporting Limit**	**Reporting Unit**	**Analytical Method**	**Holding[1] Time**
Ytterbium-169	variable	pCi/L	EPA 901.1	6 months
Zinc-65	variable	pCi/L	EPA 901.1	6 months
Zirconium-95	variable	pCi/L	EPA 901.1	6 months

[1] Radiological samples collected with acid preservation at the time of sampling. Radiological samples collected without preservation must be acidified within 5 days of collection and held in original sample container for a minimum of 16 hours between acidification and analysis (APHA 1989). The holding time of 6 months is not cited in reference.

TABLE 4.5-5

NONROUTINE RADIOLOGICAL ANALYSES PERFORMED BY SHL

Constituent or Physical Property	**Reporting Limit**	**Reporting Unit**	**Analytical Method**	**Holding[1] Time**
Gross Alpha (with high solid content)	variable	pCi/L	EPA 00-02	6 months

[1] Radiological samples collected with acid preservation at the time of sampling. Radiological samples collected without preservation must be acidified within 5 days of collection and held in original sample container for a minimum of 16 hours between acidification and analysis (APHA 1989). The holding time of 6 months is not cited in reference.

TABLE 4.5-6

ROUTINE BACTERIOLOGICAL ANALYSES PERFORMED BY KHEL

Constituent or Physical Property	**Reporting Limit**	**Reporting Unit**	**Analytical Method**	**Holding[1] Time**
Escherichia coli Quantitray	10	MPN/100 mL	APHA 9223B	24 hours

[1] KDHE stream chemistry program adopted an extended holding time due to logistical (sample transport) issues.

4.6 Internal Procedures for Assessing Data Precision, Accuracy, Representativeness and Comparability

4.6.1 In-house Audits

The section chief generally audits field and laboratory personnel, systems and procedures on annual basis. These actions may include system audits, consisting of qualitative, onsite reviews of QA systems and physical facilities for monitoring, measurement and calibration, or performance audits, during which quantitative assessments are made of the bias (accuracy) and variability (precision) of analytical measurements. During system audits, staff responsible for sample collection and field operations are required to demonstrate a proper understanding of the requirements imposed by the QA management plan and accompanying SOPs. During performance audits, staff are required to conduct field measurements in the presence of the section chief and to report measured values for temperature, pH, and specific conductance measurements that fall within five percent of the values established by the section chief. Should these values fall outside control limits, the section chief and participating staff initiate corrective actions as described in section 4.8.

4.6.2 Instrument Calibration and Standardization

At yearly intervals, the performance of thermometers used in the field is checked against a reference thermometer traceable to the National Institute of Standards and Technology (NIST). Before leaving for the field, monitoring staff also are expected to calibrate the pH and specific conductance meters and test the instruments for normal operation. The pH and specific conductance meters are standardized in the field, immediately prior to use, using NIST-traceable pH buffer solutions and commercially certified conductance standards (Appendix B). The instruments must meet all manufacturer performance specifications. Should the meters be found to drift significantly, more frequent calibrations are performed or corrective action procedures are invoked (section 4.8.1).

4.6.3 Field Blanks

The possibility of sample contamination during sample preparation, handling, storage and analysis is assessed through the use of field blanks prepared with glass distilled water (inorganic analyses) or demineralized water (organic analyses) and subjected to the same treatment as surface water samples. (Contamination is an especially important consideration when sampling for trace metals and metalloids, as ambient concentrations of these parameters are often less than 1.0 μL, and sample concentrations may be greatly augmented through exposure to airborne particulate matter, etc.). On each sampling run, or on a least one run during any week of sampling, the weighted stainless-steel bucket is filled under field conditions with glass distilled water initially meeting ASTM Type-I specifications. The water (blank sample) is transferred to a complete set of randomly selected sample containers and subjected to the same preservation, handling, storage, and analysis procedures as the actual field samples. This procedure is repeated using the stainless-

steel pail and demineralized water to prepare field blanks for the organic parameters (Appendix B). If the limits for sample contaminations presented in section 2, paragraph (1) are exceeded, corrective actions are implemented in accordance with section 4.8.2, below.

4.6.4 Container Blanks

Bottles used to transport and store sample fractions cannot be regarded as clean and uncontaminated without some form of empirical verification. This is true even when new bottles are used or when reusable bottles have undergone extensive cleaning and preparation. Such bottles can (and sometimes do) contribute to imprecision and bias in the environmental data collection process. Container blanks provide an indication of the potential chemical, radiological and/or microbiological contamination resulting from sample containment. On monthly basis, staff obtain a container of ASTM Type-I quality water from the KHEL inorganic laboratory. Prior to leaving the lab, this water (blank sample) is transferred directly to a complete set of randomly selected sample containers (or transported in the sampling vehicle and then poured directly into sample bottles under field conditions) and subjected to the same preservation, handling, storage, and analysis procedures as the actual field samples (Appendix B). If the limits for sample contamination presented in section 2, paragraph (1) are exceeded, corrective actions are implemented in accordance with section 4.8.2, below.

4.6.5 Field Duplicate Samples

Quality control measures implemented in the field also include the collection of sequential and concurrent duplicate (replicate) samples. Sequential duplicate samples (collected approximately five minutes apart) are obtained from a minimum of one station during each sampling run to assess variability among samples resulting from collection, processing, transport, and laboratory procedures. Concurrent duplicate samples are periodically collected by filling separate sample containers concurrently from the same sampling device to assess sample homogeneity (Appendix B). Should the precision of the data fall outside the control limits established in section 2, paragraph (1), corrective action procedures are invoked in accordance with section 4.8.3, below.

4.6.6 Field Matrix Spiked Samples

At least four times each year, a set of spiked samples is prepared in the field under the direct supervision of the program manager through the addition of known concentrations of selected parameters to one of two or more replicate samples. Following laboratory analysis, measured levels of these parameters in the spiked samples are compared to those in the unamended samples to provide an overall indication of sample degradation and analytical recovery. Field spikes are prepared using high accuracy and high precision fixed- and adjustable-volume pipettes, volumetric glassware, and certified reference standards obtained from EPA, USGS, or appropriate commercial vendors (Appendix B). Should the accuracy of the data fall outside the control limits established in section 2, paragraph (1), corrective action procedures are invoked in accordance with section 4.8.3, below.

4.6.7 Preventative Maintenance

Periodic inspection of sampling and analytical equipment and routine maintenance of this equipment is necessary to minimize malfunctions, which could result in the loss of program data or disruption of program activities. Field instrumentation must routinely be inspected prior to use and calibrated at intervals recommended by the manufacturer. Equipment maintenance logs must be maintained for all field thermometers, pH meters, and specific conductance meters. Vehicles used for field activities must be maintained in a reliable condition and kept free of trash, debris, tobacco products, or other materials that could significantly increase the risk of sample contamination (section 4.8.2). Entries must be made in the vehicle log upon completion of each field trip. Instrument and vehicle malfunctions must be reported to the program manager as soon as possible to expedite necessary repairs or the acquisition of new equipment (section 4.8.1).

4.6.8 Safety Considerations

Attention to job safety protects the health and well-being of program staff and helps maintain a work atmosphere which ultimately enhances data quality and consistency. Program staff must be familiar with proper precautionary measures and the use of available safety equipment prior to assuming field duties. Each vehicle used in the stream chemistry monitoring program must be maintained in proper operation condition and equipped with a first aid kit, safety glasses, portable eye wash station, fire extinguishers, spare tire and tire changing equipment, rain gear, emergency road reflectors and/or flares, and at least one operable flashlight. A cellular phone is assigned to each monitoring vehicle and staff are directed to turn these on when in the vehicle so that communication can be maintained with the central office in the event of vehicle mishaps, medical problems, or other emergencies. The use of a cellular phone is especially important when conducting overnight sampling runs or when traveling alone or during periods of potentially severe weather. As an added safety feature when traveling in remote areas of the state, an automated external defibrillator (AED) was procured to provide aid in the event of cardiac emergencies; this lifesaving device guides the rescuer step by step through the entire rescue pending the arrival of trained medical personnel. All field staff must also exercise care when handling glassware and chemical reagents in the field. Chemical reagents used in the field include manganous sulfate (eye and mucous membrane irritant), alkaline potassium azide iodide (oral toxin), concentrated sulfuric acid (strong acid and oxidizer), nitric acid (strong acid and oxidizer), and pH buffer solutions (eye and mucous membrane irritants). Staff should not engage in the use of these reagents or breakable glassware if the weather, terrain, traffic or any other concern impedes concentration, reduces visibility, jeopardizes footing, or otherwise precludes the safe handling of these materials. Rather, staff should move to a level, dry, protected, and well lighted area before preserving or analyzing samples. If the wind is blowing strongly, staff should avoid handling samples and reagents immediately upwind of their face and eyes. Additional safety considerations are presented in the SOPs accompanying this QA management plan.

4.7 External Procedures for Assessing Data Precision, Accuracy, Representativeness and Comparability

At the discretion of the section chief, bureau QA representative or other administrative staff, the stream chemistry monitoring program may, from time to time, participate in independent audits or in cooperative, interlaboratory sample comparison programs or reference sample programs. Participation in such activities promotes scientific peer review and enhances the technical integrity and overall credibility of the program.

4.8 Corrective Action Procedures of Out-of-Control Situations

4.8.1 Equipment Malfunction

Any equipment malfunction discovered by staff during routine calibration/standardization activities or during an internal or external performance audit shall be recorded in the appropriate log chart and immediately reported to the program manager. The program manager is responsible for appraising the scope and seriousness of the problem and, if necessary, for determining whether the instrument should be repaired or replaced. The program manager also is responsible for ensuring that backup instrumentation is available for all critical field activities. Similarly, arrangements for a backup vehicle must be made in advance of any mechanical problems or mishaps that might render the primary vehicle inoperable of an extended period.

4.8.2 Sample Contamination

Blank concentrations outside the control limits established in section 2, paragraph (1), detract from the quality and credibility of the stream chemistry data and must be resolved in a timely manner. In instances where the source of the contamination is unknown, the program manager shall conduct an investigation to determine whether the problem is of likely field or laboratory origin. Field contamination problems may result, for example, from improper sample collection technique or exposure to contamination sources at the sampling site or within the vehicle used to transport the samples. Laboratory problems may include contaminated water supply or reagents, contaminated glassware, or some less conspicuous problem. Program staff must work closely with KHEL personnel to identify and eliminate contamination sources. Persistent problems may trigger a program audit by the section chief and/or bureau QA representative and ultimately may result in the removal of questionable data from the stream chemistry database.

4.8.3 Data Precision/Accuracy Problems

Should stream chemistry data fail to meet the precision and accuracy requirements of section 2, paragraph (1), the program manager must initiate an investigation to determine the cause of the problem. The program manager normally should work closely with KHEL to identify the cause and implement appropriate corrective measures. Persistent problems may trigger a program audit

by the section chief or bureau QA representative, result in the disqualification of a substantial amount of stream water quality data, or invoke other remedial measures (e.g., independent audit).

4.8.4 Staff Performance Problems

Should a member of the program staff have difficulty with a given work procedure (e.g., as determined by an internal performance audit), and effort must be made by the program manager to identify the scope and seriousness of the problem, to identify any data affected by the problem, and to recommend to the section chief an appropriate course of corrective action. All questionable data are either flagged within the computer database or, at the discretion of the section chief, deleted from the database. Possible corrective actions include, but are not necessarily limited to, further in-house or external training for the employee, a reassignment of work duties, or modification of the work procedure.

4.9 Data Management

The stream chemistry monitoring program routinely uses Oracle computer software to automatically perform 12 different QA/QC checks to generate data outlier/warning reports, water quality standards violation reports and summary statistics, and to graphically plot data for various combinations of sampling stations and regulated pollutants. Microsoft Visual Basic, Access, Excel, and PowerPoint are among the forms of software used to manage, share, and present the data. Environmental Systems Research Institute ArcGIS software enable the program staff to prepare maps and provide visual presentations of various environmental distributional coverages. Desktop statistical and analytical graphic software packages such as Minitab, R, and Systat SigmaPlot are used for performing statistical characterizations, comparisons, and trend analyses.

4.9.1 Data Check

All field- and laboratory-generated data are handled in an orderly and consistent manner (Table 4.9.1-1). Monitoring station identification number, index number, time and date of sample collection, sample chain-of-custody, and other basic information is recorded on standardized electronic sample submission forms (Appendix C). Upon the delivery of samples to the laboratory receiving area, these forms are visually scanned for transcription errors or spelling errors, missing information. Recorded dates and times are reviewed for accuracy and bottle numbers for proper codes and correct scanning sequence. After this review, two copies are printed and again inspected for accuracy by program personnel and saved to BOW jump drive. If any modifications, additions, or deletions are necessary, changes are completed electronically in the Excel file and re-saved. The Excel spreadsheet is then converted to a structured format to download to the HORIZON LIMS using Palm OS procedure (SOP No. SCMP-016). KHEL receiving staff convert the structured spreadsheet to a comma-delimited file and download to KHEL's HORIZON LIMS. The samples are logged and assigned lab numbers by station. An official LIMS Lab Receipt is generated, a hardcopy printed, and an electronic form saved to BOW jump drive. In the event of failure in the transmittal or saving of this electronic information, the hand-written field sheet

completed by staff during the sampling run serves as backup (Appendix C). Sampling staff and receiving laboratory personnel must sign and date both copies of the electronically generated form (or hand-written field sheet) in accordance with chain-of-custody procedures (SOP No. SCMP-006).

On a weekly basis, an Oracle stored procedure is manually initiated by the stream chemistry program manager (or designee) that executes code to create a view (a stored query in the database that can be executed when called) restricted by beginning and ending history date utilizing an external database link to HORIZON LIMS virtual tables (LIMS_DEM and LIMS_DAT) that are merged into a view (SC_INFIN) to that of the KWD format. The input table view (SC_INFIN) merges the demographic and analytic data by lab number and translates the LIMS analyte names to KWD Oracle analyte name format using a translation table (SC_CHEMPOS_1). This input view is then analyzed by an in-house outlier flagging program that generates an outlier/warning report on a station-by-station and parameter-by-parameter basis by automatically comparing new data to the historical database and flagging any new value that (a) exceeds the historical maximum value for the site in question, (b) extends more than 2.0 standard deviations beyond the historical mean concentration or (c) exceeds the established 95th percentile concentration. A second stage data warning system performs 12 different QA/QC checks to accept, qualify or reject data for inclusion in the Oracle KWD and, ultimately, the modern STORET database system. This mathematically intensive application incorporates algorithms for checking cation and anion balances, dissolved solids/specific conductance ratios, and elemental concentrations versus constituent concentrations (e.g., total phosphorus versus ortho-phosphate – P) (APHA 1998). Values that do not meet the data acceptance criteria set forth in Table 4.9.1-1 are flagged as warnings and appended to the outlier report. Additional constituent ratio calculations are also performed (e.g., sodium/chloride ratios, specific conductance/sulfate ratios). These checks reveal distinct physicochemical signatures for each water quality monitoring station and facilitate the identification of field and analytical mistakes resulting from the application of erroneous dilution factors, misinterpretation of laboratory analytical instrumentation, switching of field and/or laboratory sample bottles, collection of water from the wrong stream locations, and other factors. The report is manually checked for flags, and any documented problems are initially compared to field comments (relevant QC documentation) in the program's Excel spreadsheet sample collection tracking file. The State Hygienic Laboratory (SHL) provides an Excel spreadsheet of the analytical radiological data that is converted into the KWD's input table (SC_INFIN) format to enter the data electronically in batch. After undergoing appropriate QA/QC checks, the data is accepted, qualified, or rejected. If rejected, consultation with SHL is initiated and reanalysis of the environmental sample is performed if warranted. The Kansas Water Database is supported and backed-up daily to an external hard drive (for rolling back data within the last 30 days) by the KDHE Office of Information Technology (OIT).

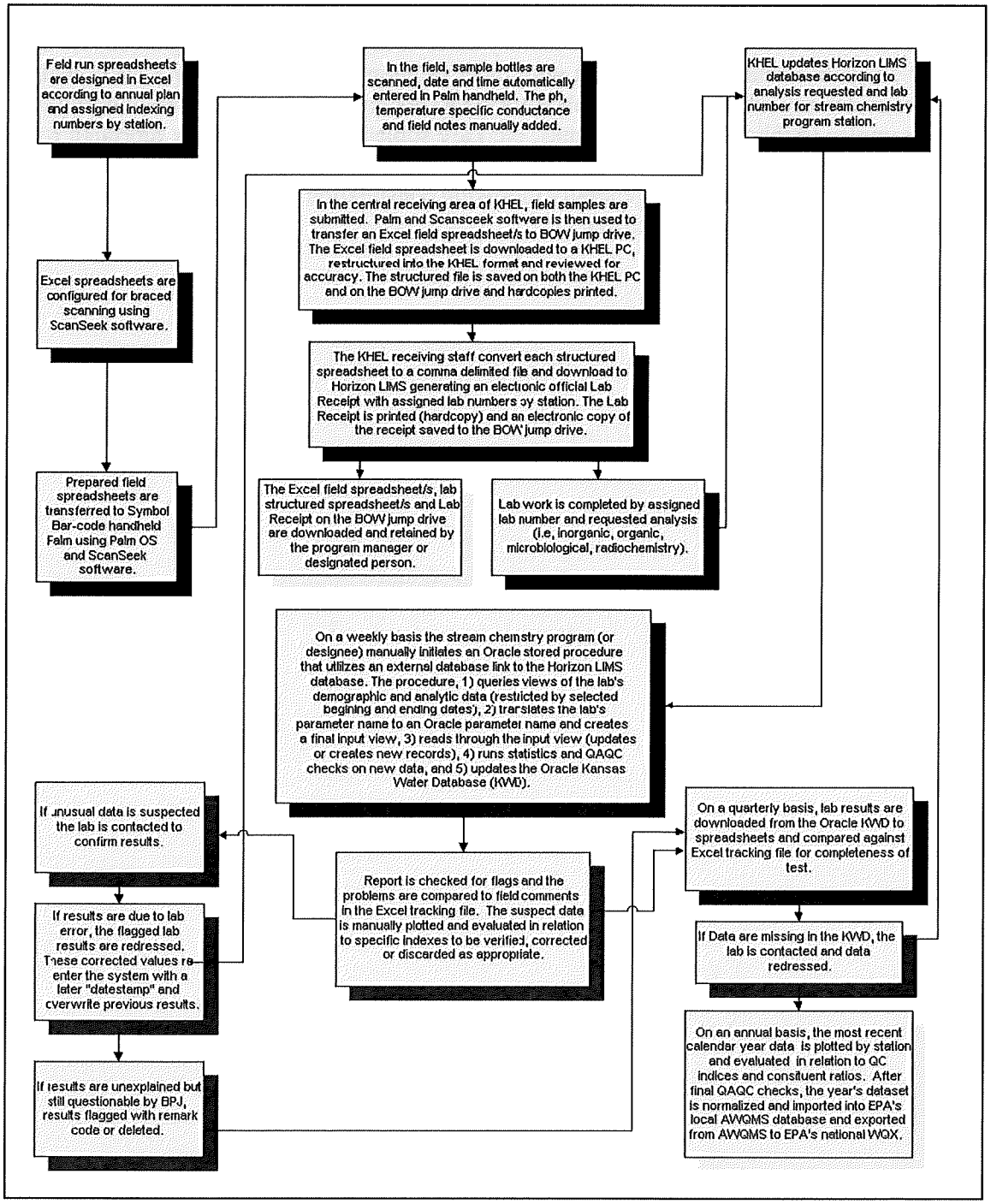
4.9.2 Data Acceptance Criteria

Once flagged, suspect data are evaluated by the program manager (usually in consultation with the data management) and verified, corrected or discarded, as appropriate. In addition, newly released

data may be electronically plotted and visually evaluated in relation to QC indices by the program manager and data management staff. If warranted, the lab is consulted to confirm the reported analytical results, or aid in verification, correction, or re-examination. If a laboratory error is discovered, the erroneous values in the KHEL database are replaced with the correct values and the amended data are released with a later history date. If results remain unexplained, the stream chemistry program manager may consult with other program personnel and/or KHEL analytical staff and consider any relevant (field or laboratory) QC documentation. Information derived from field QC samples (duplicates, spikes, blanks, etc.) are subjected to particularly thorough review. Data that are deemed inaccurate or grossly unrepresentative are purged from the electronic database by the program manager, generally following consultation with the section chief and data management staff (section 4.9.8, below).

TABLE 4.9.1-1

DATA MANAGEMENT FLOW CHART



On a weekly basis, the laboratory analytical analysis results view (SC_LIMS) is compared against the electronic field collection form view (SC_FLDFORMS) to construct the view (SC_COMPLETE) to assess and provide a summary of laboratory data completeness. The completeness check is predicated on the history date view (DEMO_HDATE) – the official date the analysis has been completed and released by laboratory. If laboratory data are missing in the view (SC_COMPLETE), KHEL is contacted to determine reporting status. On an annual basis, calendar year data (incorporated with period record data) are electronically plotted by station and visually evaluated in relation to QC indices and constituent ratios by the program manager and data management staff. After final QA/QC analyses are completed, the year's dataset is normalized and imported into a local EPA database called Ambient Water Quality Management System (AWQMS) and exported from AWQMS to EPA's Water Quality eXchange (WQX). Redundant forms of data storage and backup (e.g., KWD, AWQMS, WQX, and STORET) help to ensure the long-term integrity and availability of the program data.

TABLE 4.9.2-1

DATA ACCEPTANCE CRITERIA

Quality Control Analysis	**Acceptable Ratio or Result**
Calculated Total Dissolved Solids (TDS)/Lab TDS	0.98 – 1.02
Major Cation/Major Anion	0.90 – 1.10
Calculated TDS/Specific Conductance	0.50 – 0.85
Lab TDS/Calculated Specific Conductance	0.50 – 0.85
Measured DO/Percent DO Saturation	< 5 mg/L; > 130%
Ortho-PO_4^{3-} - P versus Total P	Total P $\geq$ ortho- PO_4^{3-} - P
Ammonia – N versus Kjeldahl N	Kjeldahl N $\geq$ Ammonia – N
Total Suspended Solids/Turbidity	Compare to historical station specific ratio ranges
Sodium/Chloride	Compare to historical station specific ratio ranges
Specific Conductance/Sulfate	Compare to historical station specific ratio ranges
Major Cation/Specific Conductance	Compare to historical station specific ratio ranges
Major Anion/Specific Conductance	Compare to historical station specific ratio ranges

4.9.3 Reporting Limits

The departmental laboratories frequently encounter parameter values or concentrations that are greater than or less than levels than can be reliably measured (i.e., measured within specified limits of precision and accuracy). Accordingly, the laboratories report both lower and/or upper quantitation limits depending on the analyte. These quantitation limits are used as method reporting limits (MRLs). If an analyte is not present in an amount that can be reliably quantified, its concentration is accorded a specific code and denoted as "censored" data.

4.9.4 Storing Censored Data

All censored stream chemistry parameter values are stored in the Kansas Water Database with remark codes. A less-than sign (<) under the analytical constituent name column (coded sign field) indicates an analyte either is not detected or detected at a concentration that is less than the method reporting limit (MRL). In addition, a greater-than sign (>) under the coded sign field indicates an analyte is at a concentration that is greater than the MRL. If the parameter concentration is reportable (i.e., greater than or equal to the MRL) the analytical result is recorded in the result field under the analytical constituent name column and the coded sign field is nulled to indicate the parameter is present at a quantifiable concentration.

4.9.5 Plotting and Data Transformations

Many forms of environmental data do not conform to a normal distribution and may necessitate the use of nonparametric statistical methods. Alternatively, the data may be transformed statistically to induce a normal or log normal distribution or some other preferred data distribution. In general, data are first graphed to reveal the general shape of the distribution and to help identify the most appropriate transformation procedure. Commercially available computer programs may be applied in more detailed assessments of data distribution. For example, Minitab software maintained on selected BOW desk top computers offers several algorithms for characterizing departure from normality (e.g., Ryan-Joiner and Kolomogorov-Smirnov tests).

4.9.6 Statistical Methods for Handling Censored versus Uncensored Data

Historically, statistical options for dealing with censored data have been rather limited. Nonparametric procedures based on rank-order or percentiles tend to be less influenced by these kinds of data and are often favored by staff performing statistical characterizations, comparisons and trend analyses. More recent strategies employed in the stream chemistry monitoring program are summarized in tables 4.9.6-1 and 4.9.6-2. These approaches are based on the recommendations of Helsel (2005, 2012).

4.9.7 Statistical Outliers

Essentially all environmental databases may contain a few anomalous values or statistical outliers. Obvious outliers (those that are orders of magnitude beyond any reasonable value) often constitute data transcription errors or other simple errors. In other instances, outliers may reflect the gross contamination of samples, analytical errors, or an actual (though rarely occurring) fluctuation in water quality. In the stream chemistry monitoring program, data are automatically questioned by staff if reported sequential duplicate concentrations vary by more than 20 percent or if a value is outside the historical range for the parameter and monitoring site in question. If follow-up consultations with field, laboratory, and data management personnel provide no reasonable explanation for a questionable value, the program manager may flag the value or delete the value from the database (section 4.9.1).

TABLE 4.9.6-1

STATISTICAL METHODS FOR HANDLING UNCENSORED AND CENSORED DATA

Methods for Uncensored Data Sets	**Methods for Censored Data Sets**
Computing Summary Statistics	
Descriptive Statistics	Kaplan-Meier, MLE, or ROS estimates
Comparing Two Groups	
t-test	Censored regression with 0/1 group indicators
Wilcoxon rank-sum test	Generalized Wilcoxon test
Paired t-test	Censored confidence intervals on differences
(paired) sign or signed-rank test	Paired Prentice-Wilcoxon or Akritas tests
Comparing Three or More Groups	
ANOVA	Censored regression with 0/1 group indicators
Kruskal-Wallis test	Generalized Wilcoxon test
Correlation	
Pearson's r	Likelihood r
Kendall's tau	Kendall's tau-b
Linear Regression	
Regression	Censored regression
Robust Regression	Logistic regression
Theil-Sen median line	Proportional hazards (Cox) regression
	Akritas-Theil-Sen median line

(Source: Helsel 2005, 2012)

TABLE 4.9.6-2

ESTIMATION OF SUMMARY STATISTICS FOR CENSORED DATA

Recommended Techniques for Interpretation of Data		
Percent Censored Data	**< 50 observations**	**> 50 observations**
< 50% nondetects	Kaplan-Meier	Kaplan-Meier
50 – 80% nondetects	Robust Maximum-Likelihood Estimation (MLE) or Robust Regression on Order Statistics (ROS)	Maximum-Likelihood Estimation (MLE)
> 80% nondetects	report only % above a meaningful threshold	may report high sample percentiles (90th, 95th)

(Source: Helsel 2005, 2012)

4.9.8 Verification of Calculations

Computer-based mathematical, statistical, graphical and geographical programs and models involving environmental data are tested before application by comparison to other computer programs, through hand calculations involving randomly selected data, or through other appropriate means. The reliability of these models and programs is reexamined on at least an annual basis or whenever a problem is reported within a computational system.

4.9.9 Ancillary Data

Ancillary data used in this program may include hydrological, meteorological, or biological data derived from other state and federal agencies. An effort is made to ensure that these agencies have appropriate QA program plans (QAPPs) in place. In some instances, these agencies collect data under contract to KDHE, or under the auspices of an EPA grant, both of which require development and approval of a QAPP prior to data collection (see QMP, Part I, section 2.3). Pollutant loading coeffients and some other values applied in modeling calculations are taken from documents produced by governmental agencies or from literature sources incorporating peer review of articles before publication. Program staff carefully examine the underlying technical assumptions before applying these coefficients and values.

4.10 Quality Assurance Reporting Procedures

End-of-year program evaluations are compiled by the program manager, and a written report is submitted to the bureau QA representative, bureau director, and divisional QA office by March 15 of the following year. The program manager cooperates in this evaluation and, at the request of the section chief, provides all records gathered during the evaluation period on the precision, accuracy, representativeness and comparability of the monitoring data. Program evaluations submitted by the section chief indicate when, how, and by whom the evaluation was conducted,

the specific aspects of the program subjected to review, a summary of significant findings, and technical recommendations for necessary corrective actions. The section chief discusses the reported findings with the program manager and other program staff.

4.11 Purchased Equipment and Supplies

When newly ordered or recently repaired sampling, analytical or computational equipment is delivered to the program office, the program manager (or designee) compared the item to that requested on the original order, then inspects the equipment to ensure no breakage has occurred in transit and all components function properly. Once this inspection is completed, the manager (or designee) either accepts or rejects the shipment. Office and laboratory supplies receive a comparable level of scrutiny. Reference standards and equipment must be accompanied by a certificate from the vendor or manufacturer verifying the quality of these products.

4.12 Program Deliverables

Program deliverables include electronic databases, illustrative materials, statistical water quality summaries, and detailed written reports used in a variety of agency applications. Staff of the stream chemistry monitoring program play a major role in the development of the Kansas biennial water quality assessment (305(b) report) and the Kansas list of water quality limited surface waters (303(d) list). As resources and circumstances allow, customized data retrievals are prepared by the program manager on behalf of administrative staff, legislative officials, other state and federal agencies, regulated entities, special interest groups, consultants, academicians, students, and members of the general public.

Section 5

REVIEW AND REVISION OF PLAN

5.1 Quality Management Plan Review and Revision

To ensure that the stream chemistry monitoring program continues to meet the evolving informational needs of the bureau and the agency, all portions of this QA management plan and its appended SOPs must be comprehensively reviewed by participating staff on at least an annual basis.

Revisions to the plan and SOPs require the approval of the program manager, section chief and bureau QA representative prior to implementation. Although review and revision activities normally follow the annual program evaluation in February, these activities may be implemented at any time based on urgency of need or staff workload considerations.

Original approved versions of the QA management plan and SOPs, and all historical versions of these documents, are maintained by the bureau QA representative or his/her designee. The bureau QA representative also maintains an updated electronic version of the plan and SOPs on the KDHE internet server in a "read only" pdf format.

APPENDIX A

FIELD EQUIPMENT AND SUPPLY CHECKLIST

FIELD EQUIPMENT AND SUPPLY CHECKLIST

I. VEHICLES

A. Primary sampling vehicle (three-quarter ton van with 11.25 foot wheel base load rang D tires, sliding/latching side door, double back door, cargo safety screen, roof-mounted hazard lights)

Alternate rental vehicles and district vehicles (various models, attributes and accessories, depending on availability)

B. Vehicle registration and proof of insurance

C. Vehicle log book (list of emergency phone numbers, Wright Express card, copy of tire, battery, emergency services contract)

D. Vehicle key and spare key(s), KTAG pass, CSOB parking garage door opener

E. Garmin Nuvi 2450 LM global positioning system (GPS) with soft carrying case

F. Mobile cellular telephone, instructions

G. Fluorescent orange or yellow safety vests with reflective strips, orange or yellow rain coats or ponchos with reflective strips

H. Fire extinguisher, first aid kit, CPR mouthpieces, latex rubber gloves, sunscreen, paper and cloth towels, hand sanitizing solution in plastic squeeze bottle, safety glasses, portable eyewash station, automated external defibrillator (AED)

I. Full-size spare tire (fully inflated), tire changing equipment, road reflectors and/or flares

J. Tool kit, jumper cables, tow rope, windshield ice scrapers, flashlights (fully operable).

II. OTHER FIELD EQUIPMENT AND SUPPLIES

A. Weighted stainless-steel sampling bucket (1 gal)

B. Stainless-steel pail (1 gal)

C. Stainless-steel funnel

D. Stainless-steel crucible tongs

E. Concrete-weighted ice breaker

F. Ropes, static nylon fiber, 75-ft length and 55-ft length with snap swivels on both ends and a 25-ft used when collecting water quality samples in streams known to contain live zebra mussels (*Dreissena polymorpha*)

G. Ice chests (100-qt capacity) containing bags of crushed ice

H. Wooden flats for sample container transport

I. Plastic tub for sample handling and transport

J. Sample containers with barcode labels (including two or more sets of spare containers). Note: each barcode label has a two-letter code at the end of the four digit number to insure the correct scanning of bottles (i.e., cube "CM," total organic carbon "TC," trace metal "HM," dissolved oxygen "DO," nutrient "NT," bacteria "BC," pesticide "OC," rad health "RD," and tritium "TT").

K. Glass beakers (50-ml)

L. Polyethylene disposable gloves

M. Glass distilled water (in squeeze bottles and cubitainers)

N. Clipboard (with maps, field sheets, etc.), pencils, pens, markers and labeling tape

O. Digital camera, with digital diskette, carrying case, instructions

P. Symbol SPT 1800 Palm OS handheld computer

III. FIELD MEASUREMENT APPARATUS

A. Thales Mobile Mapper CE GPS and carrying case

B. Fisher model 15-077B stainless-dial scale thermometer (-10 to +110 °C)

C. ICM model #5996-70 field pH meter (analog readout with instruction manual, carrying case, a spare backup pH meter, combination pH probe (and spare backup), reserve batteries, and pH 4, 7 and 10 buffer solutions)

D. Fisher Scientific Company model 09-328 conductivity meter (with instruction manual, carry case, a spare backup conductivity meter, probe (and spare backup) and a reserve 9 volt battery, and 1408 μmhos/cm standard solution).

E. Winkler dissolved oxygen kit (with reagents "1, 2, 3" in 250-ml Nalgene safety squeeze bottles, transported in sealed plastic container with removable lid; see Appendix B)

APPENDIX B

STANDARD OPERATING PROCEDURES

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GLOBAL POSITIONING SYSTEM (GPS) PROCEDURES FOR DETERMINATION OF GEOGRAPHICAL LOCATION OF STREAM CHEMISTRY MONITORING STATIONS (SCMP-001)

I. INTRODUCTION

A. Purpose

Accurate documentation of geographical position (longitude and latitude) reduces the risk of obtaining samples from the wrong monitoring site and facilitates the analysis of monitoring data through geographical information system (GIS) techniques. The location of all monitoring sites included in the KDHE stream chemistry monitoring network must be precisely documented using GPS procedures.

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental specialist published by the Kansas Department of Administration. They also should be experienced in the use of GPS equipment and possess a basic understanding of the underlying technology.

C. Equipment/Accessories

1. Carry bag or case
2. Thales Mobile Mapper CE GPS receiver
3. External antenna
4. Power/data cable
5. PC cable with cigarette lighter adapter
6. Serial-to-Universal Serial Buses (USB) cable
7. Battery charger

D. Vehicle GPS Unit

1. Garmin Nuvi 2450 LM with soft carrying case
2. Window suction cup mount and car charger
3. USB cable

II. PROCEDURES

A. Equipment Set-Up and Operation

Procedures described in the Thales Mobile Mapper CE standard operating procedure, which may be viewed on the KDHE intranet server (GeoSpatial Services), are adopted by reference.

B. Equipment Take-Down and Post Processing Data

Procedures described in the Thales Mobile Mapper CE standard operating procedure, which may be viewed on the KDHE intranet server (GeoSpatial Services), are adopted by reference.

C. Locate and assign monitoring stations for network run in Garmin Mapsource

1. Launch Mapsource, with a Kansas basemap that has been previously loaded.

2. Select **Edit**, **New Waypoint...** from the menu bar. When the "Waypoint Properties" dialog box appears, click in the "Name" box, name the site (e.g., SC203). Click the "Symbol" box, select a symbol for each program (e.g., *City Medium* green circle symbol for stream program) from a number of symbol choices provided in the drop box. Click in the "Position" box, correct the longitude and latitude using the geographical position information gathered in GPS location procedures for each monitoring station. Click on the "Unknown" box to remove the default check mark on the "Proximity" line. Click in the "Proximity" box and assign a value of 0.5. Click on the "Comment" box, and enter the water body name (e.g., Kansas River at Kansas City, Kansas) with approximate location to the nearest incorporated town or unincorporated community. Click the *Show On Map* button. Click *OK* button.

3. Repeat Step 2 for each monitoring station to be visited on scheduled network run. Save the *Waypoints* by selecting **File**, **Save as** and name file (e.g., Kansas-East Run) and exit application.

D. Plan route (network run) in Garmin Mapsource

1. Launch the saved Mapsource file containing the assigned waypoints (monitoring sites) for a network run (e.g., Kansas-East Run).

2. Select **Route Tool...** from the menu bar. On the basemap, click on the location the network run will begin (e.g., Curtis State Office Building, Topeka, Kansas) and navigate the "Route Tool" pointer to the first monitoring station and click on the site symbol.

3. Repeat Step 2 for each monitoring station, methodically moving from station to station that will be tentatively visited that day. As each station is added to the route, a colored (e.g., magenta) line is drawn between stations highlighting the chosen route. End the day's route at a designated overnight stay motel or KHEL. Right click on the mouse, select "Cancel" to end route setup.

4. Click on arrow on the upper left corner of the basemap to access the "User Data Tabs". When the "User Data Tabs" dialog box appears, select the "Routes" tab. Double-click on the default name under the Name column. When the "Route Properties" dialog box appears, uncheck the *autoname* box. Click in the *Name* box and re-name the route "Day 1".

5. Repeat Steps 2 through 4 to add additional days ("Day 2', "Day 3") to network run.

6. Review all drawn routes. If necessary, re-arrange a route using additional via-points to optimize the most efficient rout (i.e., best roads) to complete all the station visits designated for that day. Once accepted, save the route by selecting **File**, **Save as** and name file (e.g., Kansas-East Run).

E. <u>Download routes with via-points to automotive Garmin GPS unit</u>

1. Start the Mapsource application. Navigate to the Mapsource network run files saved on computer. Open the desired network run. Plug GPS unit into a personal computer using a USB cable (GPS unit will automatically turn on).

2. Select **Transfer**, **Send To Device...** from the menu bar. A "Send To Device" dialog box will appear that should automatically identify the GPS unit attached. If the application fails to automatically indentify the attached unit, click on the "Find Device" button under the *Device settings* column to search for the attached unit's electronic identification. Once recognized, the device's model and unit ID should be visible in the "Device" box.

3. Under the *What To Send* column, ensure only the "Waypoints" and "Routes" boxes are checked for transfer. Click on the "Send" button. After the "Transfer Complete" dialog box appears indicating the data was successfully sent, click on the "OK" button.

F. Navigation in a vehicle using Garmin GPS unit

1. Hold down the power button to turn on the GPS unit; always turn on the GPS unit while the vehicle is stationary. When the Garmin GPS user agreement comes up, press the "Agree" button displayed on screen indicating the user will abide by Garmin's GPS unit agreement use.

2. In the main menu screen, two options are displayed on screen, "Where To?" and "View Map." Tap the "Where To?" icon displayed on screen.

3. The GPS will display a number of navigation options. Tap the arrow buttons (up and down) on the left hand side of screen to view all available options. Tap the "Trip Planner" icon when actively displayed on screen.

4. The GPS will display a list of the saved routes (network runs) that have been successfully loaded and available.

5. Select the desired network run (e.g., Southeast –West Day 1). A summary of the monitoring stations and via-points will be displayed on screen. If desired, tap the arrow buttons (up and down) on the left hand side of screen to view all available. Tap the "Go!" button.

6. The GPS unit will display the monitoring stations in the order they were scheduled to be visited that day. By default, the first scheduled station to be visited is marked by with a blue circle. Likewise, any of the listed monitoring station or via-point can be randomly selected from the list by using the arrow buttons (up and down) on the left hand side displayed on the GPS unit's screen. Tap the button "Start" to begin the trip.

7. Follow the directions as displayed on the GPS unit. Note: At any travel point along the fixed route and while the vehicle is parked, a new destination (i.e., monitoring station or via-point) can be randomly selected by tapping the current destination icon on the top of screen. When the available stations and via-points are

displayed, use the arrow buttons (up and down) on left hand of screen to select an updated destination. Tap the "Go!" button to begin the re-route and follow directions as displayed on the GPS unit.

G. Updating the lifetime maps application for Garmin GPS unit

1. Plug GPS unit into a personal computer using a USB cable (GPS unit will automatically turn on).

2. The preloaded Garmin Express Software application will activate on the personal computer and check for software or map device updates.

3. Follow on-screen prompts to select an update or click the "update all" option to download and install all updates.

4. To install, check box to accept the terms and conditions statement and select "Next."

5. Once the download and install process is completed, a message "All updates successfully completed" will appear.

VEHICLE SAFETY AND MAINTENANCE PROCEDURES (SCMP-002)

I. INTRODUCTION

A. PURPOSE

The following text outlines vehicle safety and maintenance procedures used during the collection and transport of stream chemistry samples. Safety procedures are established to prevent or minimize property damage, personal injuries, and/or loss of life. Maintenance procedures are established to prevent to minimize vehicle breakdowns and to extend the usable life of the vehicle. Accidents and mechanical failures are costly and result in loss of productivity.

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental specialist published by the Kansas Department of Administration. They also should possess a valid Kansas driver's license and current certifications in standard first aid, cardiopulmonary resuscitation (CPR), and use of automated external defibrillators (AEDs). Although not required, these employees are strongly encouraged to participate in defensive driving courses offered by some law enforcement agencies and other qualified organizations.

C. Equipment/Accessories

Van, three-quarter ton, with 11.25-foot wheel base, load range D tires sliding/latching side door, double back door, cargo safety screen, mounted emergency flashing lights, portable emergency road reflectors or road flares, fire extinguisher, spare tire, tire changing equipment, jumper cables, tow rope, tool kit, first aid kit, disposable latex gloves, disposable CPR mouthpieces, safety glasses, emergency eye wash station, flashlight, windshield ice scraper, cellular phone with magnetic mountable antenna, AM/FM radio, and all other equipment indicated in Appendix A. (Note: any other vehicle driven by program staff or district office staff while engaged in stream monitoring operations should include comparable safety equipment and accessories, with the exception of the cargo screen, sliding and double doors, and roof-mounted hazard lights which are installed only on the primary sampling van.)

II. PROCEDURES

A. Vehicle Safety Procedures

1. The following conditions and safety precautions must be met and observed while operating motor vehicles in association with stream monitoring operations:

   a. Vehicle operators must possess a valid Kansas driver's license.

   b. Drivers will abide by all applicable regulations for operation of motor vehicles.

   c. SEAT BELTS MUST BE WORN AT ALL TIMES WHILE OPERATING OR RIDING IN MOTOR VEHICLES

   d. Drivers must observe posted speed limits. Upon encountering slippery road conditions, high winds, reduced visibility, road construction, heavy traffic, slower traffic (e.g., farm or construction vehicles, bicycles, pedestrians, saddle horses, horse drawn carriages, trucks with oversized loads, military convoys, etc.) or other conditions warranting greater caution, drivers shall slow to a reasonable and prudent speed.

   e. Drivers want to avoid tailgating or "drafting" and observe proper driving intervals behind the vehicle ahead.

   f. Drivers must pass other vehicles only when and where the safety and legality of passing is not in doubt.

   g. Electrical turn signals or, in emergencies, proper hand signals want to be used when operating vehicles.

   h. Drivers must become familiar with vehicle manufacturer's operating instructions and drive vehicle accordingly.

   i. Drivers will not use cell phone (including text messaging) while driving. When receiving incoming cell calls or text messages, drivers are to delay answering (or allow to go to voice message) or responding to text message until the vehicle can safely be parked on the shoulder of the road (or if no shoulder exists the nearest safe parking location).

2. Vehicles must be checked for any apparent safety problems before and after each sampling trip. Vehicles with potentially serious operational defects will not be used for sampling events. Concerns about vehicle safety must be directed immediately to the program manager or higher level supervisor.

3. Vehicles must not be operated when the driver has been on the job for more than ten hours or when the driver is exhausted, ill, or taking medications or drugs that may cause drowsiness or impair sensory functions, reflexes or reasoning. Smoking in vehicle is strictly prohibited.

4. Except for the cargo safety screen and roof-mounted hazard lights, which are installed only on the primary sampling van, safety equipment indicated in paragraph I.C, above, must be maintained in all agency vehicles used for stream chemistry monitoring operations.

5. Sampling vehicles will not be parked in any location or in any manner that may create a traffic hazard or impede the flow of traffic. Parking or stopping of sampling vehicles on bridges is strictly prohibited.

6. When obtaining samples or performing related reconnaissance activities, park on the shoulder of the road within walking distance of the bridge (or as far to the side of the road as practicable if not shoulder exists). In urban and other heavily congested areas, a nearby parking lot generally offers the safest parking alternative.

7. Upon approaching a stream that is scheduled for sampling or reconnaissance activities, engage the roof-mounted hazard lights on the sampling van (or the emergency flashers on alternate vehicles and district vehicles). After parking near the bridge, check to make sure the hazard lights (or flashers) are engaged prior to leaving the parked vehicle. Look for traffic in the side-view mirror, then look for traffic over the shoulder, before carefully opening the door and exiting the vehicle.

8. Additional driver information such as "rules of the road", general safety tips, and weather related precautions, can be found in the "Kansas Driving Handbook" prepared by the Kansas Department of Revenue, Division of Vehicles, viewable at the following website: www.ksrevenue.org/pdf/dlhb.pdf.

B. Vehicle Maintenance Procedures

1. The sampling vehicle shall be scheduled for normal service maintenance every 5,000 miles. Routine maintenance is performed by a designated maintenance provider and typically includes changing of oil and oil filter, lubrication of chassis and suspension, checking of fluid levels/antifreeze strength, and inspection of belts, hoses, tires, shocks and/or struts, brakes, air conditioner, heater, dash and exterior lights, windshield wiper, and exhaust system. Other repairs are performed as needed.

2. Other routine maintenance occurs at specific mileage limits, such as rotation of tires (10,000), air filter check/replacement, wheel bearing assessment, and "wheels off" brake inspection (20,000), engine belt check/replacement and fuel filter replacement (50,000), tune-ups, etc. (100,000), or can be performed according to the vehicle manufacturer's recommendations or when warranted. This information may be obtained either in the vehicle owner's manual or by contacting the designated maintenance provider.

3. For emergency repairs, unscheduled maintenance, or towing of vehicles, field staff must attempt to contact the program manager, section chief or bureau director for guidance. In the event field staff are unable to contact the appropriate parties and circumstances dictate an immediate resolution, staff may elect to cover expenses out of pocket with expectation of being reimbursed at a later time by the agency. If immediate assistance is needed after normal business hours, field staff also can contact the KDHE Emergency Spill Response Reporting Number (785 296-1679), active 24 hours a day, seven days a week. Operators taking such calls can help track down higher-level departmental personnel or otherwise contact the requested parties on behalf of field staff.

4. The purchase of tires is covered under State contract. A copy of the current contract will be attached to the vehicle log clipboard.

5. An adequate supply of fuel must be maintained in the gas tank at all times. Fuel can only be purchased with the Wright Express card at Wright Express locations. A current Wright Express directory shall be attached to the vehicles clipboard. When purchasing gasoline, confirm that the vendor is an approved Wright Express vendor prior to pumping fuel. During the refueling process, clean the windshield if necessary. Check the engine oil level and visually inspect the tires at least once every two weeks, or every 500 miles, whichever comes first.

Steps required to purchase fuel:

(a) Use the assigned card that displays the vehicle identifier on the lower left hand side. Enter the sex-digit driver identification number and current odometer reading on the electronic keypad, either at the pump or inside the station.

(b) After fueling, obtain a printed electronic receipt and document transaction on vehicle travel log.

6. The vehicle log must be updated each time the vehicle is utilized by entering the appropriate date, operator's name, mileage, and destination. All vehicle purchases and/or repair costs must also be reported in the vehicle log. The vehicle logs and accompanying receipts shall be turned over to assigned clerical staff and forwarded to the KDHE Business Office on a monthly basis.

CALIBRATION AND MAINTENANCE PROCEDURES FOR FIELD ANALYTICAL EQUIPMENT (SCMP-003)

I. INTRODUCTION

A. Purpose

The following text establishes standard procedures for the proper care, calibration, and maintenance of pH meters, specific conductivity meters, and thermometers.

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental specialist published by the Kansas Department of Administration. They also should be experienced in the measurement of the chemical and physical properties of surface water and have a basic technical understanding of the associated measurement apparatus.

C. pH Meter Specifications

Manufacturer:	ICM
Instrument type:	Field Analog pH Meter
Model number:	5996-70
Range:	0 to 14 pH Units
Resolution:	0.1 pH Units

D. Conductivity Meter Specifications

Manufacturer:	Fisher Scientific Company
Instrument type:	Traceable Expanded Range Conductivity Meter
Model number:	15-077-977
Range selection:	0-200,000 μS
Resolution:	1% of full scale +1 digit

E. Thermometer Specifications

Manufacturer:	Fisher
Instrument type:	Dial scale thermometer
Model number:	15-077B
Range:	-10 to 110 degrees Celsius (°C)
Resolution:	1°C

II. PROCEDURES

A. pH Meter

The field pH instrument features battery operation, two point standardization, and manual temperature compensation. It is used in conjunction with a combination glass/calomel reference pH electrode. When properly calibrated, standardized, and compensated with respect to temperature, it provides an accurate analog readout of sample pH, defined as the negative logarithm of the hydrogen ion activity in moles per liter. In most surface water samples and other dilute solutions, hydrogen ion activity is essentially identical to hydrogen ion concentration.

1. pH Meter Calibration and Standardization

a. Meter is factory calibrated but may require zeroing of readout needle. Check needle position with meter turned off. If needle does not read zero, then use mechanical zero screw to adjust needle to zero.

b. Connect pH electrode to instrument, remove electrode cap and liberally rinse electrode tip and barrel with demineralized water from squeeze bottle.

c. Immerse electrode in pH 7 buffer solution and turn meter on. Stir electrode gently while adjusting **SET** control for a reading of 7.0. Allow reading to stabilize before proceeding to next step.

d. Rinse the electrode thoroughly in demineralized water, and gently shake off excess water.

e. Immerse electrode in either pH 4 or pH 10 buffer solution such that standardization brackets the expected pH range of sample.

f. Allow a few seconds for the reading to stabilize, then adjust **SLOPE** control for a pH reading of 4.0 or 10.0 (depending on buffer used).

g. Rinse the electrode in demineralized water, and shake off excess water.

h. Meter is now calibrated, standardized, and ready to use.

2. pH Meter Inspection and Maintenance

   a. Proper calibration of instrument must be confirmed prior to each field trip. If meter is malfunctioning, a backup meter must be used pending repair or replacement of original meter.

   b. Routine maintenance includes periodic electrode and battery replacement. At a minimum, batteries and electrodes must be replaced annually. All maintenance checks and electrode/battery replacements must be noted on instrument log chart located on the inside of lid of meter.

   c. If electrode becomes dirty or if a crust develops, rinse thoroughly with demineralized water or stir electrode in water and detergent solution. **DO NOT** abrade electrode by wiping or cleaning with cloths or paper towels. For protein layers, wash electrode tip with pepsin or 0.1N HCL; for inorganic deposits, wash with EDTA or acids; and for grease or similar films, wash with acetone, methanol or diethyl ether in an appropriately ventilated area well removed from any open flame.

   d. Record all operational problems, routine maintenance actions, and instrument repairs in instrument log chart located on the inside of lid of meter.

B. Conductivity Meter

The portable specific conductivity meter is a battery operated instrument used to directly measure conductivity in μmho/cm. The probe contains an internal thermistor, and the meter automatically compensated for temperature variation among samples. The meter operates three ranges selectable with a front panel switch.

1. Conductivity Meter Calibration and Standardization

   a. Replace meter batteries if meter reads **LO BAT**, provides erratic reading, or fails to produce any digit display.

   b. At beginning of each day, place probe in fresh reference standard (1,408μmhos/cm).

   c. After given a few minutes to allow the meter to warm up, the meter should read 1,408 μmhos/cm. If not, hold "CAL/ESC" button until

reading starts blinking. Use the up and down arrows to adjust reading to 1,408μmhos/cm. Press the "enter" button to save calibration settings.

d. Using plastic squeeze bottle filled with demineralized water, rinse electrode tip and barrel thoroughly after completing calibration process. Immerse electrode bulb and lower portion of barrel in 50-ml beaker of demineralized water between sample measurements (e.g., during travel between sampling stations).

2. Conductivity Meter Inspection and Maintenance

a. The conductivity meter must be thoroughly inspected and calibrated at the beginning of each day to ensure proper operation. If meter is malfunctioning, a backup meter must be used pending repair or replacement of instrument.

b. Record all operational problems, routine maintenance actions, and instrument repairs in the instrument log chart located on the inside of lid of pH meter.

c. Routine maintenance may include probe or battery replacement. All maintenance checks are recorded.

C. Thermometer

The Fisher model stainless-steel dial scale thermometer is an easy to use, portable, manual, direct read instrument. It measures temperature in degrees Celsius within the range –10 to 110 degrees.

1. Thermometer calibration is accomplished by comparing instrument to an NIST-traceable reference thermometer on a yearly basis. If adjustment is required, carefully turn adjusting nut located on back of dial until correction is completed.

2. Procedures for thermometer maintenance include a thorough inspection at each new calendar year to ensure instrument is properly calibrated and operating within manufacturer's specifications. If instrument is malfunctioning and/or cannot be calibrated, it must be replaced. If probe becomes dirty or if a crust develops, rinse it thoroughly with demineralized water or mild detergent solution.

PROCEDURES FOR FIELD ANALYTICAL MEASUREMENTS (SCMP-004)

I. INTRODUCTION

A. Purpose

The following text establishes standard procedures for the measurement of stream pH, conductivity, and temperature.

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental associate published by the Kansas Department of Administration. They also should be experienced in the measurement of the chemical and physical properties of surface water and have a basic technical understanding of the associated measurement apparatus.

C. Equipment/Accessories

1. ICM model 5996-70 field analog pH meter (with instruction manual, carrying case, a spare backup pH meter pH probe and AA batteries, and pH 4, 7, and 10 buffer solutions).

2. Fisher Scientific traceable expanded range model 15-077-977 conductivity meter (with instruction manual, carry case, a spare backup conductivity meter, probe and 4 AAA batteries, and 1408 μmhos/cm standard solution).

3. Fisher Scientific Company model 15-0778 stainless steel dial scale thermometer (with a spare backup thermometer in case of loss or failure).

II. PROCEDURES

A. pH Meter

1. Immerse electrode in 50-ml beaker containing the stream water sample. Set temperature knob to sample temperature (measured with Fisher model 15-077B stainless-steel dial scale thermometer; see below). Gently stir electrode, and allow time for pH reading to stabilize.

This procedure, first adopted in 1995, had been incorporated into SCMP-003 in 2000. With the addition of the specific conductance measurement, the field measurement procedures have been moved back to their original designation "SCMP-004" SOP.

2. After stabilization, read the analog display for sample pH. Record indicated pH value on handheld computer and field data sheet.

3. Using plastic squeeze bottle filled with demineralized water, rinse electrode tip and barrel thoroughly. Immerse electrode bulb and lower portion of barrel in 50-ml beaker of demineralized water between sample measurements (e.g., during travel between sampling stations).

NOTE: If the accuracy of a measured pH value is in doubt, place the electrode in pH 7.0 buffer to check instrument operation. If standardization is necessary, repeat step 1 (a-h) SCMP-003. After instrument is recalibrated and deemed to be operating properly, collect and additional fresh sample using the stainless-steel pail and repeat steps (1-3), above, to confirm or correct the previous pH reading. **ADDITIONALLY, t**hese steps should be repeated at beginning of each day of sampling run. Measure pH 7.0 buffer at intervals during day as additional safeguard. If zeroing and standardization are necessary, also repeat steps 1-3 above.

B. Conductivity Meter

1. Plug probe to connector on bottom of meter housing. Press "set/esc" button to power on meter. Meter will automatically power down after 20 minutes of being idle.

2. Immerse conductivity probe in 50-ml beaker containing the stream water sample. Dip probe up and down a few times and gently stir to remove air bubbles from tip.

3. After meter number display stabilizes (indicated by "ready" on left side of screen) record conductivity values on the handheld computer and field data sheet.

4. Thoroughly rinse probe and immerse electrode bulb and lower portion of barrel in 50-ml beaker of demineralized water between sample measurements (e.g., during travel between sampling stations).

5. Turn meter off after use or meter will automatically turn off after 20 minutes of being idle. After thoroughly rinsing probe in demineralized water, allow probe to dry in empty 50-ml beaker between sampling activities.

NOTE: If the accuracy of a measured specific conductance value is in doubt, place the probe in reference standard to check instrument operation. If standardization is necessary, repeat step 1 (a-d) SCMP-003. After instrument is recalibrated and deemed to be operating properly, collect and additional fresh sample using the stainless-steel sampling equipment and repeat steps 2-6, above, to confirm or correct the previous specific conductance reading.

C. Temperature

1. Immerse thermometer probe in 50-ml beaker containing the stream sample. When measuring temperature of sample, immerse at least a couple of inches of thermometer probe into sample. Avoid touching probe just prior to and during measurement. Read temperature to nearest one degree by observing indicator on dial. Do not use the thermometer to measure substances colder than –10°C or hotter than 110 °C.

2. Record the temperature values on the handheld computer and field data sheet. Store in designated holder between sample measurements (e.g., during travel between sample stations).

PROCEDURES FOR COLLECTING, PRESERVING AND TRANSPORTING STREAM WATER SAMPLES (SCMP-005)

I. INTRODUCTION

A. Purpose

The following text outlines the proper procedures for the collection, preservation and transport of stream water samples.

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental specialist published by the Kansas Department of Administration. They also should be experienced in the measurement of the physicochemical and microbiological properties of surface water and in the performance of environmental field investigations.

C. Field Equipment and Supply Checklist

See Appendix A.

II. PROCEDURES

A. Safety Requirements and Protocols

1. All program personnel must read SCMP-002, Vehicle Safety and Maintenance Procedures, before engaging in stream sampling or reconnaissance operations. Procedures and requirements indicated in SCMP-002 must be strictly observed by program personnel.

2. Personnel collecting a sample or performing reconnaissance shall be alert to traffic conditions and exercise caution when walking between sampling vehicle and bridge and when working from bridge. Fluorescent orange or yellow safety vests (or jackets) with reflective strips, or orange or yellow rain coats (or ponchos), shall be worn by all sampling personnel upon exiting sampling vehicle.

3. Sample collectors must apply caution when leaning over bridge railings to lower or retrieve sampling buckets/pails or other equipment. Added caution must be applied when sampling from slippery or icy bridge surfaces.

4. Sampling and reconnaissance operations shall not be attempted if rising water, flooding, inclement weather, bridge or road damage or repairs, or other conditions preclude performance of duties in a safe manner.

5. If thick ice formation, shallow water or other conditions preclude collection of samples from bridge, sampling personnel may attempt to access stream from bank, within road public right-of-way, **provided this can be done without undue risk of personal injury or harm**. Staff shall not walk or drive on frozen streams during sampling or reconnaissance operations.

6. Suitable hand and eye protection are encouraged to be used when preserving samples with acids or other chemical reagents or when handling samples that are obviously contaminated with sewage effluent, livestock waste, or other potentially hazardous or infective materials. Staff shall avoid handling containers with acids or other reagents when sampling vehicle is in motion.

7. Field equipment and supplies, including ice chests, sample containers and containers bearing acids or other chemical reagents, shall be safely stored and secured during transport. Plastic bottles containing acids or other chemical reagents shall be capped and placed in covered plastic storage container when not in use.

B. Collection and Preservation of Stream Water Samples

1. At each monitoring site, stream water samples are obtained from bridge using a rope and weighted stainless-steel bucket or stainless-steel pail. Each sample is collected from downstream side of bridge and from apparent thalweg (deepest appearing point in stream channel cross-section; see glossary), unless woody debris or other obstructions or safety conditions dictate otherwise. The thalweg generally is associated with main flow or main braid of stream.

2. The weighted stainless-steel bucket normally is used to obtain the following sample fractions: physicochemical (total suspended solids, major anions, specific conductance, total dissolved solids), total organic carbon, trace metal (various trace metals and metalloids), dissolved oxygen, nutrients (Kjeldahl nitrogen, total ammonia, total phosphorus), *E. coli* bacteria, pH and temperature, and the tritium samples. The stainless-steel pail is used for pesticide samples (selected pesticides, pesticide degradation products, PCBs), radiological samples and, if necessary, volatile organic compound (VOC) samples.

3. If stream is too shallow for using weighted stainless-steel bucket, then stainless-steel pail is used for all samples. If sample collector cannot retrieve a representative sample from bridge, using either bucket or pail, he/she may sample stream from stream bank subject to restrictions of procedures II.A.5, above. The precise location of sampling point, and the sampling procedures actually used by employee, are recorded on the handheld computer and the field data recording sheet (Appendix C). The back of this sheet may be used to sketch location of sampling point in relation to bridge and to record other important details.

4. Prior to obtaining water samples from a given stream monitoring station, use handheld computer to scan each bottle by pressing yellow button whiled directing scanner beam onto bottle barcode . Scanning of barcode will automatically update focus field to the scanned value on handheld computer. Scan bottles in the following order: physicochemical cubitainer, total organic carbon, trace metal, dissolved oxygen, nutrient, bacteria, pesticide, rad heath, and tritium bottles. A "NO" appearing on line next to pesticide, rad health and tritium data fields indicates that no bottle is to be scanned, nor any such sample collected. Note: each barcode label has a two-letter code at the end of the four digit number to insure the correct scanning of bottles (i.e., cubitainer "CM," total organic carbon "TC," trace metal "HM," dissolved oxygen "DO," nutrient "NT," bacteria "BC," pesticide "OC," rad health "RD," and tritium "TT"). After scanning last bottle for station, scroll upwards to display Date/Time Field line. All sample containers must have a barcode label and their corresponding identification number recorded on handheld computer and field data recording sheet (Appendix C). All handwritten recorded entries must be neat and legible to avoid confusion of sample and to provide a backup for electronic form during laboratory submission and analysis.

5. As a backup for identification, using an indelible marker, record the station number on all containers (except the dissolved oxygen, and radiological bottles that are intended to be reused after appropriate lab cleaning). Load scanned sample containers in plastic tub in the event of sample spillage during filling. Conduct this work in sampling vehicle through open sliding/latching side door.

6. Walk to the sampling point on bridge, carrying coil of rope, weighted stainless-steel sampling bucket and stainless-steel sampling pail. Connect rope to bucket by attaching snap swivel at end of rope to nut on bucket (do not use bucket handle for lowering/retrieving bucket). Use rope to slowly lower sampling bucket over bridge railing and beneath surface of stream. Allow bucket to fill completely with stream water. Retrieve sampling

bucket and detach rope. Reattach rope to handle of sampling pail and slowly lower pail over bridge railing and beneath surface of stream. Retrieve pail filled with stream water, and disengage rope. Carry bucket, pail and coiled rope back to sampling vehicle. (Note: If a radiological sample is being collected, a one-gallon radiological container is carried to sampling point on bridge and filled from pail before obtaining pesticide sample. The radiological sample is transferred to sampling vehicle with other samples.)

7. Upon return to vehicle, record time of sample collection on handheld computer and field data recording sheet. Pour pesticide sample into a one-gallon dark glass jug using stainless-steel funnel, and replace and securely tighten Teflon-lined cap on jug. Hold weighted stainless-steel sampling bucket by handle and fill physicochemical, total organic carbon, trace metal, dissolved oxygen, nutrient, and bacterial sample containers, and pH/temperature and specific conductance beakers by carefully pouring water through bucket spout. (Note: If a tritium sample is being collected, fill appropriate 100-ml glass bottle). The dissolved oxygen aliquot should be poured slowly and carefully to minimize aeration of sample. Between poured fractions, gently swirl sample bucket to facilitate mixing of sample. Replace caps on containers and tighten securely. Gently shake total organic carbon, trace metal, and nutrient container to mix sample water and acid preservative. Replace cap on bacterial sample container; tighten securely but avoid touching neck and interior of container and inside of cap. Measure pH, temperature, and specific conductance of sample (SCMP-004) and record values on handheld computer and field recording sheet. Preserve dissolved oxygen sample according to Winkler method (see below). Pack pesticide jug, physicochemical cubitainer, total organic carbon bottle, nutrient bottle and bacteriological bottle in chipped ice inside ice chest pending delivery to KDHE laboratory. Store trace metal container and dissolved oxygen bottle in wooden storage flat, and position flat in a deeply shaded location (e.g., under dark towel, cardboard box, or inverted storage flat) pending delivery to KDHE laboratory. Detailed procedures for handling and preserving specific sample fractions are presented below.

(NOTE: When collecting water quality samples in streams known to contain live zebra mussels (*Dreissena polymorpha*), a dedicated rope for these sites is used and the weighted stainless-steel sample bucket and stainless-steel pail are subsequently double rinsed with demineralized water before moving to sites outside the known range of this invasive species).

C. Detailed Sample Preservation and Handling Procedures

1. Pesticide Sample

   a. Fill pesticide jug by pouring water directly from stainless-steel pail through stainless-steel funnel. Replace and securely tighten Teflon-lined plastic cap. (Note: Plastic containers or funnels should not be used for collecting/transferring pesticide samples, as organic compounds may leach from plastic and interfere with laboratory analyses.)

   b. Pack sealed pesticide jug in chipped ice in ice chest pending transfer to KHEL.

2. Physicochemical Sample

   a. Fill cubitainer by pouring directly from weighted stainless-steel sampling bucket.

   b. Replace and securely tighten bottle cap. Place cubitainer sample in ice chest and pack in chipped ice pending transfer to KHEL.

3. Total Organic Carbon Sample

   a. Fill two total organic carbon bottles by pouring directly from weighted stainless-steel sample bucket. Avoid overfilling, as bottles have been pre-acidified with phosphoric acid solution.

   b. Replace and securely tighten bottle caps. Gently shake both bottles for about 10 seconds. Place total organic carbon samples in ice chest and pack in chipped ice pending transfer to KHEL.

4. Trace metal sample

   a. Fill trace metal bottle by pouring water directly from weighted stainless-steel sampling bucket. Avoid overfilling, as bottle has been pre-acidified with nitric acid solution. Leave a one-to-two-inch air space to facilitate mixing of sample.

   b. Replace and securely tighten bottle cap. Gently shake bottle for about 10 seconds to thoroughly mix sample with acid preservative. Place sample in wooden flat. Store flat in secure location in vehicle pending transfer to KHEL.

5. Dissolved Oxygen Sample

   a. Fill dissolved oxygen (DO) bottle by pouring water from stainless-steel sampling bucket slowly and carefully to minimize sample aeration. Staff are encouraged to put on disposable polyethylene gloves and safety glasses (or other appropriate hand and eye protection) if not already in place.

   b. Add 2 milliliters (ml) of manganous sulfate to sample from Winkler DO kit. This reagent is container in squeeze bottle labeled #1. (When using a squeeze bottle, force reagent into 2-ml dispensing pipette tip by gently squeezing bottle. Dispense reagent by inverting squeeze bottle while placing pipette tip just above surface of sample).

   c. Add 2 ml of alkaline potassium iodide azide. The squeeze bottle containing this regent is labeled #2.

   d. After reagents #1 and #1 have been added to DO bottle, close stopper and invert bottle 25 times for thorough mixing of reagents with sample. Set sample aside until floc has settled one-third of way down bottle. Floc will settle more rapidly in warmer samples than in colder samples.

   e. After floc has settled one-third of way down bottle, add 2 ml of concentrated sulfuric acid from squeeze bottle labeled #3.

   f. Replace stopper, rinse outside of bottle with demineralized water, and invert bottle 25 times to break up floc and ensure thorough mixing of sample and reagents. Development of a dark brown color generally indicates a high amount of DO in sample, whereas a light amber or clear color indicates little or no DO. (Actual DO concentrations, in mg/L, are determined later by KHEL).

   g. Place sample in wooden flat and store in deeply shaded area of van pending transfer to KHEL.

6. Nutrient Sample

   a. Fill nutrient bottle by pouring water directly from stainless-steel sampling bucket. Avoid overfilling, as bottle has been pre-acidified with sulfuric acid solution.

b. Replace and securely tighten bottle cap. Gently shake bottle for about 10 seconds. Place nutrient sample in ice chest and pack in chipped ice pending transfer to KHEL.

7. Bacteriological Sample

a. Fill bacteriological bottle by pouring water directly from sampling bucket. Avoid touching interior of bottle (careless handling may contaminate sample with bacteria from collector's hand).

b. Shake off some of sample, leaving a one-to-two inch air space at top of bottle to allow for ready mixing of sample during laboratory analysis. Replace and securely tighten bottle cap, avoiding any contact with inside of cap or with interior of sample bottle. Pack sample bottle in chipped ice in ice chest pending delivery to KHEL.

8. Radiological Sample

a. Fill radiological plastic container by pouring water directly from stainless-steel pail through stainless-steel funnel. Replace and securely tighten container cap. Avoid overfilling, as bottle has been pre-acidified with nitric acid (15 mL 4 N per gallon) solution.

b. Fill tritium glass container by pouring water directly from weighted stainless-steel sampling bucket. Replace and securely tighten container cap.

Store both containers in a secure location in vehicle during transport to KDHE radiological laboratory.

9. Volatile Organic Compound (VOC) Sample (special studies only)

a. Prior to withdrawing VOC sample from stainless-steel bucket or pail, record station name or number, collector's initials, and date of collection on label of vial.

b. Immerse lip of vial slowly and carefully into sample, until vial gradually fills with water. Completely immerse vial in vertical position, and slowly lift from water so that a bead of water rises above opening of vial.

c. Float Teflon-lined septum (cap liner) on top of meniscus, ensuring that Teflon side (thin white side) is in contact with water.

d. Replace cap on vial carefully and tightly. Turn vial upside down, tap lightly, and observe for any air bubbles. If bubbles are present, empty vial, flush with sample water, repeat steps b-c, above, and recheck for bubbles.

e. Pack vial in chipped ice in ice chest pending transport to KHEL.

10. Temperature, pH, and Specific Conductance Measurements

a. Fill 50-ml beaker with 30-40 ml of sample water by pouring directly from stainless-steel sampling bucket. Immediately insert tip of thermometer into sample, wait 10-20 seconds for equilibration, record sample temperature (to the nearest °C) on handheld computer and field data recording sheet, and withdraw thermometer.

b. After pH meter has been properly calibrated and standardized (SCMP-003), place probe in beaker, compensate for sample temperature, gently stir probe until pH reading stabilizes, and record stable reading on handheld computer and field data reporting sheet.

c. After specific conductance meter has been properly calibrated and standardized (SCMP-003), place probe in beaker, gently stir probe until conductance reading stabilizes, and record stable reading on handheld computer and field data reporting sheet.

FIELD CHAIN-OF-CUSTODY PROCEDURES FOR STREAM WATER SAMPLES (SCMP-006)

I. INTRODUCTION

A. Purpose

Surface water quality data derived from the stream chemistry monitoring program may be used in agency enforcement actions or in other regulatory endeavors. Field staff involved in sample collection must ensure that water quality samples are maintained in a secure and appropriate setting and that the transfer of samples to appropriate laboratory personnel, and any intermediaries, is accurately and permanently documented. The following paragraphs describe procedures used in the stream chemistry monitoring program for relinquishing and receiving water quality samples and for ensuring their security and integrity from the moment of collection to the time of transfer to laboratory personnel.

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental specialist published by the Kansas Department of Administration. They also should be experienced in the measurement of the physicochemical and microbiological properties of surface water and in the performance of environmental field investigations.

II. PROCEDURES

A. All samples submitted to KHEL for analysis must be accompanied by an appropriate electronically generated sample submission form (Appendix C). This includes water quality samples for physicochemical, nutrient, trace metal, bacteriological, pesticides, radiological samples, and any other special samples analyzed for KHEL.

B. At the bottom of each sampling submission form are fields for chain-of-custody. The first field is signed by at least one member (and ideally all members) of the field crew that collected the samples in question. On the date the samples are delivered to KHEL, the crew member(s) must sign/date the first chain-of-custody field using indelible ink. Staff of KHEL will accept the samples and sign/date the second chain-of-custody field, again using indelible ink. This provides a record of custody from the time collection to the time of arrival to KHEL.

C. In practice, two original forms are printed by field crew member(s) at KHEL after electronic transfer of data from the handheld computer to the laboratory computer (SOP No. SCMP-016). After the content of the printed forms is checked for completeness and accuracy, signatures are obtained from field crew member(s) and laboratory receiving staff. One of the original forms is retained by field staff for routing to the program manager or his/her designee. The second is retained by the laboratory employee receiving the samples.

D. In the event, samples pass through an intermediary en route to the laboratory (e.g., samples are transferred from district staff to central staff), district staff sign/date the first chain-of-custody field on the district handwritten field sheet (electronic backup), using indelible ink. Central staff sign/date the second chain-of-custody field, again using indelible ink. A photocopy is retained for district records and the original form is routed to the program manager or his/her designee. The electronic data is transferred in accordance with SOP No. SCMP-016.

E. Electronic forms and backup forms completed in the field contain important empirical data and supporting documentation. Loss of these forms, or any accident that impairs their legibility, would result in a significant loss of data and could necessitate a return trip to the stream(s) in question. Hence, it is imperative that care be taken by staff in the handling, filing and eventual archiving of these documents. Similar considerations apply to any photographs or other forms of documentation obtained during the course of field activities.

PROCEDURES FOR FIELD BLANK SAMPLES (SCMP-007)

I. INTRODUCTION

A. Purpose

Unless closely monitored and controlled, the inadvertent contamination of samples during collection, preservation, transport, storage, processing and/or analysis may lead to erroneous conclusions about the quality of the environment. Field blanks provide one means of assessing and quantifying the overall extent of sample contamination. The following paragraphs set forth procedures for preparing field blanks utilized in the stream chemistry monitoring program.

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental specialist published by the Kansas Department of Administration. They also should be experienced in the measurement of the physicochemical and microbiological properties of surface water and in the performance of environmental field investigations.

C. Equipment/Accessories

1. All items listed in Appendix A
2. Plastic jug (1 gal) filled with ASTM Type-I quality water
3. Dark glass jug (1 gal) filled with ASTM Type-I quality water

II. PROCEDURES

A. Preparation of Field Blanks for Inorganic and Bacteriological Sample Fractions

1. Prior to sampling run, fill one-gallon plastic container (that has undergone a rigorous decontamination procedure by laboratory personnel) with ASTM Type-I quality water at KDHE inorganic laboratory. Replace and securely tighten cap. Transport container in sampling vehicle to selected stream monitoring location. Upon arrival, and following completion of regular sampling and field measurement activities (SCMP-005), fill stainless-steel self- filling bucket with glass distilled water by pouring directly from one-gallon jug.

2. Place lid on sample bucket and secure with nut. Gently swirl bucket for about 20 seconds to simulate motion during normal stream sampling procedure. Pour into sample containers. Between poured fractions, gently swirl sample bucket to facilitate mixing of sample.

3. Prepare and transport blank physicochemical, nutrient trace metal and bacteriological sample fractions, and perform pH, temperature, and specific conductance measurements, according to procedures for regular stream water samples given in SCMP-005, section II.C.

B. Preparation of Field Blanks for Pesticide Sample Fraction

1. Prior to sampling run, fill one-gallon dark glass jug with demineralized water at KHEL inorganic laboratory. Replace and securely tighten cap. Transport in sampling vehicle to selected stream monitoring location. Upon arrival, and following completion of regular sampling and field measurement activities (SCMP-005), fill stainless-steel pail with demineralized water by pouring directly from one-gallon jug.

2. Gently swirl pail for about 20 seconds to simulate motion during normal stream sampling procedure.

3. Prepare and transport blank pesticide sample fraction according to procedures for regular stream water samples given in SCMP-005, section II.C.

C. Field Blank Laboratory Identification Codes and Related Considerations

1. The blank sample is assigned a laboratory identification code of SC000. Record sample "collection" time, equaling that of previous regular sample plus five minutes, on the handheld computer and field data recording sheet. (This five-minute time separation will be used, along with identification code, to designate sample as a field blank in Kansas Water Database).

2. Along with other data recorded for blank sample on handheld computer and field data recording sheet, indicate name and number of monitoring station sampled prior to preparation of field blank (to provide an indication of contaminant carry-over from sample to sample).

PROCEDURES FOR FIELD DUPLICATE SAMPLES (SCMP-008)

I. INTRODUCTION

A. Purpose

Sequential and concurrent field duplicate (replicate) samples provide a combined measure of natural sample variability and the variability inherent in sampling and analytical efforts. They allow estimates of data precision to be obtained and incorporated into statistical measures of surface water quality. The following text outlines procedures used in the stream chemistry monitoring program for the collection and handling of duplicate (replicate) stream water samples.

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental specialist published by the Kansas Department of Administration. They also should be experienced in the measurement of the physicochemical and microbiological properties of surface water and in the performance of environmental field investigations.

C. Equipment/Accessories

See Appendix A.

II. PROCEDURES

A. Preparation of Field Duplicate or Replicate

1. Follow procedures described in SOP No. SCMP-005 for collection and preservation of water samples and performance of preliminary field measurements.

2. Before leaving stream chemistry monitoring station, generate another (duplicate) set of samples/measurements by repeating all above procedures.

3. If additional (replicate) sets of samples/measurements are desired, repeat the above procedures as many times as needed.

4. In concurrent duplicate samples/measurements are desired, repeat the SCMP-005 procedures but fill separate sample containers concurrently using the same sampling device and water from the same sample "pull" from the stream.

5. Record a five-minute time differential between successive sets of samples/measurements. This time interval will designate the samples as duplicate or replicate samples in the Kansas Water Database.

PROCEDURES FOR FIELD SPIKED SAMPLES (SCMP-009)

I. INTRODUCTION

A. Purpose

The following paragraphs describe those procedures used in the stream chemistry monitoring program for field spiking water samples with known concentrations of selected chemical parameters. Measured levels of these parameters in spiked samples are compared to those in unamended duplicate samples to provide an overall indication of sample degradation and analytical recovery. Field spikes provide one means of quantifying the accuracy of water quality data.

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental specialist published by the Kansas Department of Administration. They also should be experienced in the measurement of the physicochemical and microbiological properties of surface water and in the performance of environmental field investigations.

C. Equipment/Accessories

1. All items listed in Appendix A
2. Stainless-steel pail (3 gal)
3. Trace metal/metalloid reference solution
4. Cation reference solution
5. Anion reference solution
6. Nutrient-1 reference solution
7. Nutrient-2 reference solution
8. TOC reference solution
9. Pesticide reference solution
10. Graduated cylinder, 1-liter, glass, with enlarged plastic stopper
11. Graduated cylinder, 2-liter, glass, with enlarged plastic stopper (2 each)
12. Brinkmann Eppendorf pipette, fixed volume, 1000 μL
13. Brinkmann Eppendorf pipette, adjustable volume, 100-1000 μL
14. Brinkmann Eppendorf pipette tips
15. Hamilton Gastight Syringe, 1.0 mL
16. Pasteur pipette, disposable, borosilicate glass, 5-3/4"
17. Plastic jug, one-gallon, filled with ASTM Type-I quality water
18. Dedicated small cooler with ice packs

19. Zip loc storage bag for containment of used reference solutions
20. Hamilton CR-700-50 constant rate syringe, 2-50 μL

II. PROCEDURES

A. Overview of Field Spike Procedures

Follow procedures in SOP No. SCMP-005 for collection and preservation of water quality samples, with following modifications.

1. Carry three-gallon (rather than one-gallon) stainless-steel pail to sampling location on bridge. Attach pail to rope by connecting snap swivel at end of rope to bucket handle. Lower pail over bridge railing and beneath surface of stream. Allow pail to fill completely. If stream is too shallow to submerge three-gallon pail in an upright position, use one-gallon pail to fill larger pail, pouring water slowly to minimize aeration of sample.

2. Transport three-gallon pail with sample to field vehicle. Immediately fill sampling containers and graduated cylinders needed for organic sample fraction (see below). Swirl pail gently before each pour to minimize settling of any suspended materials.

3. Repeat step (1), above. Transport three-gallon pail with sample to field vehicle. Immediately fill sampling containers and graduated cylinders needed for inorganic sample fraction (see below). Swirl pail gently before each pour to minimize settling of suspended materials. Measure water temperature, pH, and specific conductance as described in (SCMP-004). Sample containers that have no spike additions (DO and bacteriological) are filled and preserved as described in (SCMP-005.II.B-C).

4. The laboratory identification code for all field-spiked fractions is recorded as SC999. Time of collection for all field-spiked fractions is recorded as five minutes after collection of regular sample. The code and five-minute time differential are used to signify a field-spiked sample in Kansas Water Database.

B. Specific Field Spike Procedures

1. Pesticide (Organic) Spike

   a. Rinse a two-liter graduated cylinder with sample water by pouring water from three-gallon stainless-steel pail through stainless-steel funnel. Discard rinse water and refill two-liter cylinder to 2000-ml

mark (read bottom of meniscus formed when sample water wets cylinder wall). Transfer contents into a one gallon dark glass jug using funnel and repeat process.

b. Use funnel and remaining water in sampling pail to completely fill another one-gallon dark glass jug. Replace cap and tighten securely. This jug contains unamended pesticide sample.

c. Invert pesticide ampule several times to mix. Open ampule by carefully snapping at score line. Transfer 1.0 mL of contents using the Hamilton Gastight syringe into jug containing 4000 ml of sample water. Replace Teflon-lined plastic cap and tighten securely. Mix contents of jug by inverting several times. This jug contains amended (spiked) pesticide sample.

d. Rinse two-liter cylinder three times with glass distilled water, discard rinse water, and store cylinder with other supplies for transport. Pack amended and unamended pesticide sample containers in chipped ice and store inside ice chest pending delivery to KHEL. Place used pesticide ampule in zip loc bag and place in cooler pending transport to laboratory of disposal.

2. Combined Trace Metal and Cation Spike

a. Rinse one-liter graduated cylinder by pouring sample water into cylinder from three-gallon stainless-steel pail through stainless-steel funnel. Discard rinse water. Pour a predetermined volume of sample water into rinsed one-liter cylinder using funnel. (Note: This volume is calculated prior to sampling run by program manager based on targeted spike amendment, which varies from run to run).

b. Pour remaining sample water from sampling pail directly into trace metal bottle. This bottle contains unamended trace metal sample.

c. Invert ampule marked "trace metals" several times to mix. Unscrew cap from ampule and transfer predetermined amount of ampule contents (trace metal reference solution) into one-liter cylinder using adjustable Eppendorf pipette.

d. Invert ampule marked "cations" several times to mix. Unscrew cap from ampule and transfer predetermined amount of ampule contents (cation reference solution) into one-liter cylinder using adjustable Eppendorf pipette.

e. Cap cylinder with plastic stopper and invert ten times to mix. Transfer contents of cylinder into trace metal sample bottle. This bottle contains amended (spiked) trace metal sample.

f. Rinse one-liter cylinder three times with glass distilled water, discard rinse water, and store cylinder with other supplies for transport. Gently shake both (amended and unamended) trace metal bottles approximately ten seconds to ensure thorough mixing of sample and preservative. Place bottles in wooded flat and store in secure area of sampling vehicle pending delivery to KHEL. Place used metal and cation reference solution ampules in zip loc bag and place in cooler pending transport to laboratory for disposal.

3. Nutrient and Anion Spikes

a. Rinse a two-liter graduated cylinder by pouring sample water into cylinder from three-gallon stainless-steel pail through stainless-steel funnel. Discard rinse water. Pour a predetermined volume of sample water into cylinder using funnel.

b. Apportion remaining sample water among physicochemical container (one-quart cubitainer) and nutrient bottle, pouring directly from pail through funnel. Cubitainer and bottle contain unamended physicochemical sample and unamended nutrient sample, respectively.

c. Invert ampule marked "anions" several times to mix. Unscrew cap from ampule and transfer predetermined amount of contents (anion reference solution) into two-liter cylinder using adjustable Eppendorf pipette. (Note: This same cylinder is referenced in steps a and c, above). Cap cylinder with plastic stopper and invert ten times to mix contents.

d. Invert ampule marked "nutrient-1" several times to mix. Unscrew cap from ampule and transfer predetermined amount of contents (anion reference solution) into two-liter cylinder using adjustable Eppendorf pipette. (Note: This same cylinder is referenced in steps a and c, above). Cap cylinder with plastic stopper and invert ten times to mix contents.

e. Apportion contents of cylinder among physicochemical cubitainer and nutrient bottle. Cubitainer and bottle contain amended

physicochemical sample and amended nutrient (ammonia-N) sample, respectively.

f. Repeat step a, above, using a clean two-liter graduated cylinder.

g. Invert ampule marked "nutrient-2" several times to mix. Unscrew cap from ampule and transfer predetermined volume of contents (Kjeldahl-nitrogen reference solution) into a clean cylinder using adjustable Eppendorf pipette and clean (unused) pipette tip. Cap cylinder with plastic stopper and invert ten times to mix.

h. Transfer 250 ml from cylinder referenced in step f and g, above into clean nutrient bottle. Bottle contains amended nutrient (Kjeldahl-N) sample.

i. **Caution:** If ammonia-nitrogen and Kjeldahl-nitrogen field spikes are prepared on same stream monitoring run, and at same stream monitoring station, then care must be taken to dilute contents of nutrient-1 (ammonia-nitrogen) ampule and nutrient-2 (Kjeldahl-nitrogen) ampule in different graduated cylinders and to transfer resulting solutions into different nutrient bottles.

j. Replace and securely tighten bottle caps. Gently shake each bottle for about 10 seconds to ensure complete mixing of sample, any added nutrients, and acid preservative.

k. Rinse both two-liter graduated cylinders three times with glass distilled water, discard rinse water, and store cylinders with other supplies for transport. Pack all physicochemical sample cubitainers and nutrient sample bottles in chipped ice inside ice chest. Store ice chest in secure location in sampling vehicle pending transport to KHEL. Place used anion and nutrient-1 and nutrient-2 reference solution ampules in zip loc bag and place in cooler pending transport to laboratory for disposal.

4. TOC Spikes

a. Rinse two-liter graduated cylinder by pouring sample water into cylinder from three-gallon stainless-steel pail through stainless-steel funnel. Discard rinse water. Pour a predetermined volume of sample water into one-liter cylinder using funnel.

b. Pour remaining sample water from sampling pail directly into TOC bottle. This bottle contains unamended TOC sample.

c. Invert ampule marked "TOC" several times to mix. Unscrew cap from ampule and transfer predetermined amount of contents (total organic carbon reference solution) into one-liter cylinder using adjustable Eppendorf pipette.

d. Cap cylinder with plastic stopper and invert ten times to mix. Transfer contents of cylinder into TOC sample bottle. This bottle contains amended (spiked) TOC sample.

e. Rinse one-liter cylinder three times with glass distilled water, discard rinse water, and store cylinder with other supplies for transport. Gently shake both TOC bottles approximately ten seconds to ensure thorough mixing of sample and preservative. Pack all TOC bottles in chipped ice inside ice chest. Store ice chest in secure location in sampling vehicle pending transport to KHEL. Place used TOC reference solution ampules in zip loc bag and place in cooler pending transport to laboratory for disposal.

PROCEDURES FOR CONTAINER BLANK SAMPLES (SCMP-010)

I. INTRODUCTION

A. Purpose

Sample bottles are routinely taken for granted to be clean and uncontaminated, especially when using new certified sample bottles or reusable bottles that have undergone a rigorous laboratory decontamination procedure. However, unless routinely monitored for contamination, these bottles can reduce the precision and increase the bias of the environmental data collection process. Container blanks provide an indication of the level of contamination associated with the use of new or reused sample bottles. The following paragraphs set forth procedures utilized in the stream chemistry monitoring program for preparing container blanks and assessing the level of container contamination.

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental specialist published by the Kansas Department of Administration. They also should be experienced in the measurement of the physicochemical and microbiological properties of surface water and in the performance of environmental field investigations.

C. Equipment/Accessories

1. All items listed in Appendix A
2. Plastic jug (1 gal) filled with ASTM Type-I quality water

II. PROCEDURES

A. Preparation of Container Blanks for Inorganic and Bacteriological Sample Fractions

1. Prior to sampling run, fill one-gallon plastic container with ASTM Type-I quality water at KHEL inorganic laboratory. Replace and securely tighten cap. Prior to leaving laboratory, pour water directly into a random set of sample bottles or transport in sampling vehicle and then pour directly into a random set of sample bottles under field conditions.

2. Prepare and transport container blank physicochemical, total organic carbon, trace metal, dissolved oxygen, nutrient, and bacteriological sample

fractions and perform pH, temperature, and specific conductance measurements according to procedures for regular stream water samples given in SCMP-005, section II.C.

B. Container Blank Laboratory Identification Codes and Related Considerations

1. The container blank sample is assigned a laboratory identification code of SC001. Record sample "collection" time on the handheld computer and field data recording sheet.

2. Record bottle number of one-gallon plastic container, and date container was filled, in flow comment section on handheld computer and field data recording sheet.

PROCEDURES FOR CREATING EXCEL SPREADSHEET TEMPLATE AND SPECIFIC NETWORK RUN FILE FOR DOWNLOAD TO PALM OS HANDHELD COMPUTER (SCMP-011)

I. INTRODUCTION

A. Purpose

The following text outlines the steps taken to create a simple Excel field collection data spreadsheet template, assisted by ScanSeek software. This template can be used as an Open Database Connectivity (ODBC) data source for a Palm OS handheld computer. Through the handheld computer, data can be added, deleted, and edited, and then uploaded back into the original database on a desktop computer (see ScanSeek User's Manual).

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental specialist published by the Kansas Department of Administration. Personnel should also have some experience in the use of ODBC data source and Microsoft Excel software.

C. Equipment/Accessories

Palm OS handheld computer with Palm OS software (version 3.0 or later); personal computer or laptop running the Microsoft Windows with Excel; RioScan ScanSeek software; HotSync Manager application (installed as part of Palm Desktop software); Universal Serial Bus (USB) jump drive; cradle or serial/charge cable; power supply cord.

II. PROCEDURES

A. Creating Excel Spreadsheet as Data Source for Three-Day Stream Chemistry Run

1. Launch Excel, starting with a clean spreadsheet.

2. In cell K1 on line 1 (with assigned row height 20.25), enter "KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT." In cell K2 on line 2 (with assigned row height of 20.25), enter "DIVISION OF ENVIRONMENT." In cell B2 on line 2 (with assigned row height of 20.25), enter "PROJECT." In cell B3 on line 3 (with assigned row height of 20.25), enter e.g., "South Central-South" and in cell K3"DATA FORM.", and in cell S3 "Stream Chemistry."

3. Leave line 4 blank with assigned row height of 12.75

4. In cell B5 on line 5 (with assigned row height of 15.00), enter "STA_." In cell C5, enter "LOCATION." In cell D5, enter "NUM." In cell E5, enter "FIELD_DATE." In cell F5, enter "DEPTH." In cell G5, enter "CHEM." In cell H5, enter "TOC." In cell I5, enter "HM." In cell J5, enter "DO." In cell K5, enter "NH3." In cell L5, enter "BACT." In cell M5, enter "PEST." In cell N5, enter "RAD." In cell O5, enter "TRIT." In cell P5, enter "TEMP." In cell Q5, enter "FIELD_pH." In cell R5, enter "SP_COND." In cell S5, enter "COMMENTS." In cell T5, enter "COLLECTOR."

5. a. Create named range using mouse to select cells for number of stations scheduled plus two blank lines for station additions and QA/QC activities (e.g., B6 through T19).

   b. Add station numbers below "STA_" header and station locations below, "LOCATION" header. (Note: the size of the *named range* will fluctuate depending on sampling run and scheduled QA/QC activities.) Insert "NO" below "PEST," "RAD," and "TRIT" headers if such samples will not be collected from station during sampling run. (These parameter groups are monitored on quarterly basis; i.e., they are not scheduled every sampling run).

   c. Type "DAY1" in the range box, then press Enter key.

6. Repeat Step 4 starting on next available blank line.

7. a. Repeat Step 5 a.

   b. Repeat Step 5 b.

   c. Type "DAY2" in the range box, then press Enter key.

8. Repeat Step 4 starting on next available blank line.

9. a. Repeat Step 5 a.

   b. Repeat Step 5 b.

   c. Type "DAY3" in the range box, then press Enter key.

10. For three-day network runs that include a district office first day sampling run (Northwest sampling runs only), create *named range* using mouse to select cells and insert immediately below "DAY1" *named range*.

    a. Repeat Step 5 a.

    b. Repeat Step 5 b.

    c. Type "DDAY1" in the range box, then press Enter key.

11. For three-day network runs that include a district office second day sampling run (Northwest sampling runs only), create *named range* using mouse to select cells and insert immediately below "DAY2" *named range*.

    a. Repeat Step 5 a.

    b. Repeat Step 5 b.

    c. Type "DDAY2" in the range box, then press Enter key.

12. In cell K57, enter "CHAIN OF CUSTODY." In cell B59 through E62, enter "Received by: (Signature)." In cell F59 through J63, enter "Date/Time." In cell K59 through Q62, enter "Received by:" In cell K63 through Q66, enter "Received for lab by: (Signature)." In cell S63 through T63, enter "Date/Time."

13. Select **Tools, ScanSeek Analyzer...** from menu bar. In the "ScanSeek Analyzer" dialog box, select the *named range* "DAY1" from the drop down menu. Click *Analyze* button to continue. If problems are discovered concerning elements in *named range*, *ScanSeek Analyzer* will display one or more confirmation dialog boxes. Click *Yes* button in each dialog box to enable analyzer to fix problems. When *ScanSeek Analyzer* has corrected all problems, a dialog box will be displayed summarizing the analyzer's actions (ScanSeek User's Manual). Repeat for *named range* "DAY2," "DAY3," "DDAY1," and "DDAY2." Select **File, Save as** and name file "SC Three-day Run Template" and exit application.

B. <u>Creating Excel Spreadsheet as Data Source for Two-Day Run</u>

1. Open spreadsheet "SC Three-Day Run Template" and delete *named range* "DAY3 and DDAY2."

2. Add appropriate spaces in *named range* "DAY1" and DAY2" to balance the spreadsheet aesthetically.

3. For two-day network runs that include a district office one day sampling run (Southwest sampling run only), add or subtract spaces in *named range* "DDAY1" as needed.

4. Reapply station numbers below "STA_" header and station location below "LOCATION" header in "DAY1," DAY2," and DDAY1." (Note: the size of the *named range* will fluctuate depending on sampling run and scheduled QA/QC activities.) Insert "NO" below "PEST," "RAD," and "TRIT" headers if such samples will not be collected from station during sampling run. (These parameter groups are monitored on a quarterly basis; i.e., they are not scheduled every sampling run).

5. Select **Tools, ScanSeek Analyzer...** from menu bar. In the "ScanSeek Analyzer" dialog box, select the *named range* "DAY1" from the drop down menu. Click *Analyze* button to continue. If problems are discovered concerning elements in *named range*, *ScanSeek Analyzer* will display one or more confirmation dialog boxes. Click *Yes* button in each dialog box to enable analyzer to fix problems. When *ScanSeek Analyzer* has corrected all problems, a dialog box will be displayed summarizing the analyzer's actions (ScanSeek User's Manual). Repeat for *named range* "Day2," and "DDAY1." Select **File, Save as** and name file "SC Two-Day Run Template," then press Enter key.

C. <u>Creating Excel Spreadsheet as Data Source for One-Day Run</u>

1. Open spreadsheet "SC Three-Day Run Template" and delete *named range* "DAY3," "DAY2," "DDAY2," and "DDAY1."

2. Add appropriate spaces in *named range* "DAY1" to balance the spreadsheet aesthetically.

3. Reapply station numbers below "STA_" header and station locations below "LOCATION" header in "DAY1." (Note: the size of the *named range* will fluctuate depending on sampling run and scheduled QA/QC activities.) Insert "NO" below "PEST," "RAD," and TRIT" headers if such samples will not be collected from station during sampling run. (These parameter groups are monitored on a quarterly basis; i.e.; they are not scheduled every sampling run.)

4. Select **Tools, ScanSeek Analyzer...** from menu bar. In the "ScanSeek Analyzer" dialog box, select the *named range* "DAY1" from the drop down menu. Click *Analyze* button to continue. If problems are discovered concerning elements in *named range*, *ScanSeek Analyzer* will display one or more confirmation dialog boxes. Click *Yes* button in each dialog box to enable analyzer to fix problems. When *ScanSeek Analyzer* has corrected all problems, a dialog box will be displayed summarizing the analyzer's actions (ScanSeek User's Manual). Select **File, Save as** and name file "SC One-Day Run Template" then press Enter key.

D. Creating Specific Network Run File for Downloading of Data to Palm OS Handheld Computer

1. Launch Excel and open desired "Network Run Template."

2. Check accuracy of station numbers below "STA_" header and station locations below "LOCATION" header. Add QA/QC stations, assign number index below "NUM" header, enter "0.1" under "DEPTH and enter names of field staff participating in run below "COLLECTOR" header. Ensure "NO" has been inserted below the "PEST," "RAD," and "TRIT" headers if these parameter will not be evaluated during run.

3. Select **Tools, ScanSeek Analyzer...** from menu bar. In the "ScanSeek Analyzer" dialog box, select the *named range* "DAY1" from the drop down menu. Click *Analyze* button to continue. If problems are discovered concerning elements in *named range*, *ScanSeek Analyzer* will display one or more confirmation dialog boxes. Click *Yes* button in each dialog box to enable analyzer to fix problems. When *ScanSeek Analyzer* has corrected all problems, a dialog box will be displayed summarizing the analyzer's actions (ScanSeek User's Manual). Repeat for *named range* "DAY2," "DAY3," "DDAY1," and "DDAY2" if necessary.

4. Select **File, Save as** and name the file for run to be completed, and attach date to end of file name (e.g., South-Central Run March 2-4, 2005). Press Enter key, and copy to a USB jump drive.

PROCEDURES FOR CONNECTING AND DOWNLOADING ELECTONIC FIELD SHEET TO PALM OS HANDHELD COMPUTER (SCMP-012)

I. INTRODUCTION

A. Purpose

The following paragraphs present instructions for establishing and Open Database Connectivity (ODBC) data source and downloading electronic field sheet onto the Palm OS handheld computer.

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental specialist published by the Kansas Department of Administration. Personnel should also have some experience in the use of ODBC data source and Microsoft Excel software.

C. Equipment/Accessories

Palm OS handheld computer with Palm OS software (version 3.0 or later); personal computer or laptop running the Microsoft Windows with Excel; RioScan ScanSeek software, HotSynce Manager application (installed as part of Palm Desktop software); Universal Serial Bus (USB) jump drive; cradle or serial/charge cable; power supply cord.

II. PROCEDURES

A. Setting up Open Database Connectivity (ODBC) on Laptop or Personal Computer

1. Insert USB jump drive containing *Data Exchange* Excel Spreadsheet for scheduled (upcoming) stream chemistry run. Double click on ODBC Data Source icon to display "ODBC Data Source Administrator" dialog box.

2. When ODBC Data Source Administrator dialog box appears, select User DSN tab. Double-click on highlighted "Network" under Name column.

3. Click Select Workbook... button. After "Select Workbook" dialog box appears, navigate to **Drive F** (removable jump drive), select desired Excel file (sample run to be completed), click OK button, then click on OK button in "ODBC Microsoft Excel Setup" dialog box.

4. Click OK button in "ODBC Data Source Administrator" dialog box to close box and return to desktop. This step completes link to stream run database file.

5. Double-click on ScanSeek icon to display "ScanSeek Data Exchange" dialog box. All *Data Exchange* configured for use on handheld computer are listed in "Active/Data Exchange Name" box.

6. In "ScanSeek Data Exchange" dialog box, select desired *Data Exchange* (e.g., DAY1, DAY2, DAY3, DDAY1, DDAY2, etc.) by checking the box, marking *Data Exchange* as "Active." (Note: Only active *Data Exchanges* will be downloaded to handheld computer. De-activate a *Data Exchange* by removing check in box.) If *Data Exchange* is not listed or needs to be reconfigured, see SOP No. SCMP-013.

7. Click button in upper right-hand corner of "ScanSeek Data Exchange" dialog box to exit program.

B. <u>Downloading Data from Laptop or Personal Computer to Palm Handheld Computer</u>

1. Turn on Palm OS handheld computer and start ScanSeek application by tapping icon once on menu screen.

2. Delete all existing *Data Exchanges* by tapping "ScanSeek" highlighted at top of screen. Choose "Delete All" option from Program menu. At prompt, tap "Yes" to verify intended deletion of record. Following deletion of record, return to "Choose a Data Exchange" view. Tap House icon in lower left corner of computer to return to main menu screen.

3. Place Palm OS handheld computer into cradle or attach serial/charge cable from laptop or personal computer.

4. Press HotSync button on front of cradle or tap HotSync icon on main menu screen of handheld computer. (Note: HotSync progress window should appear on desktop, and a similar screen should display on handheld computer.) Wait for software to display message indicating process is complete. If transfer of *Data Exchange* does not occur, view detailed information on HotSync process to correct problems or refer to the HotSync chapter in Product Reference Guide.

5. Open ScanSeek application by tapping icon once on menu screen. Review downloaded *Data Exchanges* (e.g., DAY1, DAY2, DDAY1, DDAY2) on handheld computer for completeness and accuracy.

6. Unplug USB jump drive by clicking on the "Safely Remove Hardware" icon located in the System Tray line on desktop. A prompt will appear "Select the device to unplug?" Select "Mass Storage Device-Drive (F:)" and click "Stop" and remove USB jump drive.

PROCEDURES FOR CONFIGURING DATA EXCHANGE WITH SCANSEEK SOFTWARE (SCMP-013)

I. INTRODUCTION

A. Purpose

The following paragraphs present instructions for configuring a data exchange assisted by ScanSeek software.

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental specialist published by the Kansas Department of Administration. Personnel should also have some experience in the use of ODBC data source and Microsoft Excel software.

C. Equipment/Accessories

Personal computer or laptop running the Microsoft Windows with Excel; RioScan ScanSeek software; HotSync Manager application (installed as part of Palm Desktop software).

II. PROCEDURES

A. Configuring Data Exchange using ScanSeek

1. Double-click on ScanSeek icon to display "ScanSeek Data Exchange" dialog box. All *Data Exchanges* configured for use on handheld computer are listed in "Active/Data Exchange Name" box. To reconfigure an existing *Data Exchange*, click on Configure… button. If required *Data Exchange* does not appear, click New…button.

2. In "Add Data Exchange" dialog box, enter name (i.e., DAY1, DAY2, DAY3, DDAY1, DDAY2, SPDAY1, SPDAY2, etc.) for new *Data Exchange*. Click OK button.

3. After naming *Data Exchange*, ScanSeek Data Exchange Wizard will appear. Follow on-screen instruction to complete configuration of new *Data Exchange*. Click Next button to start data exchange process.

4. Wizard will prompt user to choose ODBC data source for storage of data. A drop down menu will list names of properly configured ODBC data

sources (Systems DSNs). Scroll down to "Network" and click on Next button.

5. Wizard will prompt user to choose range within data source containing data intended for download. Use drop down menu to specify range to be accessed. Next, choose field that will be used to search for and identify data records. Use drop down menu to specify "NUM." Leave Read Only and Lookup Table boxes unchecked. Click Next button.

6. Wizard will prompt user to customize the way ScanSeek collects data and posts changes to data source. Choose "Only allow one record per search field." This option insures that no two records share the same indexing number. Click Next button.

7. Wizard will display summary screen of *Data Exchange* configuration. Verify all information to make sure *Data Exchange* is configured properly. Should any corrections be needed, click on Back button. If everything is correct, click Finish button.

8. ScanSeek will attempt to validate new *Data Exchange* configuration by verifying that all necessary attributes (e.g., ODBC Data Source) have been assigned and all field options are valid. If ScanSeek finds any errors, and error box will be displayed and *Data Exchange* will be marked "Inactive."

9. In "ScanSeek Data Exchange" dialog box, verify that checkbox to the left of newly created or existing *Data Exchange* is selected, marking *Data Exchange* as "Active." (Note: Only active *Data Exchange* will be downloaded to handheld computer. De-activate a *Data Exchange* by removing check in box).

10. Click button in upper right-hand corner of "ScanSeek Data Exchange" dialog box to exit program.

PROCEDURE FOR ENTERING FIELD DATA ON PALM OS HANDHELD COMPUTER (SCMP-014)

I. INTRODUCTION

A. Purpose

The following paragraphs present instruction for entering field data on the Palm OS handheld computer.

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental specialist published by the Kansas Department of Administration. Personnel should also have some experience in the use of ODBC data source and Microsoft Excel software.

C. Equipment/Accessories

Palm OS handheld computer with Palm OS software (version 3.0 or later); cradle or serial/charge cable; power supply cord.

II. PROCEDURES

A. Entering Data in Field on Palm Handheld Computer

1. Turn Palm OS handheld on and start ScanSeek application by tapping icon once on menu screen. To begin working with a configured *Data Exchange*, select its name from screen.

2. The "Seek in" screen (e.g., DAY1, DAY2, DAY3, DDAY1, DDAY2, etc.) presents a summary view of data in *Data Exchange*. Select desired *Data Exchange* in view by tapping once. Following selection, handheld computer screen view will display a number index for every record on left hand column and stream chemistry station numbers on right hand column. To view information for a give station in greater detail, simply tap desired record.

3. On bottom of record detail view, tap Edit button. Edit screen will display the following data fields: station number, location, index number, field date, bottles to be scanned, temperature, pH, specific conductance, comments,

and collector name. To edit a particular field, tap anywhere along the line containing field data.

4. To begin barcode scanning process, tap on "Chem" line to activate Auto-Scroll barcode scanning feature. Scan each bottle for each set of samples by pressing yellow button while directing scanner beam onto designated bottle barcode. Scanning a barcode will automatically update scan focus field with newly scanned value. Scan bottles in following order: cubitainer, TOC, trace metal, dissolved oxygen, nutrient, bacteriological, pesticide, radiological, and tritium bottles. A "NO" appearing on line next to pesticide, radiological, and tritium data fields confirms that such samples are not scheduled for collection. (Note: To ensure correct scanning of bottles, each barcode label has a two-letter code at end of a four-digit number. These refer to the following containers: cubitainer "CM," total organic carbon "TC," trace metal "HM," dissolved oxygen "DO," nutrient "NT," bacteria "BC," pesticide "OC," rad health "RD," and tritium "TT.") After scanning last bottle of a set at a given station, scroll up to display Date/Time Field line.

5. Complete field sample collection process (see SCMP-005).

6. Tap Date/Time Field line. Date values and time values associated with a single station are edited separately. To change date portion of any field, tap the date line of that field. The Calendar control will appear, allowing entry of a modified date. Select appropriate year and month, then tap on appropriate day of month. Alternatively, tap on Today button to enter current date and time. To change time portion of any field, tap the time line of that field. The Time control will appear, allowing entry of a modified time. Tap OK button.

5. Tap temperature line, then "123" icon located on lower right corner of interactive screen. A virtual keyboard will appear with Numeric keypad display. Use keypad to enter measured field temperature. To close display, tap Done button followed by X button in upper right portion of the box. Repeat same steps for entering field pH and specific conductance readings.

6. Tap comments line. Tap "abc" icon located on lower left corner of interactive screen. The virtual keyboard will appear with Alpha keyboard display. Use Alpha keyboard to enter text. Enter information in text field on prevailing flow and environmental conditions separating each observation by a backslash. Enter information on flow conditions (e.g., high, low, average) first, followed by information on the appearance of the water (e.g., clear, turbid, slight green cast, etc.), and finally other important

information up to a limit of 60 characters total. If no samples are collected, record the reason (e.g., dry, pooled, etc.), followed by "No sample." If chlorophyll-a samples are collected, record the percentage of stream bottom covered by periphyton (e.g., < 5% "none," > 5% but < 33% as "low," >33% but < 67% as "moderate," > 76% as "high") and then enter flow conditions. Tap Done button to finish, then tap X button in upper right portion of display to close.

7. Tap Done button to return to "Seek in" screen. Handheld computer is now ready to enter information for next monitoring station.

PROCEDURES FOR SYNCHRONIZING DATA ON PALM OS HANDHELD COMPUTER USING LAPTOP OR PERSONAL COMPUTER (SCMP-015)

I. INTRODUCTION

A. Purpose

The following paragraphs present instructions for synchronizing data from the Palm OS handheld computer through HotSync Manager Application, for saving this data to a Universal Serial Bus (USB) jump drive on a laptop or personal computer.

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental specialist published by the Kansas Department of Administration. Personnel should also have some experience in the use of ODBC data source and Microsoft Excel software.

C. Equipment/Accessories

Palm OS handheld computer with Palm OS software (version 3.0 or later); personal computer or laptop running the Microsoft Windows with Excel; RioScan ScanSeek software; HotSynce Manager application (installed as part of Palm Desktop software); Universal Serial Bus (USB) jump drive; cradle or serial/charge cable, cord; power supply.

II. PROCEDURES

A. Synchronizing Field Data on Palm Handheld Computer with Spreadsheet on Laptop or Personal Computer

1. Log on to laptop or personal computer by entering user name followed by current password.

2. Insert USB jump drive containing the *Data Exchange* Excel Spreadsheet for the stream chemistry run. Navigate to **Drive F** and open *Data Exchange* Data file in Excel to confirm availability of spreadsheet. Close Excel.

3. Double click the ODBC Data Source icon to display "ODBC Data Source Administrator" dialog box. When ODBC Data Source Administrator dialog box appears, select User DSN tab. Double-click on highlighted "Network" tab.

4. Click Select Workbook... button to activate "Select Workbook" dialog box. Select desired Excel file (from completed sample run) and click OK button. Click OK button in "ODBC Microsoft Excel Setup" dialog box.

5. Click OK button in "ODBC Data Source Administrator" dialog box to close box and return to desktop main menu. This step completes the link to database file containing data from sampling run.

6. Double-click on the ScanSeek icon on laptop or personal computer or laboratory computer system to display the "ScanSeek Data Exchange" dialog box. All *Data Exchanges* configured for use on the handheld computer are listed in the "Active/Data Exchange Name" box. Place a check in box for selected *Data Exchange* (e.g., DAY1, DAY2, DAY3, DDAY1, DDAY2, etc.). If selected *Data Exchange* does not work properly or is not listed, please refer to SCMP-012 procedures II.B. to reconfigure an existing *Data Exchange* or add a new *Data Exchange*.

7. Place Palm handheld computer into cradle or attach serial/charge cable from the laptop or personal computer or laboratory computer.

8. Press HotSync button on front of cradle or tap HotSync icon on main menu screen of handheld computer (Note: HotSync progress window should appear on desktop, and a similar screen should display on handheld computer). Wait for software to display message indicating synchronization is complete. If transfer of *Data Exchange* does not occur, view detailed information on HotSync process to correct problems or refer to the HotSync chapter in Product Reference Guide.

9. Click the "Safely Remove Hardware" icon located in the System Tray line on desktop. A prompt will appear "Select the device to unplug?" Select "Mass Storage Device-Drive (F:)" and click "Stop" and remove USB jump drive.

PROCEDURES FOR TRANSFER OF ELECTRONIC DATA AND UPLOADING TO LABORATORY DATA COLLECTION SYSTEM (SCMP-016)

I. INTRODUCTION

A. Purpose

The following paragraphs present instructions for electronically transferring data from district to central office staff, and for uploading network run electronic data to the laboratory computer system at Forbes Field, Topeka, Kansas. Collectively, these procedures constitute the stream chemistry monitoring program's electronic sample submission system.

B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental specialist published by the Kansas Department of Administration. Personnel should also have some experience in the use of ODBC data source and Microsoft Excel software.

C. Equipment/Accessories

Palm OS handheld computer with Palm OS software (version 3.0 or later); personal computer or laptop running the Microsoft Windows with Excel; RioScan ScanSeek software; HotSync Manager application (installed as part of Palm Desktop software); Universal Serial Bus (USB) jump drive; cradle or serial/charge cable; power supply cord.

II. PROCEDURES

A. Transferring Electronic Data from District to Central Office Staff

1. Open Excel, and navigate to **Drive F** (removable USB jump drive). Open *Data Exchange* file for the stream chemistry run completed.

2. **District office staff**: check populated spreadsheet for transcription errors, spelling errors, missing information, or unusual spaces in front of character information prior to meeting with central office staff to transfer custody of stream chemistry samples. If any modifications, additions, or deletions are necessary, make changes on the handheld computer in accordance with SCMP-012 and SCMP-013. Transfer custody of samples and handwritten

fieldsheet (electronic backup) to central office staff and retain copy for district records (see SCMP-006).

Central office staff: transfer district data using Microsoft Explorer. Specifically, drag district run file in **Drive F** to folder "A Jump Drive Transfer" in **Drive C** on laptop. Insert central office Master USB jump drive on laptop and drag district network run file located in "A of Jump Drive Transfer" folder (laptop) to **Drive F**. A message will prompt user to overwrite existing file. Click "Yes" button and close. Open Excel, and navigate to **Drive F**. Open updated *Data Exchange* file. Replace existing place holding accession numbers (e.g., 1,2,3, etc.) in *named range* "DDAY1" and "DDAY2" (Northwest District only). Fill in sequential index numbers by selecting the first cell in the "NUM" column, and enter the starting value . To increment the series, select the next cell and enter the next number. Select the cells that contain the starting values. Click on next cell and drag the fill handle over the range you want to fill. Fill in increasing order, by dragging down. After completion, check the entire file for accuracy and completeness and save. A message will prompt user to overwrite existing file. Click "Yes" return to desktop. Click the Safely Remove Hardware" icon located in the System Tray line on desktop. A prompt will appear "Select the device to unplug?" Select "Mass Storage Device-Drive (F:)" and click "Stop" and remove USB jump drive.

B. Synchronizing Field Data on Palm Handheld Computer using Laboratory Computer

1. Log on to laboratory computer system by entering user name "snetwork" followed by current password."

2. Insert USB jump drive containing the *Data Exchange* Excel Spreadsheet for the stream chemistry run. Navigate to **Drive F** and open *Data Exchange* Data file in Excel to confirm availability of spreadsheet. Close Excel.

3. Double-click the ODBC Data Source icon to display "ODBC Data Source Administrator" dialog box. When ODBC Data Source Administrator dialog box appears, select User DSN tab. Double-click on highlighted "Network" tab.

4. Click Select Workbook… button to activate "Select Workbook" dialog box. Select desired Excel file (from completed sample run) and click OK button. Click OK button in "ODBC Microsoft Excel Setup" dialog box.

5. Click OK button in "ODBC Data Source Administrator" dialog box to close box and return to desktop main menu. This step completes the link to database file containing data from sampling run.

6. Double-click on the ScanSeek icon on laptop or personal computer or laboratory computer system to display the "ScanSeek Data Exchange" dialog box. All *Data Exchanges* configured for use on the handheld computer are listed in the "Active/Data Exchange Name" box. Place a check in box for selected *Data Exchange* (e.g., DAY1, DAY2, DAY3, DDAY1, DDAY2, etc.). If selected *Data Exchange* does not work properly or is not listed, please refer to SCMP-012 procedures II.B. to reconfigure an existing *Data Exchange* or add a new *Data Exchange*.

7. Place Palm handheld computer into cradle or attach serial/charge cable from the laptop or personal computer or laboratory computer.

8. Press HotSync button on front of cradle or tap HotSync icon on main menu screen of handheld computer. (Note: HotSync progress window should appear on desktop, and a similar screen should display on handheld computer.) Wait for software to display message indicating synchronization is complete. If transfer of *Data Exchange* does not occur, view detailed information on HotSync process to correct problems or refer to the HotSync chapter in Product Reference Guide.

C. Transferring Electronic Data from Central Office Staff to Laboratory Computer System

1. **Central office staff**: at the laboratory receiving area, check populated spreadsheet for transcription errors, spelling errors, missing information, or unusual spaces in front of character information. Review all dates and times for accuracy, and bottle numbers for proper codes and scanning sequence. After review, print two copies and have each participating field staff review for accuracy. If any modifications, additions, or deletions are necessary, make changes in the Excel file and save. In the event of information transmittal failure, backup hand written field sheets are to be used to provide information to the laboratory. Reprint two copies for each run sheet if necessary. Sampling staff and receiving laboratory staff must sign two copies of each run sheet for chain-of-custody purposes (see SCMP-006).

2. Click toolbar button labeled "HORIZON." The stream chemistry run Excel spreadsheet is automatically structured for submittal to HORIZON LIMS. This file is saved as individual spreadsheets to the desktop location on KHEL's receiving computer and to BOW's jump drive.

D. Downloading Stream Chemistry Data into HORIZON LIMS

1. KHEL receiving staff convert the structured spreadsheet to a comma-delimited file. The file is downloaded to HORIZON LIMS.

2. The samples are logged and assigned lab numbers by station; an official HORIZON Lab Receipt is generated. At this point, KHEL has official custody of sample network run data.

3. The Lab Receipt is printed (hardcopy) and an electronic form saved to BOW jump drive. Click the "Safely Remove Hardware" icon located in the System Tray line on desktop. A prompt will appear "Select the device to unplug?" Select "Mass Storage Device-Drive (F:)" and click "Stop" and remove USB jump drive.

Upon return to home office, transfer USB jump drive to stream chemistry program manager or a designated person. The manager (or designee) will upload data into an electronic tacking file that records the number and type of samples submitted to the laboratory for analysis.

4. Barcode labels will print for all submitted bottle types: "CHEM", "TOC," "HM", "DO," "NUT," "BACT" "PESTICIDES," "RADATION," and "TRITIUM" bottle labels. These labels display both bottle numbers and lab accession numbers. Once all the labels have been printed, the program will terminate after generating barcodes.

5. Sample laboratory receiving personnel affix printed labels to sequenced bottles by matching bottle number with label and bottle number with laboratory accession number. Lab labels are applied universally on all bottles near neck area so analyst can double check for accuracy when sequencing for sample analysis.

6. After affixing and correlating generated barcodes to submitted sample bottles, laboratory personnel distribute samples and field collection worksheets to component laboratories at KHEL for analysis.

APPENDIX C

STANDARDIZED FIELD SHEETS AND SAMPLE SUBMISSION FORMS

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FORM APP.C-1

ELECTRONIC NETWORK RUN TEMPLATE LABORATORY SAMPLE SUBMISSION FORM WITH CHAIN-OF-CUSTODY BLOCK

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
DIVISION OF ENVIRONMENT
DATA FORM

PROJECT: South Central-South

PROGRAM: Stream Chemistry

STA	LOCATION	NUM	FIELD DATE	DEPTH	CHEM	TOC	HM	DO	NH3	BACT	PEST	RAD	TRIT	TEMP	FIELD pH	SP COND	COMMENTS	COLLECTOR
SC038	White Water River near Towanda			0.1														
SC730	Cowskin Creek at Wichita			0.1							NO	NO	NO					
SC288	Cowskin Creek near Haysville			0.1							NO	NO	NO					
SC728	Arkansas River at Wichita			0.1								NO	NO					
SC201	Arkansas River near Derby			0.1								NO	NO					
SC280	Ninnescah River near Belle Plaine			0.1								NO	NO					
SP812	Ninnescah River near Belle Plaine			0.1								NO	NO					
SC527	Arkansas River near Oxford			0.1								NO	NO					
SC528	Slate Creek near Wellington			0.1								NO	NO					
SC529	Chikaskia River near Corbin			0.1							NO	NO	NO				Chl - a	
SC530	Bluff Creek near Caldwell			0.1							NO	NO	NO					
SC662	Fall Creek near Caldwell			0.1							NO	NO	NO					
SC663	Shoofly Creek near Hunnewell			0.1							NO	NO	NO					
SC218	Arkansas River at Arkansas City			0.1													Chl - a	
SC531	Grouse Creek near Silverdale			0.1							NO	NO	NO				Chl - a	
SP270	Silver Creek near Winfield			0.1								NO	NO					
SC532	Walnut River near Hackney			0.1								NO	NO					
STA	LOCATION	NUM	FIELD DATE	DEPTH	CHEM	TOC	HM	DO	NH3	BACT	PEST	RAD	TRIT	TEMP	FIELD pH	SP COND	COMMENTS	COLLECTOR
SC106	Walnut River at Gordon			0.1								NO	NO					
SC278	Walnut River near El Dorado			0.1								NO	NO					
SP833	West Branch Walnut River near El Dorado			0.1								NO	NO					

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FORM APP.C-2

ELECTRONIC NETWORK RUN LABORATORY SAMPLE SUBMISSION FORM WITH QA/QC STATIONS ADDED AND CHAIN-OF-CUSTODY BLOCK

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
DIVISION OF ENVIRONMENT
DATA FORM

PROJECT: South Central-South

PROGRAM: Stream Chemistry

STA	LOCATION	NUM	FIELD DATE	DEPTH	CHEM	TOC	HM	DO	NH3	BACT	PEST	RAD	TRIT	TEMP	FIELD pH	SP COND	COMMENTS	COLLECTOR
SC036	White Water River near Towanda	1		0.1														J. Scott S. Weber
SC730	Cowskin Creek at Wichita	2		0.1							NO	NO	ND					J. Scott S. Weber
SC288	Cowskin Creek near Haysville	3		0.1							NO	NO	ND					J. Scott S. Weber
SC729	Arkansas River at Wichita	4		0.1								NO	ND					J. Scott S. Weber
SC281	Arkansas River near Derby	5		0.1								NO	ND					J. Scott S. Weber
SC280	Ninnescah River near Belle Plaine	6		0.1								NO	ND					J. Scott S. Weber
SF912	Ninnescah River near Belle Plaine	7		0.1								NO	ND					J. Scott S. Weber
SC527	Arkansas River near Oxford	8		0.1								NO	ND					J. Scott S. Weber
SC526	Slate Creek near Wellington	9		0.1								NO	ND					J. Scott S. Weber
SC529	Chikaskia River near Corbin	10		0.1							NO	NO	ND				Chl - a	J. Scott S. Weber
SC530	Bluff Creek near Caldwell	11		0.1							NO	NO	ND					J. Scott S. Weber
SC662	Fall Creek near Caldwell	12		0.1							NO	NO	ND					J. Scott S. Weber
SC663	Shoofly Creek near Hunnewell	13		0.1							NO	NO	ND					J. Scott S. Weber
SC218	Arkansas River at Arkansas City	14		0.1													Chl - a	J. Scott S. Weber
SC531	Grouse Creek near Silverdale	15		0.1							NO	NO	ND				Chl - a	J. Scott S. Weber
SF270	Silver Creek near Winfield	16		0.1								NO	ND					J. Scott S. Weber
SC532	Walnut River near Hackney	17		0.1								NO	ND					J. Scott S. Weber
SC000	QC Sample Field Blank	18		0.1								NO	ND				After	J. Scott S. Weber
SC001	QC Sample Container Blank	19		0.1							NO	NO	ND					J. Scott S. Weber
STA	LOCATION	NUM	FIELD DATE	DEPTH	CHEM	TOC	HM	DO	NH3	BACT	PEST	RAD	TRIT	TEMP	FIELD pH	SP COND	COMMENTS	COLLECTOR
SC106	Walnut River at Gordon	20		0.1								NO	ND					J. Scott S. Weber
SC279	Walnut River near El Dorado	21		0.1								NO	ND					J. Scott S. Weber
SF933	West Branch Walnut River near El Dorado	22		0.1								NO	ND					J. Scott S. Weber
SC106_D	Walnut River at Gordon Duplicate	23		0.1								NO	ND					J. Scott S. Weber

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FORM APP.C-3

ELECTRONIC NETWORK RUN VIEWED ON HANDHELD COMPUTER DISPLAYING INDIVIDUAL STATION RECORD

FORM APP.C-4

HANDWRITTEN BACKUP NETWORK RUN FIELD SHEET LABORATORY SAMPLE SUBMISSION FORM WITH CHAIN-OF-CUSTODY BLOCK

PROJECT: SOUTH CENTRAL SOUTH RUN

KANSAS DEPARTMENT OF [illegible]LTH AND ENVIRONMENT
DIVISION OF [illegible]RONMENT
DATA FORM

PROGRAM: STREAM CHEMISTRY

STA	LOCATION	NUM	FIELD DATE	DEPTH	CHEM	TOC	HM	DO	NH3	BACT	PEST	RAD	TRIT	TEMP	FIELD pH	SP. COND.	COMMENTS	COLLECTOR
SC039	White Water River near Towanda	1	1035	0.1	4543	3875	3373	3707	3907	5257	2495	00833	0752	0	7.7	1551	A/C	J. Scott S. Weber
SC230	Gossip Creek at Wichita	2	847	0.1	4553	3877	3311	3828	4084	4930	NO	NO	NO	0	7.5	909	A/C	J. Scott S. Weber
SC265	Gossip Creek near Haverhill	3	912	0.1	4546	3885	3302	3821	4070	4941	NO	NO	NO	0	7.6	847	A/C	J. Scott S. Weber
SC229	Arkansas River at Wichita	4	9:45	0.1	4545	3887	3310	3823	4076	4918	2471	NO	NO	0	7.2	1654	A/C	J. Scott S. Weber
SC231	Arkansas River near Derby	5	18:52	0.1	4547	3883	3301	3827	4054	4925	2469	NO	NO	1	7.8	1608	A/C	J. Scott S. Weber
SC260	Ninnescah River near Belle Plaine	6	18:13	0.1	4548	4253	3305	3826	4077	4929	2468	NO	NO	0	7.8	1480	A/C	J. Scott S. Weber
SP812	Ninnescah River near Belle Plaine	7	17:52	0.1	4549	4242	3300	3802	4084	4935	2470	NO	NO	0	7.7	1491	CC/A/C	J. Scott S. Weber
SC527	Arkansas River near Oxford	8	17:12	0.1	4550	3874	3304	3825	4061	4912	2507	NO	NO	1	7.7	1532	A/C/	J. Scott S. Weber
SC529	Slate Creek near Wellington	9	16:37	0.1	4554	4211	3303	3822	4086	4946	2504	NO	NO	1	7.6	1520	A/C/ice	J. Scott S. Weber
SC530	Chikaskia River near Corbin	10	15:39	0.1	4555	3826	3306	3824	4063	4924	NO	NO	NO	1	7.6	811	[illegible]/A/C/[illegible]	J. Scott S. Weber
SC532	Bluff Creek near Caldwell	11	15:09	0.1	4557	4243	3302	3820	4096	4942	NO	NO	NO	1	7.7	1019	A/C	J. Scott S. Weber
SC692	Fall Creek near Oakland	12	14:52	0.1	4559	3871	3313	3818	4065	4939	NO	NO	NO	1	7.6	1319	A/C	J. Scott S. Weber
SC693	Shoofly Creek near Hunnewell	13	14:20	0.1	4560	4259	3308	3815	4091	4932	NO	NO	NO	1	7.4	1387	BA/C/[illegible]	J. Scott S. Weber
SC218	Arkansas River at Arkansas City	14	13:36	0.1	4561	4226	3317	3805	4135	4947	2505	00021	0117	0	7.7	1738	[illegible] 10%/A/C	J. Scott S. Weber
SC531	Grouse Creek near Silverdale	15	12:27	0.1	4564	3823	3309	3804	4132	4944	NO	NO	NO	1	7.5	529	[illegible] 30%/A/C	J. Scott S. Weber
SP270	Rock Creek near Winfield	16	11:54	0.1	5565	3872	3315	3806	4133	4938	2480	NO	NO	1	7.3	553	CC/A/C	J. Scott S. Weber
SC532	Walnut River near Mackinney	17	11:32	0.1	4566	3810	3312	3857	4134	4940	2483	NO	NO	1	7.7	935	A/C	J. Scott S. Weber
SC000	[redacted]	18	950	0.1	4544	3267	3577	3702	3903	5256	2486	NO	NO	0	6.8	17.1	AH# 729/BH# 46/11-1-13	J. Scott S. Weber
SC001	[redacted]	19	1105	0.1	4542	3864	3570	3709	3911	5252	NO	NO	NO	4	6.1	0.89	AH # 51/2-22-13	J. Scott S. Weber

STA	LOCATION	NUM	FIELD DATE	DEPTH	CHEM	TOC	HM	DO	NH3	BACT	PEST	RAD	TRIT	TEMP	FIELD pH	SP. COND.	COMMENTS	COLLECTOR
SC106	[redacted]	20	1020	0.1	4548	3801	3316	4003	4287	4945	2482	NO	NO	1	8.0	1331	Aug/Clear	J. Scott S. Weber
SC279	Walnut River near El Dorado	21	1100	0.1	4541	3862	3572	3710	3948	5261	2493	NO	NO	0	7.6	853	A/C/[illegible]	J. Scott S. Weber
SP033	West Branch Walnut River near El Dorado	22	1137	0.1	4540	4249	3742	3712	3714	5253	2494	NO	NO	1	7.6	939	CC/A/C	J. Scott S. Weber
SC106 D	[redacted]	23	1025	0.1	4563	3864	3314	4004	4297	4934	2481	NO	NO	0	8.0	1308	Duplicate	J. Scott S. Weber

CHAIN OF CUSTODY

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FORM APP.C-5

FINAL ELECTRONIC NETWORK RUN LABORATORY SAMPLE SUBMISSION FORM WITH COMPLETED CHAIN-OF-CUSTODY BLOCK

KANSAS DEPARTMENT OF HEA AND ENVIRONMENT
BUREAU OF ER
DATA FORM

PROJECT: South Central South Network Run

PROGRAM: STREAM CHEMISTRY

STA	LOCATION	NUM	FIELD DATE	DEPTH	CHEM	TOC	HM	DO	NH3	BACT	PEST	RAD	TRIT	TEMP	FIELD pH	SP. COND	COMMENTS	COLLECTOR
SC728	White Water River near Towanda	1	12/10/2013 10:35	0.1	4543CM	3875TC	3573HM	3707DO	3907NT	5257BC	7495OC	0003IRD	0752TT	0	7.7	1331	Avg/clear	J. Scott, S. Weber
SC730	Gowin Creek at Wichita	2	12/10/2013 8:47	0.1	4553CM	3877TC	3311HM	3828DO	4084NT	4930BC	ND	ND	ND	0	7.5	939	Avg/clear	J. Scott, S. Weber
SC728	Gowin Creek near Haysville	3	12/10/2013 9:12	0.1	4546CM	3885TC	3302HM	3821DO	4079NT	4941BC	ND	ND	ND	0	7.6	887	Avg/clear	J. Scott, S. Weber
SC729	Arkansas River at Wichita	4	12/10/2013 9:45	0.1	4545CM	3887TC	3312HM	3823DO	4076NT	4918BC	2471OC	NO	ND	0	7.8	1554	Avg/clear	J. Scott, S. Weber
SC731	Arkansas River near Derby	5	12/10/2013 10:53	0.1	4547CM	3883TC	3301HM	3827DO	4094NT	4925BC	2469OC	NO	ND	1	7.8	1608	Average/clear	J. Scott, S. Weber
SC289	Ninnescah River near Belle Plaine	6	12/10/2013 10:14	0.1	4548CM	4253TC	3305HM	3826DO	4077NT	4929BC	2468OC	ND	ND	0	7.8	1480	Average/clear	J. Scott, S. Weber
SP913	Ninnescah River near Belle Plaine	7	12/10/2013 12:52	0.1	4549CM	4242TC	3300HM	3807DO	4089NT	4915BC	2470OC	ND	ND	0	7.7	1491	Cr/avg/clr	J. Scott, S. Weber
SC727	Arkansas River near Oxford	8	12/10/2013 12:12	0.1	4550CM	3874TC	3304HM	3825DO	4061NT	4912BC	2507OC	ND	ND	1	7.7	1557	Average/clear	J. Scott, S. Weber
SC528	Dale Creek near Wellington	9	12/10/2013 16:37	0.1	4554CM	4211TC	3303HM	3827DO	4086NT	4945BC	2504OC	ND	ND	1	7.6	1520	Average/clear/ice covered	J. Scott, S. Weber
SC529	Chikaskia River near Grimes	10	12/10/2013 15:19	0.1	4555CM	3870TC	3306HM	3824DO	4063NT	4974BC	ND	ND	ND	1	7.6	811	Chl - a yst/average/clear/brake up	J. Scott, S. Weber
SC530	Bluff Creek near Caldwell	11	12/10/2013 15:05	0.1	4557CM	4243TC	3307HM	3820DO	4096NT	4942BC	ND	ND	ND	1	7.7	1076	Average/clear	J. Scott, S. Weber
SC532	Fall Creek near Caldwell	12	12/10/2013 14:52	0.1	4558CM	3871TC	3313HM	3818DO	4065NT	4829BC	ND	ND	ND	1	7.6	1319	Average/clear	J. Scott, S. Weber
SC661	Shoofly Creek near Hunnewell	13	12/10/2013 14:20	0.1	4560CM	4249TC	3304HM	3815DO	4091NT	4933BC	ND	ND	ND	1	7.4	1387	Below average/clear/polled	J. Scott, S. Weber
SC518	Arkansas River at Arkansas City	14	12/10/2013 13:46	0.1	4561CM	4278TC	3317HM	3805DO	4175NT	4942BC	2505OC	0002IRD	0517TT	0	7.7	1738	Chl - a <10%/average/clear	J. Scott, S. Weber
SC531	Grouse Creek near Silverdale	15	12/10/2013 12:27	0.1	4564CM	3873TC	3309HM	3804DO	4132NT	4944BC	ND	ND	ND	1	7.9	529	Chl - a 30%/average/clear	J. Scott, S. Weber
SP370	Silver Creek near Winfield	16	12/10/2013 11:54	0.1	4563CM	3877TC	3315HM	3806DO	4133NT	4939BC	2480OC	ND	ND	1	7.3	553	Cr/average/clear	J. Scott, S. Weber
SC532	Walnut River near Hackney	17	12/10/2013 11:32	0.1	4566CM	3870TC	3312HM	3847DO	4134NT	4940BC	2483OC	ND	ND	1	7.7	834	Average/clear	J. Scott, S. Weber
SC900	QC Sample Field Blank	18	12/10/2013 9:50	0.1	4544CM	3867TC	3322HM	3708DO	3903NT	5256BC	2486OC	NO	ND	0	6.8	17.1	After sr729/bele 6u/11-1-2013	J. Scott, S. Weber
SC901	QC Sample Container Blank	19	12/10/2013 11:05	0.1	4542CM	3868TC	3329HM	3709DO	3911NT	5252BC	ND	ND	ND	4	6.3	0.89	Blk61/2-22-2013	J. Scott, S. Weber
STA	LOCATION	NUM	FIELD DATE	DEPTH	CHEM	TOC	HM	DO	NH3	BACT	PEST	RAD	TRIT	TEMP	FIELD pH	SP. COND	COMMENTS	COLLECTOR
SC596	Walnut River at Gordon	20	12/10/2013 10:20	0.1	4568CM	3903TC	3318HM	4000DO	4287NT	4945BC	2482OC	ND	ND	1	8.0	1331	Avg/clear	J. Scott, S. Weber
SC579	Walnut River near El Dorado	21	12/10/2013 11:03	0.1	4541CM	3862TC	3322HM	3733DO	3948NT	5391BC	2495OC	ND	ND	0	7.6	853	Avg/clear/ice covered	J. Scott, S. Weber
SP833	West Branch Walnut River near El Dorado	22	12/10/2013 11:27	0.1	4540CM	4249TC	3342HM	3713DO	3914NT	5253BC	2494OC	ND	ND	1	7.8	439	Cr/avg/clear	J. Scott, S. Weber
SC596_D	Walnut River at Gordon Duplicate	23	12/10/2013 10:35	0.1	4567CM	3864TC	3314HM	4004DO	4297NT	4934BC	2481OC	ND	ND	0	8.0	1308	Duplicate	J. Scott, S. Weber

CHAIN OF CUSTODY

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FORM APP.C-6
FINAL ELECTRONIC LABORATORY RECEIPT SAMPLE SUBMISSION FORM WITH COMPLETED CHAIN-OF-CUSTODY BLOCK

Project: Stream Chemistry
Collector: J. Scott_S. Weber

3270

Kansas Department of Health and Department of Environment
Data Form

STA_	Location	Lab No	Field_Date	CHEM	TOC	HM	DO	NH3	BACT	PEST	RAD	TRIT	Temp	pH	Flow_Cond
SC038	Whitewater River At Towanda	13952	12/10/13 10:35	4543CM	3875TC	3573HM	3707DO	3907NT	5257BC	2495OC	00033R	0752TT	0	7.7	Avg/clear
SC730	Cowskin Creek at Wichita	13953	12/10/13 08:47	4553CM	3877TC	3311HM	3828DO	4084NT	4930BC				0	7.5	Avg/clear
SC288	Cowskin Crock In Wichita-	13954	12/10/13 09:12	4546CM	3885TC	3302HM	3821DO	4070NT	4941BC				0	7.6	Avg/clear
SC729	Arkansas River at Wichita	13955	12/10/13 09:45	4545CM	3887TC	3310HM	3823DO	4076NT	4918BC	2471OC			0	7.8	Avg/clear
SC281	Arkansas River At Derby	13956	12/09/13 06:52	4547CM	3883TC	3301HM	3827DO	4054NT	4925BC	2469OC			1	7.8	Average/clear
SC280	Ninnescah River Near Belle	13957	12/09/13 06:13	4548CM	4253TC	3305HM	3826DO	4077NT	4929BC	2468OC			0	7.8	Average/clear
SP912	Ninnescah River near Belle	13958	12/09/13 05:52	4549CM	4242TC	3300HM	3802DO	4089NT	4935BC	2470OC			0	7.7	Cc/avg/clr
SC527	Arkansas River near Oxford	13959	12/09/13 05:12	4550CM	3874TC	3304HM	3825DO	4061NT	4912BC	2507OC			1	7.7	Average/clear
SC528	Slate Creek near Wellington	13960	12/09/13 04:37	4554CM	4211TC	3303HM	3822DO	4086NT	4946BC	2504OC			1	7.6	Average/clear/ice covered
SC529	Chikaskia River near Corbin	13961	12/09/13 03:39	4555CM	3876TC	3306HM	3824DO	4063NT	4924BC				1	7.6	Chl - a unk/average/clear/broke ice
SC530	Bluff Creek near Caldwell	13962	12/09/13 03:09	4557CM	4243TC	3307HM	3820DO	4096NT	4942BC				1	7.7	Average/clear
SC662	Fall Creek near Caldwell	13963	12/09/13 02:52	4559CM	3871TC	3313HM	3818DO	4065NT	4939BC				1	7.6	Average/clear
SC663	Shoofly Creek near	13964	12/09/13 02:20	4560CM	4259TC	3308HM	3815DO	4091NT	4933BC				1	7.4	Below average/clear/pailed
SC218	Arkansas River Near	13965	12/09/13 01:36	4561CM	4226TC	3317HM	3805DO	4135NT	4947BC	2505OC	00021R	0117TT	0	7.7	Chl - a <10%/average/clear
SC531	Grouse Creek near Silverdale	13966	12/09/13 12:27	4564CM	3823TC	3309HM	3804DO	4132NT	4944BC				1	7.9	Chl - a 30%/average/clear
SP270	Silver Creek near Winfield	13967	12/09/13 11:54:	4565CM	3872TC	3315HM	3806DO	4133NT	4938BC	2480OC			1	7.3	Cc/average/clear
SC532	Walnut River near Hackney	13968	12/09/13 11:32:	4566CM	3810TC	3312HM	3857DO	4134NT	4940BC	2483OC			1	7.7	Average/clear
SC000	QC Sample Field Blank	13969	12/10/13 09:50	4544CM	3867TC	3577HM	3708DO	3903NT	5256BC	2486OC			0	6.8	After sc729/btl# 46/11-1-2013
SC001	QC Sample Container Blank	13970	12/10/13 11:05:	4542CM	3868TC	3570HM	3709DO	3911NT	5252BC				4	6.1	Btl#51/2-22-2013
SC106	Walnut River At Gordon	13971	12/09/13 10:20	4568CM	3801TC	3316HM	4003DO	4287NT	4945BC	2482OC			1	8	Avg/clear
SC279	Walnut River Near El Dorado	13972	12/10/13 11:00:	4541CM	3862TC	3572HM	3710DO	3948NT	5261BC	2493OC			0	7.6	Avg/clear/ice covered
SP933	West Branch Walnut River	13973	12/10/13 11:37:	4540CM	4249TC	3742HM	3712DO	3914NT	5253BC	2494OC			1	7.6	Cc/avg/clear
SC106_	Walnut River at Gordon	13974	12/09/13 10:25	4567CM	3864TC	3314HM	4004DO	4297NT	4934BC	2481OC			0	8	Duplicate

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APPENDIX D

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REFERENCES

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APPENDIX E

GLOSSARY OF TERMS

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accuracy - - the extent to which a measured value actually represents the condition being measured. Accuracy is influenced by the degree of random error (precision) and systematic error (bias) inherent in the measurement operation (e.g., environmental sampling and analytical operations).

activity - - an all inclusive term describing a specific set of operations or related tasks to be performed, either serially or in parallel (e.g., research and development, field sampling, analytical operations), that in total result in a product or service.

assessment - - the evaluation process used to measure the performance or effectiveness of a system and its elements. As used in this program QA management plan, "assessment" is an all-inclusive term used to denote audits, performance evaluations, management system reviews, internal reviews and related actions.

audit - - a systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.

automated external defibrillator (AED) - - a portable, battery powered lifesaving device employed by trained individuals in medical emergencies to correct a chaotic heart rhythm in an ill or injured person by subjecting the heart of said person to a controlled electrical shock.

bias - - the systematic or persistent distortion of a measurement process which causes errors in one direction (i.e., the degree to which the expected sample measurement is different from the true sample value).

calibration - - a comparison of a measurement standard, instrument, or item with a standard, instrument or item of higher accuracy to detect, quantify and report inaccuracies and to eliminate these inaccuracies through adjustments.

censored data - - a dataset containing data points whose measured properties are not present in an amount that can be reliably quantified and therefore accorded a specific code.

chain-of-custody - - an unbroken trail of accountability that ensures the physical security of samples, data and records.

comparability - - a measure of the confidence with which one item (e.g., data set) can be compared to another.

completeness - - a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

computer program - - a sequence of instructions suitable for processing by a computer. Processing may include the use of an assembler, compiler, interpreter, or translator to prepare the program for execution. A computer program may be stored on electrical, magnetic or optical media.

concurrent duplicate - - a surface water quality sample that is arbitrarily split by filling separate sample containers concurrently from the same sampling device to assess sample homogeity in the sample collection process.

container blank - - a clean water sample (e.g., distilled water) transferred directly to a randomly selected sample container in order to assess or monitor contamination resulting from sample containment.

corrective action - - any measure taken to rectify a condition adverse to quality and, if possible, to preclude its recurrence.

data performance criteria - - qualitative and quantitative statements that define the appropriate type of data and/or specify tolerable levels of potential decision errors. These criteria establish the quality and quantity of data needed to support decisions.

data quality assessment - - a scientific and statistical evaluation of a set of environmental data to determine the adequacy of the data for its intended use.

deficiency - - an unauthorized deviation from acceptable procedures or practices.

detection limit - - the lowest concentration of a target analyte that a given method or instrument can reliably ascertain and report as greater than zero.

document - - any written or pictorial information describing, defining, specifying, reporting or certifying activities, requirements, procedures or results.

duplicate samples - - paired samples collected at essentially the same time from the same site and carried through all assessment and analytical procedures in an identical manner. Duplicate samples are used to measure natural variability as well as the precision of a method, monitoring instrument, and/or analyst. More than two such samples are referred to as replicate samples.

ecoregion - - an ecologically distinctive geographical area, defined in the context of scale by a combination of landscape features such as climate, physiography, soils, vegetation or potential vegetation, geology, and land use.

environmental data - - the description of a physical medium (e.g., air, water, soil, sediment) or biological system expressed in terms of some measurable physical, chemical, radiological or biological characteristic or set of characteristics.

environmental monitoring program - - a planned and systematic operation for characterizing and environmental process or condition. For the purposes of this document, the term "program" refers to a major, ongoing or longer term environmental monitoring operation.

environmental monitoring project - - a planned and systematic operation for characterizing an environmental process or condition. For the purposes of this document, the term "project" refers to a smaller scale or shorter term environmental monitoring operation.

field blank - - a clean sample (e.g., distilled water) that is treated the same as samples collected in the field. Field blanks are submitted to the analyst along with other samples and are used to detect and quantify contamination incurred during sample collection, transport, storage, and analysis.

field spike - - a spiked sample prepared in the field. See spiked sample.

holding time - - an agreed upon, maximum interval of time in which a sample can be held under prescribed preservation methods.

independent assessment - - a quality assessment of an environmental monitoring program, project or system performed by a qualified individual, group, or organization that is not part of the program, project or system.

inspection - - examination or measurement of an activity to verify conformance with specific requirements.

internal assessment - - any quality assessment of the work performed by an individual, group, or organization, conducted by those overseeing and/or performing the work.

method - - a body of procedures for performing an activity in a systematic and repeatable manner.

method reporting limit (MRL) - - a minimum concentration of an analyte that can be measured within laboratory specified limits of precision and accuracy (cf., reporting limit).

nonparametric statistics - - procedures for organizing and interpreting numerical data that are free of any assumptions about the data distribution and do not require estimation of the variance, mean or other population parameters.

open database connectivity (ODBC) - - a computer interface that provides a seamless connection between a database-independent application and a target database.

parametric statistics - - procedures for organizing and interpreting numerical data that employ certain assumptions about the data distribution and require estimation of a least one population parameter.

peer review - - a critical review of a finding or document conducted by qualified individuals other than those who produced the finding or document but collectively equivalent in technical expertise.

performance evaluation - - a type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of a technician, analyst or laboratory.

precision - - the level of agreement among individual measurements of the same property, conducted under identical or similar conditions.

qualified data - - data that have been modified, adjusted or flagged in a data base following data validation procedures.

quality - - those features of a product or service that bear on its ability to meet the stated or implied needs and expectations of the user.

quality assurance (QA) - - an integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item or service is of the type and quality needed and expected by the user.

quality control (QC) - - the overall system of technical activities that measures the attributes and performance of a process, item or service against defined standards to verify that the process, item or service meets the stated requirements of the user.

quality management plan (QMP) - - a formal document that describes a quality management system in terms of the organizational structure, functional responsibilities, and planning, implementation and assessment of work.

record - - a document or portion thereof furnishing evidence of the quality of an item or activity, validated and authenticated as technically complete and correct. Records may include reports, photographs, drawings, and data stored on electronic, magnetic, optical or other recording media.

reference site - - a monitored site (e.g., stream location or segment) that is little impacted by urban, industrial or agricultural development or any other human enterprise. Reference sites serve as points or comparison of assessing the extent of human impact on the
ecological integrity of other sites in the same geographical area, drainage basin, or ecoregion.

relative percent difference (RPD - - a value calculated by subtracting the lower of two duplicate analyses from the higher, then dividing this difference by the average of the two analyses and multiplying the result by 100 to convert to percent difference.

replicate sample - - see duplicate sample.

reporting limit - - the lowest (or highest) concentration (or level) of a parameter that can be reliably reported by an individual analyst or laboratory based on the applied analytical method and instrumentation, the ability of the analyst or laboratory, and the effort devoted to the analytical determination.

representativeness - - a measure of the degree to which data accurately and precisely represent a selected characteristic of a monitored system.

reproducibility - - a measure of the degree to which sequential or repeated measurements of the same system vary from one another, independently of any actual change in the system.

sensitivity - - a measure of the capacity of an analytical method or instrument to discriminate between different levels of a variable of interest.

sequential duplicate - - a sequence of separate surface water quality samples (usually two) collected within minutes of each other at a specified location to assess variability among samples resulting from collection, processing transport, and laboratory preparation and procedures.

spiked sample - - a sample of water, air, soil, sediment, biological tissue or other material which is amended by the addition of a known amount of a given chemical element or compound. The measured concentration of the element or compound in the amended material is compared to the measured amount in the unamended material to provide a measure of analytical recovery and accuracy.

standard operating procedure (SOP) - - a written, formally approved document that comprehensively and sequentially describes the methods employed in a routine operation, analysis or action.

technical review - - a critical review of an operation by independent reviewers collectively equivalent in technical expertise to those performing the operation (cf., peer review).

thalweg - - a line defining the lowest points along the length of a stream bed or valley.

total maximum daily load (TMDL) - - an estimate of the maximum quantity of a given pollutant that may be added to a surface water body from all sources without violating established water quality criteria, minus a margin of error that accounts for, and corresponds to, the statistical uncertainty inherent in the loading estimate.

validation - - the establishment of a conclusion based on detailed evidence or by demonstration. This term is often used in conjunction with formal legal or official actions.