Water Resources Board Meeting
October 31, 2016
1:00 PM EDT
Training Room C
300 Sower Blvd
Frankfort, Kentucky 40601

1. Call Meeting to Order and Roll Call of Board Members
2. Introduction of Guests
3. Approve Minutes of September 29, 2016
4. Presentation by Peter Goodmann, Director, DOW and Bill Caldwell, Scientist, DOW – Looking Ahead to a Kentucky Water Resources Plan
5. Action Items and Reports
    a. Projects Profiles Report
6. Open Discussion for Board Members
7. Public Comment Period
8. Next Meeting

Water Resources Board
Draft Meeting Minutes
September 29, 2016

Board Members in Attendance: Earl Bush (County Judge Executives); Steve Coleman (KY Farm Bureau); Lloyd Cress, Jr. (KY League of Cities); John Dix (KRWA); Peter Goodmann (Proxy, EEC, Director DOW); Kevin Jeffries (Soil and Water Conservation Districts); Tom McKee (LRC); Kevin Rogers (KY Chamber of Commerce); Lance Terrell (Proxy, KDA); Steve Workman (Proxy, UK)

Board Members Absent: Dr. Nancy Cox (UK); Ryan Quarles (Commissioner Dept. of Agriculture); Charles Snavely (EEC Secretary);

Others in Attendance: Lowell Atchley (LRC); Jory Becker (DOW); Joe Cain (KY Farm Bureau); Bill Caldwell (KDOW); Annette Dupoint-Ewing (KMUA); Carey Johnson (DOW); Samantha Kaiser (DOW); Jim Kipp (KWRRI); Gary Larimore (KRWA); Haley McCoy (EEC); Kate Shanks (KY Chamber of Commerce); Chuck Taylor (KGS)

The meeting began at 1:05 p.m.

Call Meeting to Order and Roll Call of Board Members

Peter Goodmann called the meeting to order and led the roll call of Board members.

Introduction of Guests

Guests introduced themselves.

Approve Minutes of August 29, 2016

No changes were made to the meeting minutes from August.

Presentation by Chuck Taylor, Head, Water Resources Section, Kentucky Geological Survey – *Overview of Kentucky's Aquifers- The Framework for Groundwater Availability & Priority Groundwater Data and Research Needs- KGS Perspective*

Mr. Taylor gave a Power Point presentation regarding groundwater aquifers. He discussed several different types of aquifers and how porosity and permeability factors in storage capacity and flow rate. Characteristic of an ideal aquifer include the extraction rate and quantity of water needed for use; water quality suitable for intended uses; highly porous, permeable, and mostly homogenous geological material; geographic extensiveness; good saturated thickness and below elevation for base-level drainage; and enough recharge and groundwater storage to main sustainability. Kentucky is a topographically and geologically diverse state, which makes its aquifers equally as diverse. Due to different flow rates and paths of groundwater, this affects groundwater recharge, residence time, and quality. Kentucky's six aquifer systems by physiographic region are Jackson Purchase, Western Coal Field, Ohio River Alluvium, Mississippian Plateau Karst, Inner Bluegrass Karst, and Eastern Coal Field. Many aquifers are highly productive, but water quality may not be suitable. The diversity and complexity of fractured and karst aquifers contribute to difficulty in mapping aquifers, quantifying their hydrologic properties, and assessing groundwater availability.

All groundwater data collected in Kentucky is accessible by the Groundwater Data Repository (GWDR). KGS identified four priority groundwater data and research needs: (1) Kentucky needs a statewide long-term groundwater observation network (KGON). KGS is currently working to rebuild the KGON, but long-term maintenance, expansion, or enhancement of the network and data-collection activities will require additional outside funding and partnership. (2) More quantitative data on aquifer yield and hydraulic properties. KGS has preliminary data from the Jackson Purchase Area, but additional well monitoring and data collection is needed. (3) Aquifer delineation and mapping, improved groundwater availability assessment, and resource development and management. Currently DOW and KGS are working on a proposal for a pilot-scale project for aquifers used by permitted groundwater suppliers. A publicly-accessible aquifer test archive database will be accessible in the future through a KGS website currently being built. (4) Development of improved groundwater management tools. This may involve the creation of groundwater flow models or well-hydraulic response simulation tools that can help predict groundwater availability and sustainability. This objective will depend on data from previous items discussed.

Due to time constraints, the presentation by Peter Goodmann, Director, DOW, and Bill Caldwell, Scientist, DOW– *A Kentucky Water Resources Plan* will be given at the next meeting.

Action Items and Reports

There were no additional details to discuss. The sub-committee will meet prior to the next meeting to prioritize projects.

Open Discussion for Board Members

The Board again indicated interest in a presentation on funding sources, and to discuss the differences between State Cost Share Funds (SCS) and State Revolving Funds (SRF). A member from the Army Corps of Engineers will be invited to a future meeting. During that same meeting the Board would also like to discuss jurisdiction of the waters of the Commonwealth. The Board would like to discuss how the Water Resources Development Act will affect Kentuckians if the bill passes.

Public Comment Period

No public comments were made.

Next Meeting 1:00 PM – October 31, 2016 Training Room C

The meeting adjourned at 3:22 p.m.

DRAFT

Project Profiles Summaries

Applicant: Kentucky Climate Center, WKU

Project Profile: WKU-1

Title: The Kentucky Mesonet Station Acquisition and Installation

The project will create a pool for matching funds to be used to fund new Mesonet sites. Local/stakeholder match will be a 40 percent share of a $25,000 cost plus an annual O and M commitment of $4,000 per year. The project has a 5 year timeline and an annual cost of $45,000 per year placed into a matching funds pool.

Project Profile: WKU-2

Title: Kentucky Mesonet Soil Monitoring

The project will expand the Mesonet soil moisture monitoring network from 13 sites to 67 sites across Kentucky. Soil moisture and temperature data will be collected and be made publicly available on an hourly basis. Data will be provided to the National Weather Service to support flood and flash flood forecasting. Data will also be used in drought monitoring and other water resources management projects and applications.

The project has a 2-year timeline and an annual cost of $36,000 per year. This project is retrofitting existing Mesonet sites with soil moisture monitoring capability.

Project Profile: WKU-3

Title: Kentucky Mesonet Precipitation Monitoring

This project will replace aging weighing-bucket precipitation gages that are approaching the end of their useful service life. These are the most expensive pieces of equipment at a Mesonet station. Current KADF grant is funding 25 gages on a one to one match. This project will enable the purchase of an additional 40 gages. The project has a 2-year timeline with an annual cost of $124,000 per year with an estimated need of 50 percent match.

Project Profile: WKU-4

Title: Summaries, Forecasts and Outlooks

The project will develop a service to provide customized weather and climate summaries, forecasts and outlooks via a multi-media information gateway. Users will be able to access locally accurate information tailored to their decision making needs. The service will utilize the Kentucky Mesonet and WKU's meteorology program to provide this service to various

economic sectors including agriculture and water managers. Users will subscribe or contract for customized services.

The project has a 2-year timeline and an estimated cost of $200,000 per year. It is expected that an ongoing revenue stream from subscriptions, contracts and sponsorships will cover operating costs. Primary costs during start-up will be associated with hiring of staff and student interns.

Applicant: US Geological Survey

Project Profile: USGS-1

Title: Agricultural and drought data management and integration application for Kentucky

This project will create a web-based tool that will gather critical weather, climate, hydrological, soil and other information into one informative tool. The tool will compile and integrate data from various Kentucky-specific sources to assist in water resource planning and management with a focus on agricultural drought and impacts to supplies and demands for water.

USGS will host the web application at no additional cost for a period of 5 years or until superseded by a newer tool. The project timeline is one year at a cost of $40,000. Cooperative funds from USGS are not available at this time and there are no equipment costs whereby USGS could contribute and offset the cost; therefore we are seeking $40,000 for salary only.

Project Profile: USGS-2

Title: Streamflow gaging stations in critical areas with existing data gaps

This project is will construct and operate for 3 years 5 stream gages within a 22 county area of Kentucky. The stream gage will be located in watersheds that are identified as gaps in the current statewide coverage with a focus on collecting hydrologic information in agricultural and rural water sheds. Where possible gages will be collocated in watersheds that contain a KGS groundwater observation well to supply data to compute groundwater recharge and stream baseflow.

The project has a timeline of 3 years at an annual average cost of $90,000 per year. USGS will contribute $60,000 in equipment and labor for a final remaining annual funding request of $210,000, or $70,000 per year.

Project Profile: USGS-3

Title: Water Quality Monitoring stations to better quantify nutrient loading from Kentucky

The project will construct and operate for 3 years, 2 water quality "super gages" near the mouths of the Kentucky and Salt River basins. Additionally the USGS proposes the continuation of the 2 existing water quality gages for one year (located at the mouth of the Green River and on the Ohio River. The gages will collect standard water quality parameters including nitrate. Phosphorus will be continuously measured on the Kentucky River only.

Total costs for a 3 year timeline is $830,000. See Breakdown on the long-form profile.

Applicant: Kentucky Geological Survey

Project Profile: KGS-1

Title: Kentucky Groundwater Observation Network

This project is intended to provide support needed for statewide groundwater-level data collection by the KGS for the ongoing installation, operation and maintenance of wells included in the KGS Groundwater Observation Network. Continuous collection of groundwater data for a period of at least 5 years is needed to build a period of record of sufficient length to identify seasonal and longer-term trends in groundwater levels. This project will focus on upgrading data transmission to a satellite based system, and construction of up to 10 new wells in critical locations where existing wells are unsuitable for use. All data collected will be publicly accessible with a special website created to display hydrographs of groundwater fluctuations in each well.

Project timeline is 3 years with an estimated annual cost of $122,000 per year. See detailed budget in the long-form profile.

Project Profile: KGS-2

Title: A Groundwater Withdrawal Assessment Tool for the Jackson Purchase Region

This project will develop an online tool to assess the effects of high-yield withdrawals on groundwater resources in the Jackson Purchase region. The tool will allow a user to evaluate aquifer response (drawdown) from a groundwater withdrawal by specifying specific inputs such as well location, well depth and pumping rate. The tool will calculate drawdown using analytical solutions that fit the hydrogeological characteristic for the area. The online tool will be provided through an interactive web based tool that will allow the user to see the aquifer responses form a withdrawals as images and animations that are easily understood.

The anticipated deliverables are an online tool, a report and a flyer for publicizing the tool. The project timeline is 12 months with a total cost of $75,000.

Applicant: Steve Higgins/University of Kentucky

Project Profile: UK-1

Title: Stormwater Management, Water Harvesting, and the LEAF Program

The project will implement stormwater management and water harvesting practices at regional demonstration hubs, which will be utilized as demonstration and educational sites for the LEAF Program.

Stormwater management and water harvesting are two complementary practices that can help to reduce the amount of runoff, erosion, and offsite delivery of nutrients that are often associated with production areas. Currently, efforts are underway to develop the LEAF program which will include these two practices as a part of an integrated farm management strategy that includes topics such as: Farm organization and planning, soil management, crop health and protection, pollution control, animal science, energy efficiency, water management, and community engagement. The main goal of stormwater management, water harvesting, and the LEAF Program in general will be to reduce the potential environmental impact of agriculture while improving community relations and the economic viability of Kentucky's agriculture sector.

The project duration is variable and project-specific as is the estimated costs, which can range form $20,000 to $130,000. Project match is variable as well. Dr. Higgins will be available to summarize this profile.

PROJECT PROFILE

KENTUCKY WATER RESOURCES BOARD

Applicant Name/Organization Stuart A. Foster and Rezaul Mahmood, Kentucky Climate Center

Project Working Title – Kentucky Mesonet Station Acquisition and Installation

Introduction (What issues/needs will this project address)

Locally accurate and reliable weather and climate data are valuable for farmers, administrators, and policy makers in regard to agricultural management. The Kentucky Mesonet has become a valuable source of such data and there is local demand for the addition of new stations in various parts of the state. This project would provide assistance to local governments and stakeholder groups seeking to fund a mesonet station to serve their needs.

Project Summary

The project would set up a matching fund pool to cover the cost for acquisition and installation of a new mesonet station, including the option for soil monitoring probes. The present cost for acquiring and installing a new station is estimated at $25,000. (This cost reflects the latest changes in the suite of instrumentation.) Local governments and/or stakeholder groups would be required to provide 40% ($10,000) of the acquisition and installation cost and then commit to providing assistance for ongoing operations and maintenance, currently estimated at $4,000/year.

Project Deliverables and Benefits to Agricultural and Rural Communities

The Kentucky Climate Center will install, operate, and maintain new Kentucky Mesonet monitoring stations and provide services to support agriculture and local communities. This will include providing publicly accessible data and information via the Kentucky Mesonet website.

Budget Summary

(Project Duration and estimated cost per year)
This will be scheduled as a 5-year project with an estimated cost of $45,000/year placed in a matching funds pool.

(Project Timeline and Milestones)
Gauges will be installed in conjunction with regularly schedule site maintenance passes. The project will begin on 7/1/2017 and conclude on 6/30/2022.

(Estimated Percent Matching Funds Needed)
Each station installation will draw $15,000 from the pool and require local governments and/or stakeholder groups to match this with $10,000 and a commitment for annual operating and maintenance support.

PROJECT PROFILE

KENTUCKY WATER RESOURCES BOARD

Applicant Name/Organization Stuart A. Foster and Rezaul Mahmood, Kentucky Climate Center

Project Working Title – Kentucky Mesonet Soil Monitoring

Introduction (What issues/needs will this project address)

Crop development and field operations are affected by soil moisture. Operational decision making concerning the irrigation of crops can be optimized by having representative data regarding soil moisture. Likewise, soil moisture data can provide early indications of soil moisture deficits that can evolve into drought. In the midst of drought, soil moisture data help to measure field response to precipitation events. This project will expand soil monitoring capabilities of the Kentucky Mesonet.

Project Summary

The Kentucky Mesonet is in the process of expanding the number of stations that include soil monitoring. Currently, soil probes are installed at 13 of the 67 Kentucky Mesonet sites. While most sites are suitable for soil monitoring, a small number are not. This project would install soil probes at 40 additional sites. Where possible, probes will be installed according to USDA NRCS standards, requiring a set of five probes at depths from 2 inches to 40 inches.

Project Deliverables and Benefits to Agricultural and Rural Communities

With each new set of soil probes that is installed, the Kentucky Mesonet will ensure the collection and provision of accurate soil moisture and soil temperature data at hourly intervals. Data will be publicly available and will be provided to the National Weather Service to support forecasting for floods and flash floods. Data will also be used to support drought monitoring.

Budget Summary

(Project Duration and estimated cost per year)
This will be scheduled as a 2-year project with an estimated cost of $36,000/year, which includes the cost of probes, shipping, and materials for installation.

(Project Timeline and Milestones)
Gauges will be installed in conjunction with regularly schedule site maintenance passes. The project will begin on 5/1/2017 and conclude on 4/30/2019.

(Estimated Percent Matching Funds Needed)
Full funding is appropriate for this project.

PROJECT PROFILE

KENTUCKY WATER RESOURCES BOARD

Applicant Name/Organization Stuart A. Foster and Rezaul Mahmood, Kentucky Climate Center

Project Working Title – Kentucky Mesonet Precipitation Monitoring

Introduction (What issues/needs will this project address)

Effective water resources management begins with accurate and locally representative precipitation data. Operational decision making requires information regarding total precipitation and intensity of precipitation produced by individual storm events. Strategic decision making demands accurate climatological precipitation information, including averages and frequencies of extreme wet and dry periods. This project will upgrade precipitation measurement capabilities of the Kentucky Mesonet.

Project Summary

The Kentucky Mesonet is in the process of replacing its original weighing-bucket precipitation gauges that are rapidly approaching the end of their useful service. At $6,036.50, these gauges and accessories are the most expensive piece of meteorological equipment comprising a mesonet station. We currently, have a KADF grant that will enable us to purchase 25 gauges based on a one-to-one match. Beyond this, we have 40 stations that will still need a new gauge, and this project will enable the purchase of those gauges.

Project Deliverables and Benefits to Agricultural and Rural Communities

With each new gauge that is installed, the Kentucky Mesonet will ensure the collection and provision of accurate precipitation data with observations every 5 minutes. Precipitation data will be aggregated to provide summaries, including hour, daily, and monthly totals. Data will be publicly available and will be provided to the National Weather Service to support forecasting for floods and flash floods. Data will also be used to support drought monitoring.

Budget Summary

(Project Duration and estimated cost per year)
This will be scheduled as a 2-year project with an estimated cost of $124,000/year, which includes the cost of gauges, shipping, and materials for installation.

(Project Timeline and Milestones)
Gauges will be installed in conjunction with regularly schedule site maintenance passes. The project will begin on 9/1/2017 and conclude on 8/31/2019.

(Estimated Percent Matching Funds Needed)
We estimate the need for 50% matching funds.

PROJECT PROFILE

KENTUCKY WATER RESOURCES BOARD

Applicant Name/Organization Stuart A. Foster and Rezaul Mahmood, Kentucky Climate Center

Project Working Title – Summaries, Forecasts, and Outlooks

Introduction (What issues/needs will this project address)

Farmers and water managers have access to a wide range of data from various environmental monitoring networks ranging from the local to the national scale. However, effective operational and strategic decision making depends upon extracting useful and usable information from those data, and this can sometimes be overwhelming. There is a need for a service that tailors and customizes information to the local needs of users engaged in agriculture and water management.

Project Summary

The Kentucky Climate Center will develop a service to provide customized weather and climate summaries, forecasts, and outlooks via a multi-media information gateway. This service will leverage the Kentucky Mesonet and WKU's meteorology program, and it will integrate data and information from various state and federal sources. Products will be designed for various economic sectors, including agriculture and water managers, and will be delivered via a website, mobile app, and text/e-mail alerts. Users will subscribe or contract for customized services.

Project Deliverables and Benefits to Agricultural and Rural Communities

Users will be able to access locally accurate information tailored to their decision making needs so that they can make better informed management decisions.

Budget Summary

(Project Duration and estimated cost per year)
This will be scheduled as a 2-year project start-up with an estimated cost of $200,000/year. The primary costs during the start-up phase will be associated with hiring staff and student interns.

(Project Timeline and Milestones)
The project will begin on 7/1/2017 and conclude on 6/30/2019. This project is expected to develop an ongoing revenue stream from user subscriptions, contracts, and sponsorships to cover operating costs.

(Estimated Percent Matching Funds Needed)
We estimate the need for 50% matching funds.

PROJECT PROFILE: USGS-1

KENTUCKY WATER RESOURCES BOARD

Applicant Name/Organization __US Geological Survey

Project Working Title

Agricultural and drought data management and integration application for Kentucky

Introduction (What issues/needs will this project address)

Environmental data of all types is commonplace in Kentucky and across the Nation; however, this data typically exists in isolated databases, does not work in unison, and is difficult to interpret (much data with little information). This lack of integrated data has created several problems in that data gaps are not easily identified, it is difficult of optimize data-collection efforts / networks, and it makes it very difficult to mitigate issues (such as drought, irrigation needs, etc.) without extensive data analysis. The USGS, along with collaborative partners at the Kentucky Farm Bureau, identified many of the critical data sources available in Kentucky and compiled them into one place (http://ky.water.usgs.gov/projects/ky_ag_monitoring_committee/Farm_Bureau_Page/KFB6.html); however, the data sources provided still do not summarize the data into a format that would allow the agricultural community to make better / more informed decisions – especially regarding drought mitigation.

Given this, the USGS proposes to create an integrated web-based tool that would take critical pieces of information from all applicable sites and integrate this data into one informative tool. A similar concept has been available in the Commonwealth of Pennsylvania for many years and, for example, integrates the Palmer Drought Severity Index (PDSI), precipitation totals, streamflow, and groundwater levels into one color-coded tool that is linked to the PA drought-mitigation plan's prescribed actions. This tool is available for viewing at: http://pa.water.usgs.gov/drought/. A Kentucky based web tool will be scalable to display correctly on mobile platforms (phones); however, for the initial creation of the tool, development will be based on concept of the user accessing the tool primarily via the internet.

Given that Kentucky agriculture is more impacted by agricultural drought than hydrologic drought. USGS will consult with our partners across the state to focus on that issue while compiling this data and programming the tool; parameters such as soil moisture and crop-based indexes will likely take on a greater role in Kentucky's tool as this type of parameter will more likely drive agricultural management and(or) mitigation strategies. A second component to this tool will be obtaining / utilizing critical variables to solve a basic water-budget equation in critical areas; a water budget will allow water-resources managers to determine regional "supply and demand". The water-budget equation is simply:

Precipitation = Evapotranspiration (ET) + Streamflow (Q) + Groundwater change (GW) + Soil Moisture change (SM) + Reservoir Storage change (RSV) + Diversions

While expected to be fully functional, this tool is expected to evolve over time as further inputs / contributions are obtained and noted and the initial deliverable will be considered a "beta" version from which to base future efforts. Where the water-budget equation cannot be solved, or a critical piece of data is missing, a data gap exists that may be identified as a priority for future action if within a critical area of Kentucky and the tool will omit the missing value or, if possible, replace it with a lesser, but appropriate replacement. Computer code will be fully documented and publically available to share with our partners on the USGS GitHub site or equivalent (https://github.com/usgs).

Project Summary

The USGS will coordinate with our partners at the National Weather Service, Kentucky Geological Survey, Kentucky Climate Center (WKU), and others (typically the partners within the Kentucky Agriculture Science and Monitoring Committee) to identify, gain consensus on, key parameters and conceptual needs for the tool (in some cases there are several competing data sources / indexes).

The USGS will then program these identified / critical parameters into a live web-based tool and host it on the USGS web server (sharing with any / all others); live meaning that the web site will retrieve data from other sites (typically via web services) and process it for use, as possible, without requiring user inputs for all but ancillary functions (viewing different displays, etc.). The USGS will use modern coding techniques comparable to the used by the major news outlets including (but not limited to) such technologies as "Data-Driven Documents" or "D3" Javasripting (https://d3js.org/) that is widely used by "Nature", "the New York Times", and others for their on-line publications. Computer code will be fully documented and publically available on the USGS GitHub site or equivalent (https://github.com/usgs).

Project Deliverables and Benefits to Agricultural and Rural Communities

The project deliverable will be a web-based tool that will be publically accessible and will compile / integrate data from various Kentucky-specific sources to assist in water-resource planning and utilization with a focus on agricultural drought and also supply and demand. The tool will be web-based and primarily accessible via the internet, but it will be scaled to display properly and be functional on a mobile device (iPhone, Android, etc.). Agricultural communities will benefit as this tool will convert data into information and allow much better planning and mitigation of climate-related issues; as noted, there is precedent for similar tools elsewhere in the Nation, so this concept (with the exception of the focus on agricultural drought) is not entirely new.

Budget Summary

(Project Duration and estimated cost per year)

The project duration is for one year and the cost is $40,000. USGS will host this tool, at no additional cost, on the USGS web site for a period of no less than 5-years or until superseded by a newer tool. Additional / future modifications to the code (after final acceptance of the tool) are not included in hosting.

(Project Timeline and Milestones)

FY17 (October 1, 2016 to December 31, 2017)

Milestones –

1) Immediately - Meet with KFB Water Management Working Group and our partners within the Kentucky Agriculture Science and Monitoring Committee and identify key components of concern to producers and various scientists.
2) Within 6-8 months - Code draft tool
3) Submit for comment
4) Within 3 months of comment period - Revise
5) 14 months - Publish

(Estimated Percent Matching Funds Needed)

USGS does not have cooperative matching funds available until Fiscal year 2018 and there are no equipment costs whereby USGS could contribute and offset the cost; therefore, we are seeking $40,000 for salary only.

PROJECT PROFILE: USGS-2

KENTUCKY WATER RESOURCES BOARD

Applicant Name/Organization __US Geological Survey

Project Working Title

Streamflow gaging stations in critical areas with existing data gaps

Introduction (What issues/needs will this project address)

Quantification of a basic water budget is the cornerstone for most hydrologic tools and decision making; understanding and managing water resources is heavily dependent on understanding streamflow in critical areas. Streamgages provide water-quantity information but also provide critical data to compute groundwater recharge, baseflow to streams, and runoff (through analysis of the streamflow over time, these parameters are easily determined). This information is critical when apportioning precipitation into the various components that will be utilized by Kentucky's agricultural community (groundwater, soil moisture, streamflow, and so forth).

A water budget is a basic equation given by:

Precipitation = Evapotranspiration (ET) + Streamflow (Q) + Groundwater change (GW) + Soil Moisture change (SM) + Reservoir Storage change (RSV) + Diversions

Project Summary

The USGS proposes to construct, and operate for 3 years, 5 streamgages within a 22 county area of Kentucky. These gages will collect, and transmit over the USGS satellite network, streamflow (in cubic-feet per second) and water level.

Installation, equipment, and operation costs in the first year include all site-design, reconnaissance, and other work to successfully locate, install, and operate a viable USGS streamgage. USGS has extensive experience with the construction and operation of streamgages and, currently, USGS operates over 200 gages within the Commonwealth of Kentucky – some locations dating back over 100 years (such as the Cumberland River at Cumberland Falls gage).

Discharge at a streamgage is typically derived by means of a stage discharge rating which is developed from data collected by a stage sensor and a range of discharge measurements made with an acoustic Doppler velocity meter and(or) current meter. USGS crews will regularly measure the streamflow and validate the stage discharge rating once it has been established.

Project Deliverables and Benefits to Agricultural and Rural Communities

Streamflow and water level data collected at 15 minute intervals. These data will be available in near-real-time via the web as provisional data. Hydrographers will quality assure and update the web with a final, approved data set at regular intervals throughout the year.

Agricultural and rural communities benefit from these data which provide an important piece of the water budget puzzle. Additionally, these gages supply data to compute groundwater recharge, baseflow to streams, can be used to develop flood forecasts/warnings, and they capture runoff.

Budget Summary

(Project Duration and estimated cost per year)

Costs noted below are noted by 12-month water year (October 1 to September 30). Partial years will be prorated as applicable and(or) work will be appended to end of timeline to yield full years of data.

Streamgages – Year 1

INSTALLATION, EQUIPMENT, AND OPERATION COSTS – 5 STREAMGAGES $130,000

Streamgages – Year 2

OPERATION AND MAINTENANCE - 5 STREAMGAGES $70,000

Streamgages – Year 3

OPERATION AND MAINTENANCE - 5 STREAMGAGES $70,000

SUMMARY

TOTAL 3-YEAR COSTS $270,000

(Project Timeline and Milestones)

FY2017 (Water year is October 1, 2016 thru September 30, 2017)

Installation of 5 streamgages and 12 months O&M for each of those gages

FY2018 (Water year is October 1, 2017 thru September 30, 2018)

12 months O&M for 5 streamgages

FY2019 (Water year is October 1, 2018 thru September 30, 2019)

12 months O&M for 5 streamgages

(Estimated Percent Matching Funds Needed)
USGS contributions:
Equipment and labor contributing to the installation of 5 streamgages = $60,000

Remaining funds needed:
$210,000

PROJECT PROFILE: USGS-3

KENTUCKY WATER RESOURCES BOARD

Applicant Name/Organization __US Geological Survey

Project Working Title

Addition of USGS water-quality monitoring stations or "super gages" to better quantify nutrient loading from Kentucky

Introduction (What issues/needs will this project address)

In 2013, the USGS and the Kentucky Governor's Office of Agricultural Policy (GOAP), began a study to gain defensible data and improve the understanding of nutrient loading from Kentucky by increasing the number of real-time, continuous water-quality monitors present in the region; these GOAP / USGS funded, real-time, monitoring stations, coupled with existing USGS monitoring stations (called "super gages") bracket the Ohio River as it contacts Kentucky (overall contributions from the Commonwealth) as well as the Green and Licking Rivers (agriculture-dominated basins). Monitoring efforts at these sites help provide a more definitive answer to the questions: "What are Kentucky's specific contributions to nutrient loads in the Mississippi River Basin?", "Where are the nutrients actually coming from?", and "Are river conditions getting better or worse?"

Nutrient loads from these basins are now better understood and are, often, lower than those predicted with models derived from previously limited discrete data sources from the Commonwealth of Kentucky. However, two key drivers still need to be better understood / monitored; first, the loads from the Kentucky River (known for natural geologically-derived phosphorus) and, second, the Salt River (draining the Louisville Metropolitan area and subject to urban / suburban nutrient loading). Understanding the nutrient contributions from these basins will paint a more complete picture of the specific contributions to nutrient loads in the Mississippi River Basin from Kentucky's major river basins.

Project Summary

The USGS proposes to construct and operate for 3-years, 2 water-quality "super gages" near the mouths of the Kentucky and Salt River basins, respectively. Additionally, the USGS proposes the continuation of the operation of 2 existing water-quality "super gages" for 1-year. These "super gages" are located near the mouth of the Green River and on the Ohio River (flowing into Kentucky). These gages will collect, and transmit over the USGS satellite network, streamflow (in cubic-feet per second), field parameters (temperature, dissolved oxygen, specific conductance, turbidity, and pH), and nitrate. Phosphorus concentrations will be measured continuously on the Kentucky River only.

Installation, equipment, and operation costs in the first year include all site-design, reconnaissance, and other work to successfully locate, install, and operate a viable USGS super gage. USGS is very experienced in the construction and operation of these stations and, currently, operates over 200 streamflow gages within the Commonwealth of Kentucky – some locations dating back over 100 years (such as the Cumberland River at Cumberland Falls gage).

Discharge at a super gage is typically derived by means of acoustic Doppler velocity meters and(or) radar-based non-contact systems. USGS crews will regularly measure the streamflow manually with boat-mounted systems to "rate" and validate this streamflow data.

Water-quality data from USGS real-time monitoring stations also undergoes vigorous quality control / quality assurance checks including the collection of discrete samples to ensure the real-time monitors are operating correctly and collecting data that is representative of the entire cross-section of the river (most large rivers are not well mixed and this step is critical). Sampling and analysis cost for the QA/QC discrete samples, as well as other operational processes, is included in the operation and maintenance cost presented herein.

All USGS data (including those proposed herein) are presented in near real time on various, easily-accessible web-based platforms. USGS WaterWatch is a more graphical interface that serves to better place local data into a regional or National context (http://waterwatch.usgs.gov/new/) while USGS NWISWeb is more data-driven and designed to serve data for scientific studies and(or) incorporation into other applications (http://waterdata.usgs.gov/nwis). Loads are then simply derived as the product of streamflow and constituent concentration (instantaneous, daily, annual, etc.).

Project Deliverables and Benefits to Agricultural and Rural Communities

Project deliverables include defensible, quality controlled, real-time streamflow and water-quality data to answer the questions: "What are Kentucky's specific contributions to nutrient loads in the Mississippi River Basin?", "Where are the nutrients actually coming from?", and "Are river conditions getting better or worse?" Without these USGS data, actual nutrient contributions to the Mississippi River Basin, as well as their origins, remain somewhat speculative, do not accurately account for spatial variability in soils, regional agricultural practices, local geology, or other factors that are generally not accounted for in regional models where there is a significant lack of local data to calibrate / validate those approaches.

Budget Summary

(Project Duration and estimated cost per year)
Costs noted below are noted by 12-month water year (October 1 to September 30). Partial years will be prorated as applicable and(or) work will be appended to end of timeline to yield full years of data.

Establishment – Year 1

INSTALLATION, EQUIPMENT, AND OPERATION COSTS – KENTUCKY RIVER	$211,500
INSTALLATION, EQUIPMENT, AND OPERATION COSTS – SALT RIVER	$168,500
YEAR 1 TOTAL $380,000	

Water Quality – Year 2

OPERATION AND MAINTENANCE - KENTUCKY RIVER	$91,000
OPERATION AND MAINTENANCE - SALT RIVER	$77,000
YEAR 2 TOTAL $168,000	

Water Quality – Year 3

OPERATION AND MAINTENANCE - KENTUCKY RIVER	$81,000
OPERATION AND MAINTENANCE - SALT RIVER	$67,000
OPERATION AND MAINTENANCE - OHIO RIVER (FLOWING INTO KENTUCKY)	$67,000
OPERATION AND MAINTENANCE - GREEN RIVER	$67,000
YEAR 3 TOTAL $282,000	

SUMMARY
TOTAL 3-YEAR COSTS $830,000

(Project Timeline and Milestones)
FY2017 (Water year is October 1, 2016 thru September 30, 2017)
Install plus 3 months O&M of gage, nitrate sensor, phosphorus sensor (Kentucky River only), and 5-parameter water-quality sonde near the mouths of the Kentucky River and Salt River

FY2018 (Water year is October 1, 2017 thru September 30, 2018)
12 months O&M of gage, nitrate sensor, phosphorus sensor (Kentucky River only), and 5- parameter water-quality sonde near the mouths of the Kentucky River and Salt River

FY2019 (Water year is October 1, 2018 thru September 30, 2019)
12 months O&M of gage, nitrate sensor, phosphorus sensor (KY River only), and 5- parameter water-quality sonde near the mouths of the Kentucky, Salt, and Green Rivers and on the Ohio River (flowing into Kentucky).

Note that, due to the high cost certain sensors required for this project, USGS may have limited access to back up nitrate and phosphorus sensors (other sensors / equipment, as noted above, are in stock for immediate replacement if required); while every means will be taken to protect sensors from damage (barge impacts, etc.) these sensors are installed in a harsh environment and are subject to damage. Given this, some parameters /data may be off-line temporarily if units are damaged and need to be repaired. If this is not acceptable, additional units can be purchased for redundancy.

(Estimated Percent Matching Funds Needed)
USGS contributions (available as of federal fiscal year 2017):
One phosphorus sensor for Kentucky River station = $29,000
Select equipment for streamflow gages = $12,000 X 2 = $24,000
TOTAL = $53,000

Remaining funds needed:
$777,000

PROJECT PROFILE: KGS-1

KENTUCKY WATER RESOURCES BOARD

Applicant Name/Organization: Kentucky Geological Survey (KGS), University of Kentucky

Project Working Title: Kentucky Groundwater Observation Network

Introduction (What issues/needs will this project address): Groundwater is an important natural resource used by agricultural, industrial, and energy-extraction sectors, and by many municipalities and private citizens who rely on wells or springs as a source of potable water. As the state's population and economic-development activities continue to increase, access to data needed to evaluate groundwater availability and sustainability is becoming more and more important. However, unlike water flowing in surface streams, groundwater is a hidden resource that cannot be directly observed or easily measured. Long-term measurements of water levels collected from a suitable network of observation wells is needed to provide basic information about changing groundwater conditions, to answer questions about how much groundwater is available, determine if periods of drought and increasing withdrawals are capable of depleting Kentucky aquifers, and to evaluate whether groundwater use and management practices are effectively meeting the Commonwealth's present and future needs.

This project is intended to provide support needed for statewide groundwater-level data collection by the KGS, more specifically, for the ongoing installation, operation, and maintenance of wells included in the KGS Kentucky Groundwater Observation Network. Continuous collection of water-level measurements from these wells over a period of at least five years are needed to build the data base (period of record) needed to identify monthly, seasonal, and longer-term trends in groundwater levels and to calculate important statistical parameters such as the mean (average), maximum, and minimum groundwater levels. KGS has already begun the task of selecting, testing, and equipping observation well sites, and has committed the funds and human resources needed to maintain the network through fiscal year 2017. However, longer-term maintenance and operation of the network, and expanding the geographic coverage of water-level data by adding additional well sites, will require additional outside sources of funding.

Project Summary: In early 2015, the KGS committed approximately $70,000 to begin rebuilding a statewide groundwater-level observation network and began selecting, testing, and evaluating existing water wells for inclusion in this network. To date, nine existing unused private or public water wells have been selected and/or are undergoing evaluation for the network. Four new wells were also drilled at two critical locations in the Jackson Purchase Area where the use of high-capacity center-pivot irrigation wells is increasing. With its available financial and human resources, KGS plans on establishing fifteen observation well sites by June 2017. The wells are equipped with continuous water-level-monitoring devices that must be downloaded manually and serviced monthly, and are (or will be) distributed across the state.

The requested funding will provide KGS the additional resources needed to upgrade to satellite-based real-time data transmission, to construct up to 10 new wells in critical locations where existing wells are not available or suitable for use, ensure that network operation and maintenance needs are met for at least five years, and to create and maintain an internet-based webpage that ensures ease of access of collected water-level data to all Kentucky citizens.

Project Deliverables and Benefits to Agricultural and Rural Communities: This project proposes to increase the collection and availability of water-level data needed to assess groundwater availability throughout the state, and enhance the use and management of Kentucky's freshwater aquifers to support agriculture, rural water supplies, and other important socio-economic needs. All groundwater data collected from the KGS-KGON wells will be publicly-accessible through the KGS website. A special webpage linked to the KGS Groundwater Data Repository is being created to display hydrographs of groundwater level fluctuations recorded in each observation well, and to search for and access supporting data, which are expected to include well-construction information, aquifer identification, well hydraulic tests results, groundwater-quality sampling data, etc. Collected water-level data will also be linked to a website/mobile apps server proposed for development by the USGS to improve access to hydrologic data used by farmers to evaluate irrigation and other water use needs.

Budget Summary: The project request is for multiyear funding totaling $366,000, budgeted according to the following timeline

Year 1

UPGRADE 15 EXISTING WELLS WITH REAL-TIME SATELLITE TELEMETRY	$57,000
OPERATION AND MAINTENANCE (15 WELLS)	$40,000
YEAR 1 TOTAL	**$97,000**

Year 2

DRILL UP TO 10 NEW OBSERVATION WELLS IN CRITICAL AREAS	$118,000
OPERATION AND MAINTENANCE (25 WELLS)	$66,000
YEAR 2 TOTAL	**$184,000**

Year 3

EQUIPMENT REPLACEMENT CONTINGENCY	$14,000
OPERATION AND MAINTENANCE (25 WELLS)	$71,000
YEAR 3 TOTAL	**$85,000**

SUMMARY

TOTAL 3-YEAR COSTS	**$366,000**

PROJECT PROFILE: KGS-2

KENTUCKY WATER RESOURCES BOARD

Applicant Name/Organization Kentucky Geological Survey

Project Working Title: A Groundwater Withdrawal Assessment Tool for the Jackson Purchase Region

Introduction (What issues/needs will this project address)

Groundwater has been the primary source of freshwater for public supply, industrial, and domestic uses for more than a century in the Jackson Purchase Region. In recent years, many high-yield wells (>300 gpm) have been installed for irrigation to meet increasing agriculture demands in the region. Groundwater withdrawal in the region is projected to rise further significantly in the future with increasing population and climate change. Groundwater is a finite resource everywhere; sustainability of aquifers in the region will heavily rely on water-management decisions made by the agricultural community, industry, and drinking-water supply providers. It is critical to provide them with information about the aquifers and science-driven methods so they can make informed management decisions.

Project Summary

We propose to develop an online tool to assess the effects of high-yield well withdrawals on groundwater resources in the Jackson Purchase Region. Specifically, this tool allows a user to evaluate aquifer responses (i.e., drawdowns) from a groundwater withdrawal by specifying simple inputs, such as a well location, well depth, and a pumping rate. The tool calculates drawdowns using analytical solutions that fit hydrogeological characteristics for the area. The online tool will be provided through an interactive graphic interface on KGS website and the user will be able to see the aquifer responses from a withdrawal as images and animations that are easily understandable.

Project Deliverables and Benefits to Agricultural and Rural Communities

The anticipated results are an online tool, a report, and a flyer. The tool will be public available as a part of KGS Web services and accompanied by detailed online help. The report will describe the methodology of the tool. A flyer that summarizes the purposes and benefits of the tool will be developed and delivered to County Extension Service offices and government agencies located in the Jackson Purchase Region. In addition, educational seminars may be developed for local end users. This project can improve our knowledge of aquifers and groundwater systems in the region, help local farmers in determining well locations and estimating potential well interferences, and enhance local residents' awareness of aquifer vulnerability and the importance of aquifer sustainability.

Budget Summary

(Project Duration and estimated cost per year)

The project duration is projected to be 12 months and the total estimated cost is $50,000.

(Project Timeline and Milestones)

Months 1-3: Establish a hydrogeological conceptual model for the region.

Months 4-5: Select and program analytical solutions for solving groundwater flow under pumping.

Months 6-10: Integrate the solutions and the conceptual model into an assessment tool in the ArcGIS platform.

Months 11-12: Test and implement the assessment tool online.

(Estimated Percent Matching Funds Needed) 50%

PROJECT PROFILE: UK-1

KENTUCKY WATER RESOURCES BOARD

Applicant Name/Organization ___Steve Higgins/University of Kentucky_____

Project Working Title: Stormwater Management, Water Harvesting, and The LEAF Program

Introduction (What issues/needs will this project address)

- Stormwater Management
- Water Harvesting
- Reducing runoff, erosion, and offsite delivery of nutrients.
- Linking the environment and farming (LEAF Program)

Project Summary

Stormwater management and water harvesting are two complementary practices that can help to reduce the amount of runoff, erosion, and offsite delivery of nutrients that are often associated with production areas. Currently, efforts are underway to develop the LEAF program which will include these two practices as a part of an integrated farm management strategy that includes topics such as: Farm organization and planning, soil management, crop health and protection, pollution control, animal science, energy efficiency, water management, and community engagement. This multifaceted program will be innovative in that is addresses the farm, the producer, livestock, the community, and the environment in a holistic context in which one facet cannot fully succeed without appropriate interactions with the other components of the LEAF program. The main goal of stormwater management, water harvesting, and the LEAF Program in general will be to reduce the potential environmental impact of agriculture while improving community relations and the economic viability of Kentucky's agriculture sector.

Project Deliverables and Benefits to Agricultural and Rural Communities

The project will implement stormwater management and water harvesting practices at regional demonstration hubs, which will be utilized as demonstration and educational sites for the LEAF Program. A master binder for the LEAF Program will be produced and can be customized to an individual farm in a given location. These binders will serve as management tools for producers.

Budget Summary

(Project Duration and estimated cost per year)

(Project Timeline and Milestones)

(Estimated Percent Matching Funds Needed)

Water Resources Board Meeting
300 Sower Blvd, Frankfort, KY 40601
October 31, 2016

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Water Resources Board Meeting
300 Sower Blvd, Frankfort, KY 40601
October 31, 2016

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Water Resources Board Meeting
300 Sower Blvd, Frankfort, KY 40601
October 31, 2016

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