COLORADO
Colorado Water Conservation Board
Department of Natural Resources

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John Hickenlooper, Governor

Mike King, DNR Executive Director

James Eklund, CWCB Director

TO: Colorado Water Conservation Board Members

FROM: Jeff Baessler, Deputy Section Chief,
Stream and Lake Protection Section

DATE: November 19-20, 2014 Board Meeting

AGENDA ITEM: 29a – CWCB's 2015 Project Bill – Construction Fund
Non-Reimbursable Project Investments "En-Bloc" Approval
Satellite Monitoring System Maintenance

Introduction

The Division of Water Resources (DWR) has requested an appropriation of $330,000 for the continued operational viability of the state Satellite-linked Monitoring System (SMS) and Stream Gage Refurbishment Program. Each year, funding for this program has been reviewed and approved by both the Finance Committee and the Board. It has been recognized that it is critical for both the State's water planning and water administrative agencies to support and maintain state-of-art stream gaging programs and continue to provide accurate water resources data to support multi-agency and water user needs. The DWR Satellite-linked Monitoring program is outlined in §37-60-121 and §37-80-102 C.R.S.

Staff Recommendation

Staff recommends that the Board approve this request for the General Assembly to authorize this project and appropriate $330,000 from the Construction fund to the Department of Natural Resources for allocation to the Division of Water Resources (DWR) to replace out-dated Data Collection Platforms and associated satellite telemetry equipment in the existing satellite monitoring system, and to refurbish existing stream gages.

Discussion

The $330,000 request for FY 2015-2016 will support the continued, long-term operational viability of 520 satellite-linked water resources monitoring sites. These funds will be allocated as follows:

$275,000 for replacement of out-dated Data Collection Platforms (DCP) and associated satellite telemetry equipment and upgrading of satellite transmission components. The rate of replacement of DCPs is based on a life expectancy from normal wear, tear and software life cycle issues of 10 years. Replacement of out of date DCPs may also be required to accommodate technology upgrades and changes which are mandated by NOAA, the Federal Agency managing the GOES satellite resource.

$55,000 for refurbishing existing stream gages as needed to maintain operational reliability of stream flow data collection. This is a recurring annual request to cover refurbishment and repair costs which arise due to deterioration of the physical stream gage infrastructure.

The requested funding amount of $330,000 is unchanged from last year's request. Please note that it is anticipated that a portion of the funding will go toward stream gage repair costs

associated with the September 2013 flood event. (Further details of the DWR Satellite Monitoring System funding request and a report on previous year accomplishments, including a status on flood repair costs, are explained in the attached memo from Scott Cuthbertson to James Eklund, Kirk Russell and Jeff Baessler dated July 28, 2013).

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Satellite Monitoring System Maintenance

Division of Water Resources (DWR)

November 2014 Board Meeting

PROJECT DETAILS	
Project Cost:	$330,000
NRI Funding Request:	$330,000
Funding Source:	*Construction Fund*
Project Type:	DWR Streamgaging
Type of Grantee:	State Agency

LOCATION	
Benefits:	Statewide
Water Source:	Various
Drainage Basin:	Statewide Drainage

This project entails the continued, long-term operational viability of the State Satellite Linked Monitoring System and Stream Gage Refurbishment Program, which is administered by the Division of Water Resources (DWR). This program currently encompasses 520 satellite stream gaging stations which require continued replacement of outdated data collection platforms, upgrades to transmission components, and refurbishment of the associated infrastructure. In addition, many existing gaging stations need to be modified to provide critical stream flow data for both flood and low flow monitoring. Changes in technology, which will ultimately increase reliability and real time data transmission rates, will require the DWR to continue to upgrade the system in the future. The costs associated with the continued refurbishment and operational viability of the system is currently approximately $330,000 per year.

Crystal River DWR/CWCB Satellite Gage

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER RESOURCES

John W. Hickenlooper
Governor

Mike King
Executive Director

Dick Wolfe, P.E.
Director/State Engineer

MEMORANDUM

To: James Eklund, Director - CWCB
Kirk Russell, CWCB
Jeff Baessler, CWCB

From: Scott C. Cuthbertson, Deputy State Engineer

Date: July 28, 2014

RE: DWR Satellite-linked Monitoring System and Stream Gage Refurbishment Funding Request for FY2015-16 and Report on FY2013-14 Expenditures

Summary

Thank you for the opportunity for the Colorado Division of Water Resources (DWR) to request support for our satellite monitoring stream flow program from the CWCB Construction Fund. Also included in this memo is an accounting of the funds provided for FY2013-14.

We are requesting **$330,000** for FY2015-16. The requested funds will support the continued, long-term operational viability of over 520 satellite-linked water resources monitoring sites, including routine replacement of satellite telemetry transmission components and refurbishment/renovation of gaging stations. The specific distribution of the funds requested is as follows:

1. The sum of $275,000 will be used to replace satellite telemetry equipment. This level of funding is based on a life expectancy from normal wear, tear and software life cycle issues of 10 years.
2. The remainder of $55,000 will refurbish existing stream gages as needed to maintain operational reliability of stream flow data collection. This is a recurring annual request to cover refurbishment and repair costs which arise due to deterioration of the physical stream gage infrastructure.

Introduction

The Division of Water Resources and CWCB, consistent with Section 37-60-121 and Section 37-80-102 C.R.S., maintain the stream gaging program to support multi-agency and water user needs such as water rights administration, compact protection, flood forecasting and warning and Decision Support System implementation and use. DWR must:

- maintain the electronic equipment in satellite-linked data collection stations;
- refurbish deteriorating gage station infrastructure and non-electronic station hardware;
- refurbish/replace cableways used for high flow measurements or implement alternate means of high flow measurement (for calibration of the upper end of stage-discharge relationships);
- rebuild gage sections damaged by high flows;
- flood harden, when possible, critical gages; and,
- continue, as necessary, the operation of vital gages operated by the United States Geological Survey (USGS) when that program can no longer provide the required support.

Background

The Satellite-linked Monitoring System (SMS) has been operating since 1985, starting with 82 linked gaging stations. As the need for the data has increased, the SMS has expanded. Since inception, in excess of 8 million dollars has been invested in the development of the SMS infrastructure. Currently, DWR operates and maintains over 520 data collection platforms (DCPs) on rivers, streams, reservoirs, ditches and canals to collect and transmit basic stream flow and water elevation data to support the Division's primary mission of water rights and compact administration. Additional benefits of the system include flow alerts based on parameter thresholds, such as: low flow alerts in support of CWCB ISF programs; high flow alerts in support of flood protection decision making and flood warning; and, rate of change alerts below dams and reservoirs.

Collectively, these platforms and the computer equipment in Denver are the Satellite-linked Monitoring System (SMS). The USGS and other entities operate an additional 300+ sites in Colorado. The USGS and DWR are continuously working together to improve data availability and not duplicate efforts to maximize the overall effective of the two, cooperative programs for the benefit of the citizens of Colorado. The SMS provides basic water flow data to the staffs of the Division of Water Resources and Colorado Water Conservation Board and many public and private entities, such as: the cities of Colorado Springs and Aurora, the Denver Water Board, the Arkansas River Compact Commission, emergency coordinators for most Colorado counties, water rights owners, recreationists such as fishermen and rafters, and conservation groups. Many programs of the DWR, such as various river operations analysis spreadsheets used in each of the seven DWR Division offices for water administration, and the DWR Safety of Dams Program rely upon the real-time data acquired through the SMS. Water resources accounting programs utilizing the SMS include the Dolores Project, the Colorado-Big Thompson Project and the Fryingpan-Arkansas River Project. CWCB programs, such as Stream and Lake Protection, Flood Protection and Water Supply Protection also utilize the real-time data.

FY2015-16 Funding Request

Satellite Telemetry Equipment. DWR requests $275,000 to replace worn out or damaged satellite telemetry equipment. This is the same amount as requested for FY2014-2015 and represents the basic funding required to replace equipment on a 10-year life cycle.

DWR owns about 480 total sets of electronic (DCP and stage sensor) equipment out of the 520+ gages it operates. With an average life of 10 years, we project 45-50 replacements per year. At current equipment costs, the cost of DCP replacement with newest generation satellite transceivers as well as replacement of gage height sensors ranges from $3750 to $6000 per gage, depending on the type of gage height sensor needed (shaft encoder, constant flow bubbler or radar sensor). Using a mean of $4500 and life expectancy of 10 years, the total annual projected equipment cost to simply maintain operable equipment is approximately $216,000. The life of antennas, batteries, solar panels, wiring, and grounding equipment varies considerably. Based on the last several years, we project an average annual expense of this equipment is approximately $24,000. Travel (vehicle mileage, per diem, etc.) and overtime support to perform this work around the State is projected at $35,000. Total annual current cost is, therefore, approximately $275,000.

Existing Stream Gages. DWR requests $55,000 for refurbishing existing stream gages. The request in this category of funding is level and the same as the past several years. Approximately 60% of Colorado's satellite-linked gaging stations are located in the rivers and streams of the state. The others are located in reservoirs, ditches, and canals. Gaging station physical infrastructure (shelters, stream controls, independent reference gages, etc.) must be properly maintained and periodically refurbished in order to collect accurate data.

An important physical component of many DWR stream gages around the State is the ability to measure high flows so that the upper end of stage-discharge relationships can be improved and maintained to yield accurate high/flood flow data. High flow measurement capability varies from gage to gage. High flows at stream gages are measured from cableways near the gage or from nearby up- or downstream bridges. Cableways at DWR stream gages are given a detailed inspection each four years. Many cableways, primarily because of age, have been found to need replacement of key components of the cableway system. High flow measurement sustainability projects address such identified cableway design/safe use issues. These may include replacement of cable, improvements to the cable anchorage system, replacement of A-

frame components, replacement of cable cars, etc. Costs can run from as little as $1000 per cableway to as much as $20,000 per cableway, depending on what components need replacement before a cableway can be returned to safe service. Alternatively, existing cableways found to have design or safe use deficiencies are, under certain site conditions, being replaced with bank-operated cableways. Costs of installing bank-operated cableways range from $6000 to $9000 per site. As current funding allows, we have been addressing some of these needs.

FY2013-14 Accomplishments

The CWCB provided $300,000 in FY2013-14 for satellite telemetry equipment upgrade and replacement and stream gage refurbishment. An additional $39,811.13 in CWCB carryover funds was available from the previous fiscal year for a total FY2013-14 project budget of $339,811.13. DWR expended the entire available funds, an accounting of which is shown in the attached Table 1.

Satellite Telemetry Upgrade Program. The procurement and installation of new generation, high data rate, satellite-linked monitoring equipment and associated components expended the entire allocation of $245,000 plus $15,347 of the $39,811 carried over from the previous year. The expenditure of more funds in this area than planned was due, in part, to the need to replace equipment lost during the September 2013 flood in the South Platte River basin, which is discussed in more detail below.

Stream Gage Refurbishment. The $55,000 allocated plus $24,463 in carry over funds was expended to refurbish existing stream gages throughout the State. Refurbishment projects and miscellaneous expenditures totaling $79,463.58 were completed at the stream gages listed in Table 1, approximately $43,000 of which went to replace gages destroyed by the South Platte flood (Division 1), as discussed below. The other unplanned event was the construction of four new gages to help manage flow alert systems in the West Fork Complex wild fire area in Division 3. Initially, $34,472.67 was spent to install the gages, however, $32,960 was reimbursed by the special fund from CWCB to assist with the wildfire, leaving a net expenditure from this program of $1,531.15.

September 2013 Flood

The September flooding in Division 1 caused approximately $450,000 in damage to the stream gaging stations and equipment. As a result, the lion's share, approximately $43,000, of this year's funds allocated to stream gage repair was diverted to assist with the recovery of gages required to administer water rights in the South Platte. With a Herculean effort by the South Platte hydrography team for which they deserve significant recognition, 18 of the 23 stream gages destroyed by the flood were operational by April 1, 2014. An additional two temporary gages were installed as surrogates for stream gages located where significant stream restoration is required before a permanent structure can be installed. The remaining three gages, representing approximately $150,000 in anticipated costs, cannot be installed until CDOT has completed the final road construction in the canyons of the Big and Little Thompson Rivers.

To address the cost of the flood damage, DWR has applied for four grants from the FEMA Public Assistance (PA) program, two of which affect the stream gage program. One grant in the amount of $34,407 is to cover the cost of setting up three temporary gages: one on the Big Thompson below the canyon mouth, one near Greeley on the South Platte and one on the Saint Vrain in Lyons. The second application, in the amount of $400,378 covers the cost to replace the 23 stream gages destroyed by the flood. While the FEMA PA program is only expected to cover a very small portion of the actual cost (approximately 5%), the PA application process is being used by State Risk Management to quantify the losses and gain whatever benefit is possible from the program. State Risk has indicated they will reimburse the agency for the total cost of repair that is not funded by FEMA.

Once DWR is fully reimbursed by State Risk, we will likely not need the typical program support included for gage repair. The question, however, is one of timing. We anticipate receiving $34,407 this fiscal year (2014-15), which will go toward reimbursing the $43,000 spent last year on the unplanned flood recovery work and will give the program a total FY2014-15 allocation of $89,407 for repair work ($55,000 from the previous construction fund request and $34,407 from State Risk). We still need approximately $150,000 to complete the replacement of flood damaged structures, so in all likelihood, a significant portion of the $89,000 will again go to cover that work. Because that work is not expected to be finished until FY2015-16, which means we do not anticipate any additional reimbursement from State Risk until FY2016-17.

Because we do not expect to be reimbursed for flood damages until 2016-17, we have not decreased our request for FY2015-16 support. We do, however, anticipate significantly reducing our FY2016-17 and perhaps even our FY2017-18 requests as the final reimbursement for flood damages will likely cover one or two years of normal program support. We have not asked for more support in FY2015-16 because we simply haven't the personnel resources to effectively spend more than about $100,000 in one fiscal year on normal gage repair projects.

TABLE 1 - FY2013-14 Gage Projects			
Div. I	**Project Name**	**Description of Work**	**TOTAL**
	South Platte at Stateline	New return gage	$ 102.92
	September Flood Recovery	Temporary stream gages and permanent repairs	$ 43,143.20
Div. II			
	Arkansas River above Pueblo Reservoir	New inflow location	$ 1,844.70
	Various locations	Radar sensor installation	$ 115.92
Div. III			
	Rio Grande River nr Del Norte	Installation of new cableway A-frames	$ 25,213.83
	Willow Creek nr Crestone	Replace control	$ 1,380.35
	Los Pinos nr Ortiz	Replace condemned cableway	$ 728.42
	West Fork Complex Fire Area	Installed 4 streamgages for flood warning	$ 1,531.15
Div. IV			
			$ -
Div. V			
	Snake River	New cantilever and radar installation	$ 2,172.79
Div. VI			
	Michigan River at Walden	Materials for sensor install	$ 146.25
Div. VII			
	Howardsville Gage	Bank operated cableway installation	$ 873.50
	Jackson Gulch Reservoi Inlet	Outside horizontal cantilever gage	$ 374.31
Miscellaneous			
	Misc. supplies and equipment		$ 1,661.24
	Misc. gage maintenance		$ 175.00
		TOTAL	**$ 79,463.58**