



COLORADO WATER CONSERVATION BOARD

WATER SUPPLY RESERVE ACCOUNT 2006-2007 GRANT APPLICATION FORM

Reference Information

The following information is available via the internet. The reference information provides additional detail and background information regarding these criteria and guidelines and water policy issues affecting our state.

Sedimentation Management Study For Paonia Reservoir North Fork of the Gunnison

Colorado Water Conservation Board Policies

Name of Water Activity/Project

River Basin Location

Loan and Grant policies and information are available at - <http://cwcb.state.co.us/Finance/>

Water Supply Reserve Account Criteria and Guidelines –

http://cwcb.state.co.us/IWMD/tools.htm#Water_Supply_Reserve_Account

Interbasin Compact Committee and Basin Roundtables

Interbasin Compact Committee By-laws and Charter –

<http://dnr.state.co.us/Home/ColoradoWaterforthe21stCentury/Interbasin+Compact+Committee/IbccHomePage.htm>

Basin Roundtable By-laws –

<http://dnr.state.co.us/Home/ColoradoWaterforthe21stCentury/IbccHome.htm>

Legislation

House Bill 05-1177 - Also known as the Water for the 21st Century Act –

<http://cwcb.state.co.us/IWMD/statutes.htm>

House Bill 06-1400 – Adopted the Interbasin Compact Committee Charter –

<http://cwcb.state.co.us/IWMD/statutes.htm>

Senate Bill 06-179 – Created the Water Supply Reserve Account –

<http://cwcb.state.co.us/IWMD/statutes.htm>

Statewide Water Supply Initiative

General Information - <http://cwcb.state.co.us/IWMD/>

Phase 1 Report - <http://cwcb.state.co.us/IWMD/PhaseIReport.htm>

Water Supply Reserve Account – Grant Application Form

Form Revised October 2006

COLORADO WATER CONSERVATION BOARD

WATER SUPPLY RESERVE ACCOUNT 2006-2007 GRANT APPLICATION FORM SEDIMENTATION MANAGEMENT STUDY FOR PAONIA RESERVOIR

OVERVIEW SUPPLEMENT

Paonia Reservoir, was commissioned in 1962, with an original capacity of 21,000 acre-feet. The reservoir has lost approximately 24% of its total capacity as of the last sediment survey in 2002, and storage losses to sediment continue at an annual rate of about 124 acre-feet. At the historic rate of sedimentation, the storage volume will be completely displaced by sediment within the next 125 years. Nearly all of the dead and inactive pools (storage reserved by the U.S. Federal Government) have presently been depleted due to sedimentation losses and active storage is currently being encroached on.

A large sedimentation delta has been forming and moving toward the dam since the reservoir was placed in operation and has migrated downstream over 80 percent of the length of the reservoir to within 3,000 feet of the dam. This delta is expected to reach the dam within the next decade or two. Once that happens the scope of negative impacts is expected to increase. The accumulation of sediment around the outlet's intake structure is expected to adversely affect the reservoir outlet in ways that may harmfully impact the ability to control the reservoir in a manner consistent with historic operation, in accordance with downstream demands for storage releases and in a way which avoids detrimental downstream environmental impacts.

The result is that storage water which has historically been used for agriculture and other purposes is being lost and conditions are developing which may jeopardize the ability to judiciously operate the reservoir. In addition to irrigation water, the Paonia Reservoir provides flatwater recreation, fishing, improved late season flows to the North Fork of the Gunnison River, flood control for downstream towns and developments such as the towns of Paonia and Hotchkiss, water for downstream calls (specifically calls placed by Redlands Water and Power Company), water to supplement normal late summer low stream flows and existing as well as potential future augmentation water. All these uses will be curtailed if no solution to the sediment problem is found. Additionally, use of the water to fill present augmentation needs is limited based on the uncertainty of future availability of committed pool volumes. There are no other currently available irrigation options for the farms and ranches in this area that presently rely on water stored in Paonia Reservoir and, without some action, there will be a devastating impact on existing agricultural water users. Unless the storage volume in the reservoir can be maintained or restored, the only alternatives will be to abandon the existing storage rights or to

build additional storage projects in the same drainage basin at a much higher cost. Therefore, there is a compelling need to evaluate a range of sedimentation mitigation options and identify the best and most cost effective method(s) for insuring reservoir sustainability and a continued full supply of water from the Paonia Reservoir project.

The North Fork Water Conservancy District has been moving forward with relatively limited incremental tasks including preliminary studies of dredging feasibility, evaluation of historic sediment accumulation data and preliminary analysis of sedimentation mitigation options. However, with the potential availability of additional funding, there is a desire to take a much more substantial step toward identifying possible solutions so as to enable implementation of mitigation measures as early as possible.

The objective of this study is to investigate sediment management options for Paonia Reservoir with the intent of identifying means to accomplish one or all of the following goals:

1. Remove a portion of the historically accumulated sediment.
2. Reduce the rate of future sediment accumulation.
3. Identify operational and management practices which will extend the life of the reservoir, preferably indefinitely.

The study will assess the technical feasibility of alternative sediment management techniques and identify the most economical and practical technique(s) for long-term sediment management. The intent is to establish a solid technical and regulatory basis on which to make decisions regarding future goals such as construction of sedimentation control features, removal of existing sediment, improvements in the drainage basin, operation and maintenance protocols and future sedimentation monitoring.

Maps are included in Appendix A which depict the location of the reservoir, the boundary of the North Fork Water Conservancy District and the Paonia Reservoir service area.

Addressing Paonia Reservoir sedimentation is included specifically as an item (Category II, item No. 14) in the Gunnison Basin Round Table (GBRT) needs assessment memorandum. The need for reservoir rehabilitation and maintenance is recognized as a water management objective in the Statewide Water Supply Initiative (SWSI). Sediment mitigation is considered a rehabilitative effort. Specific SWSI objectives are addressed by this project as follows:

1. Long term sustainability of the existing Paonia Reservoir storage volume is the ultimate intent of the project. The proposed project is a major step toward implementing capital and operational measures which will partially or fully mitigate the sedimentation problem.
2. The project is intended to develop measures which will offset, abate or eliminate the inevitable loss of irrigation water storage volume if no action is taken.
3. Optimization of existing and future water supplies includes sustaining existing storage

capacity that will otherwise be lost or that must be replaced with less effective facilities at much greater cost and with greater environmental impacts.

4. By assuring the long term sustainability of Paonia Reservoir and the stable stream flow that results from summer releases, recreational opportunities in the area are protected. The ultimate outcome of the no-action alternative will be a reservoir basin fully filled with sediment, land of questionable usefulness and complete loss of current recreational opportunities associated with the reservoir and its storage releases.

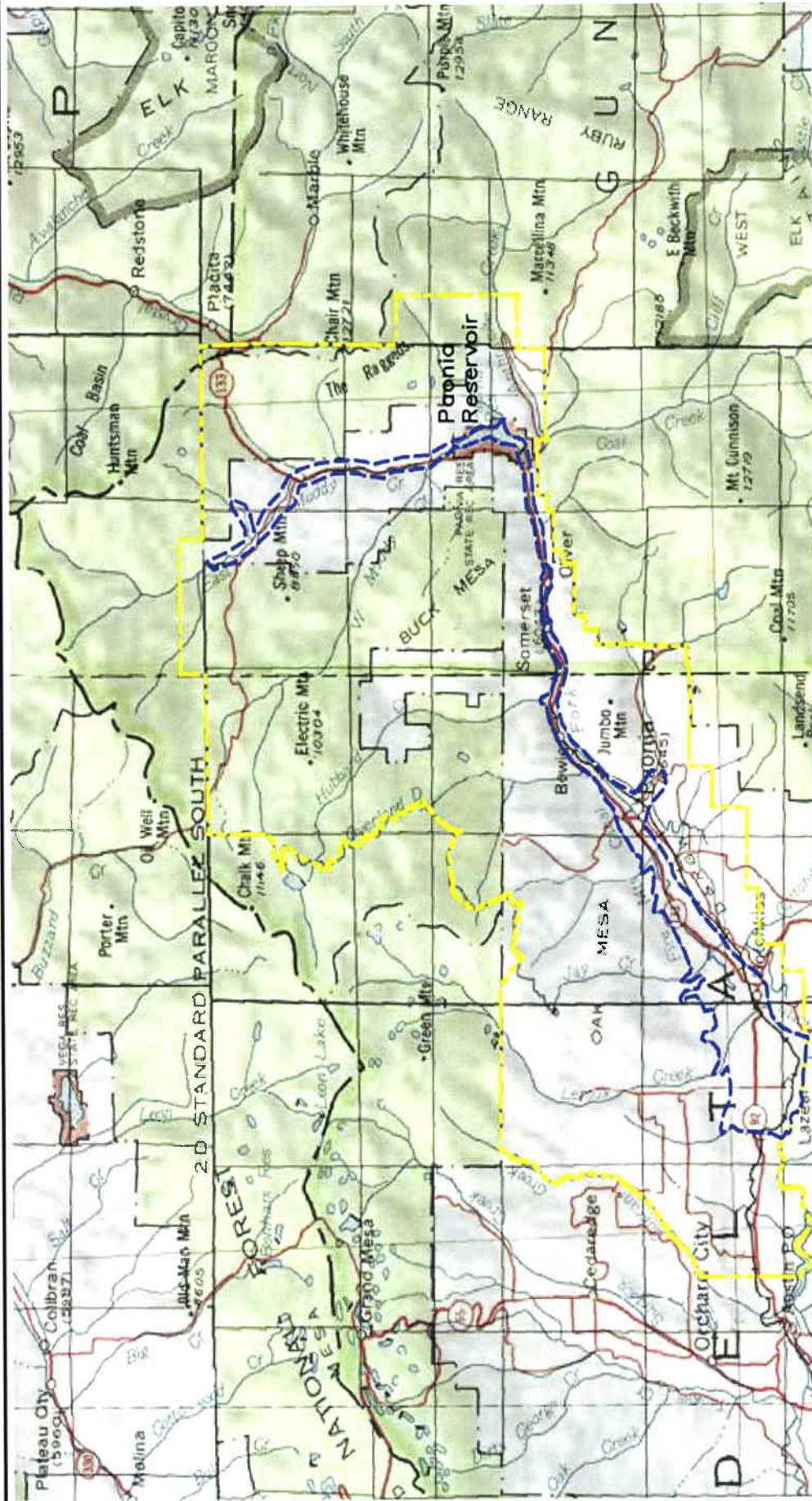
5. Environmental enhancements will result from this project in relation to the potential destructive consequences that will otherwise occur as a result of continued, unrestrained sedimentation. Continued sedimentation will result in a completely sediment filled reservoir basin and may involve replacement of the storage capacity at one or more other sites with the attendant environmental repercussions. Additionally, if no action is taken, the sedimentation delta will eventually surround the intake structure, and the ability to control the rate for release of sediment from the reservoir will be decreased. Sediment releases may occur episodically, in slugs and with unavoidable negative environmental impacts.

6. Instituting a sustainability plan for Paonia Reservoir will avoid the costs, disruption and environmental impacts of developing one or more alternative storage sites. Also, reduction of sediment loads against the dam will avoid costly dam modifications which may be necessary to buttress the embankment against potential failure

7. If the sedimentation continues at current rates, the impact on the dam's outlet works may start to restrict the range of allowable operational flexibility due to downstream environmental and other considerations. Therefore, one of the benefits of developing a plan to control sedimentation impacts will be to maintain current operational versatility.

8. The project will comply with all applicable laws, regulations and will protect all existing water rights.

A map showing the service area for Paonia Reservoir and the boundaries of the North Fork Water Conservancy District follows:



LEGEND: — Boundary of North Fork Water Conservancy District
 — Padonia Reservoir Service Area



NORTH FORK WATER CONSERVANCY DISTRICT SEDIMENTATION MANAGEMENT STUDY FOR PADONIA RESERVOIR

COLORADO WATER CONSERVATION BOARD

WATER SUPPLY RESERVE ACCOUNT 2006-2007 GRANT APPLICATION FORM SEDIMENTATION MANAGEMENT STUDY FOR PAONIA RESERVOIR

SCOPE OF WORK SUPPLEMENT

The work will be performed in two phases. The first phase will consist of identifying and evaluating possible mitigation options at a feasibility level in order to narrow the focus to the most feasible alternative(s). The objective of the first phase of the study is to assess the potential technical feasibility of alternative sediment management techniques, identify the most economical alternative, and identify potential fatal flaws. This phase will also research regulatory requirements associated with optional sediment management techniques. Phase One work will include the following:

1. Review Existing Information – Existing information includes original construction documents, established operation and maintenance procedures, sediment surveys performed by the U.S. Bureau of Reclamation, as well as sampling and studies performed by the U.S. Geologic Survey, the Colorado Department of Health and Environment and the U.S. Forest Service. The initial step of the study will include research and familiarization with these and any other documents discovered.

2. Peer Review of Previous Studies – Previous studies conducted by Western Engineers include the following:

April 2005 – Preliminary Dredging Feasibility Study

May 2006 – Evaluation of Historic Sediment Surveys

February 2007 – Preliminary Evaluation of Sediment Mitigation Options

A review of this information will be conducted by a firm or individual with broad experience and expertise in reservoir sedimentation. A preliminary report will be prepared discussing the results of the peer review including comments regarding validity of conclusions

3. Collection of Additional Data - This task entails collecting the following information:
 - a. Hydrologic data (stream flow and rainfall data).
 - b. Sediment sampling and testing – Samples will be collected from the surface of the sediment at 10 to 15 locations. These samples will be tested for grain size distribution, index properties, moisture content, organic carbon content and agronomic characteristics. Selected samples will be tested for hazardous constituents.
 - c. Grab samples of the inflow and outflow water will be obtained several times during the season and the samples will be tested for solids concentration plus the characteristics listed above for the sediment samples. It is anticipated that 10 to 15 of these water samples will be obtained and tested.
4. Feasibility Evaluation of Optional Sediment Management Techniques – A range of possible mitigation options will be considered and evaluated as discussed below:
 - a. Pressure Flushing – Pressure flushing is executed with a high water surface elevation in the reservoir and entails opening a low-level gate at the dam. This flushing technique is usually implemented solely to clear deposited sediment from the immediate area in front of low level outlets. Pressure flushing leads to the development of a cone-like space upstream of the outlet, which is cleared of sediment.
 - b. Drawdown Flushing – Drawdown flushing is used to remove deposited sediment from the reservoir bed. The objective with drawdown flushing is to draw the water surface elevation in the reservoir down sufficiently to result in river-like flow conditions in the reservoir that will lead to re-suspension of deposited sediment and its discharge downstream of the dam. Such operation requires a low-level outlet with sufficient discharge capacity, and at a low enough invert, to develop the desired flow conditions. Once the river-like flow conditions have established it is necessary to discharge enough water through the reservoir to re-suspend the sediment and discharge it downstream of the dam.
 - c. Reservoir Routing – This option entails creating flow conditions in the reservoir during flood flows that will, ideally, transport incoming sediment through the reservoir without deposition. This technique does not increase reservoir capacity, because it does not re-suspend any significant amounts of deposited sediment. The main goal is to prevent additional sedimentation by conveying incoming sediment through the reservoir without deposition. The investigation of routing or flushing options will also involve evaluation of the feasibility for installation of a low-level controlled outlet.
 - d. Mechanical Dredging – Mechanical dredging involves using a mechanical dredge

to loosen sediment material, pump it into a discharge line and transport the dredged slurry to a sedimentation basin where it can be settled and decanted. The disposal site must be sufficiently flat and large enough to allow for local permanent disposal of the dewatered sediment.

e. Hydro-Suction – This option is similar in concept to mechanical dredging except that the removal of the sediment from the reservoir basin is done without a pump. The sediment is lifted from the bottom of the reservoir and transported downstream from the dam based on the difference in elevation between the reservoir level and the downstream disposal site. Both mechanical dredging and hydro-suction require a disposal site and, therefore, the Phase One work will include identification of potential sites.

f. Reduction of Basin Sediment Yield - Although experience has shown that catchment management is not generally an economically feasible approach to reservoir sedimentation management, information from long-time local residents suggests that a large source, if not the primary source, of sediment consists of a landslide, or series of landslides, located within a very limited stretch of one of the tributaries to Paonia Reservoir. This part of the study will include a detailed field examination of the drainage basin, selected sampling and testing of grab samples from any suspect source areas, review of aerial photography, research existing sediment yield information (including regional data), identification of both human and natural disturbances and characterization of any channel degradation.

5. The evaluation of alternatives will include conceptual designs as appropriate and associated cost estimates.

6. Investigate Regulatory Constraints – The cost and/or feasibility of some mitigation options may be significantly impacted by the necessity to satisfy federal, state and local legislative and regulatory agency rules and standards. Additionally, some of the methods normally used for sediment control may not be commonly used in the State of Colorado and rules and regulations may need to be clarified, expanded or revised to address these methods. Therefore, it will be important to adequately identify and define the limitations that will constrain these methods.

7. The Phase One study findings will be presented in a report. The report will identify the technical feasibility of the alternative sediment management techniques and will select the most economical sediment management options. Additionally, the report will provide the engineers' opinions regarding the likely degree of success that can be anticipated using the techniques evaluated. The report will be followed by discussions between the project sponsors and the engineers. The objective of the discussions will be to agree on two or three selected sediment management techniques that should be investigated in more detail in Phase Two.

Phase Two work will consist of refining the selected option(s) by obtaining more comprehensive supporting data, performing more detailed engineering analyses, refining cost estimates and pursuing needed permits. The actual scope of the Phase Two work will be somewhat dependent on the results of the Phase One analyses. The current application for funding is based on the anticipated scope of work described below. The cost estimate includes a not-to-exceed amount for investigation of the selected option(s). A contingency factor has been applied to the estimated study cost to account for any needed modifications to the Phase Two scope of work:

1. Detailed Evaluation of the Selected Option(s) – Depending on the selected option(s) the

Phase Two work may include one or more of the following possible work tasks:

- a. Preparation of Numeric Sediment Transport Model and Evaluation – In order to evaluate the potential success of mitigation options which involve flushing or routing, it will be necessary to develop a computerized sediment transport/deposition model of the reservoir basin. This model will be developed using one of the existing modeling programs for unsteady, non-uniform sediment transport such as MIKE 11 or MIKE 21C (developed by the Danish Hydraulic Institute). This work will include a conceptual investigation to determine the most appropriate software; calibration of the model using currently existing stream concentration and flow data, data collected as part of this investigation as well as existing reservoir sedimentation data; and running the model under various anticipated or proposed conditions. In addition to modeling the effect of various flushing/routing scenarios, analyses will be made of variations in reservoir operational protocols on future sediment accumulation rates.
 - b. Dredging Disposal Sites – It will be necessary to enter into discussions with the owners of potential disposal sites in order to assure that a suitable site can be obtained and to assess the likely cost involved with developing such a site. Preliminary designs will be provided for identified sites. It will also be necessary to determine the right of way requirements needed to provide a discharge pipeline route from the dam to the disposal site.
 - c. Drainage Basin Yield Reduction – Further investigations will be conducted related to any methods which are identified in the Phase One evaluation as having a potential for economical success. The related Phase Two work will include obtaining field soil samples and performing investigations into the costs involved and the likelihood of success for these options. For example, if it is found that active slides comprise a significant source of sediment, shallow soil samples will be obtained and tested, the slide characteristics will be further investigated and preliminary stability evaluations will be performed to identify possible stabilization alternatives. It is not intended that this work will include detailed geotechnical investigations or analyses.
 - d. Preliminary designs may be performed for installation of a low-level outlet gate. This work will include collaboration with the U.S. Bureau of Reclamation which retains safety and technical oversight of the facility.
2. Monitoring and Sampling – It is anticipated that sediment monitoring stations will be established at two locations. These locations will be immediately upstream from the reservoir (probably located near the existing flow gauging station) and immediately downstream from the reservoir. These stations will provide a means to start gathering baseline data for such tasks as correlating the stations with total trapped sediment, correlating with runoff rates, identifying seasonal variations in sedimentation and establishing patterns of sediment inflow and outflow which will be needed to implement a flushing or routing protocol. This task will include the following:
- a. Each station will include means to monitor water turbidity, temperature and conductivity. The turbidity probe will be tethered at the most appropriate location and depth in the stream in such a way that it will rise and fall with the stream stage.
 - b. Each station will also include the ability to monitor stream stage.

c. A pumped sampler will be installed at each station which includes the ability to obtain stream samples at the location of the turbidity probe at designated times. The sampling events may be triggered either by pre-established rules, or by remote communication. Each sampler will be capable of obtaining and storing up to 24 samples.

d. Measurement data will be remotely available by means of satellite telemetry.

e. At the downstream station (and, if necessary, at the upstream station), a flow rating curve will be developed using standard flow measurement techniques. If appropriate, the station at the upper end of the reservoir basin will be located near the existing stream gauging station. Stream flows downstream from the reservoir will also be determined based on inflow and storage variations. Time-variable relationships will be determined between reservoir stage and reservoir storage capacity based on historic sedimentation rates.

f. Turbidity/Sediment Concentration and Stage/Sediment Concentration relationships will be determined based on periodic field suspended sediment samples taken at each station. It is anticipated that samples will be taken during normal flow periods each season as well as important flow events such as rising and falling limbs of storms and various spring runoff flows. The estimated cost for the proposed work is based on a maximum of 15 sampling events.

g. The turbidity monitoring and suspended sediment monitoring will need to be supplemented with bed load sampling. However, previous studies have indicated that bed load is a small percentage of total load and, therefore, it is anticipated that the number of bed load samples will be approximately 25 percent of the suspended sediment samples.

h. Samples will be obtained of the bed material at selected locations.

i. Appropriate laboratory tests will be performed on all collected samples.

j. The costs presented in this application are based on a sampling, monitoring and calibration program which continues for a period of two years.

3. Cost/Benefit Analysis – A cost/benefit analysis will be performed for each of the selected mitigation methods evaluated. Costs will include construction costs, life-cycle costs and any other indirect costs. Benefits will include both direct benefits from storage recovery as well as any identifiable indirect benefits.

4. Runoff Prediction Tools – The ability to reliably anticipate storable runoff volume will increase the range of sediment management options. For example, if flushing is found to be a feasible option, the ability to maximize the average available reservoir head and/or reservoir release flows while still assuring full storage will increase the effectiveness of the flushing processes. Therefore, part of the Phase Two portion of the study will be to evaluate the potential for developing accurate runoff prediction models based on a combination of SNOTEL data, basin characteristics and climate forecasts. This work will consist of the following:

a. Research the availability of existing runoff prediction models and their applicability.

b. Make a preliminary correlation between historic SNOTEL records and runoff volume.

5. Investigate Funding Options – Research will be done to assure that all feasible sources of funding have been identified. These may include but not be limited to water users, the Colorado River Water Conservation District, State agencies and Federal Agencies.

6. Investigate Partnering Possibilities – There may be other entities which have an interest

in pursuing sediment mitigation but are not in a position to contribute funding to the project. These entities might be able to contribute technical expertise, political support or administrative assistance. These groups might include, but are not be limited to, the U.S. Natural Resource Conservation Service, the U.S. Bureau of Reclamation, the U.S. Fish and Wildlife Service, the U.S. Geological Survey, the local Soil Conservation District, local water users groups, the Colorado Department of Health and Environment, the Colorado Division of Wildlife, the North Fork River Improvement Association and the Colorado Water Conservation Board. The potential interested parties will be identified and contacted to determine interest and ability to assist.

7. Meetings and Preparation of Report – Status and steering meetings will be held with the North Fork Water Conservancy District and other interest parties at selected intervals. A final report will be prepared which summarizes the investigations performed and their results, provides updated cost estimates for the alternatives, presents advantages and disadvantages of each alternative and presents conclusions and recommendations for future action.

A time schedule along with a schedule of costs and a detailed study cost estimate are included with this supplement.

TASK ITEM:	2007			2008			2009									
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PHASE ONE EVALUATION:																
Review Existing Information																
Peer Review of Existing Studies																
Collection of Additional Data																
Feasibility of Management Options																
Conceptual Designs and Cost Estimates																
Regulatory Constraints																
Report and Meeting																
PHASE TWO EVALUATION:																
Evaluation of Selected Options																
Monitoring And Sampling																
Cost Benefit Analysis																
Runoff Prediction Tools																
Investigate Funding Options																
Investigate Partnering Possibilities																
Meetings And Preparation of Report																
STATUS REPORTS																
SCHEDULE OF COSTS:																
PHASE ONE EVALUATION:																
Review Existing Information																
Peer Review of Existing Studies																
Collection of Additional Data																
Feasibility of Management Options																
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Cost Benefit Analysis																
Runoff Prediction Tools																
Investigate Funding Options																
Investigate Partnering Possibilities																
Meetings And Preparation of Report																
TOTAL COST	\$24,000	\$29,100	\$18,800	\$17,300	\$13,500											
SPONSOR CONTRIBUTION	\$10,000															
GBRT FUNDING REQUEST	\$14,000	\$29,100	\$18,800	\$17,300	\$13,500											
STATEWIDE FUNDING REQUEST																

NORTH FORK WATER CONSERVANCY DISTRICT
SEDIMENTATION MANAGEMENT STUDY FOR PAONIA RESERVOIR
SCHEDULE OF WORK ITEMS AND COSTS

FIGURE 1
4/17/2007

PAONIA RESERVOIR SEDIMENTATION MANAGEMENT STUDY

[illegible]

COLORADO WATER CONSERVATION BOARD

WATER SUPPLY RESERVE ACCOUNT 2006-2007 GRANT APPLICATION FORM SEDIMENTATION MANAGEMENT STUDY FOR PAONIA RESERVOIR

EVALUATION CRITERIA SUPPLEMENT

Following is a summary of the ways in which this project will satisfy the evaluation criteria enumerated in the CWCBC "Water Supply Reserve Account Criteria and Guidelines". This summary follows the same outline format as presented in the Criteria and Guidelines:

Threshold Criteria

1. Eligibility Requirements – The project falls under the following two Eligible Water Activities:
 - a. Water Activity Number two – "Technical assistance regarding permitting, feasibility studies, and environmental compliance"
 - b. Water Activity Number three – "Studies or analysis of structural, nonstructural, consumptive, and nonconsumptive water needs, projects, or activities"

The NFWCD meets the eligibility requirements as a public entity (Conservancy District). The FMCC meets the eligibility requirements as a private, incorporated, not-for-profit ditch company.

2. Conformance With Section 37-75-102 C.R.S. – This project will not conflict with or otherwise impair the current system of water rights allocation in the state of Colorado.
3. GBRT Evaluation and Approval – A copy of the letter indicating approval of the request for funding of this project from the Gunnison Basin Roundtable is attached to this supplement.
4. Conformance With 37-75-104 (2) (c), C.R.S. – In the "Draft Memorandum on Gunnison Basin Water Needs Assessment and Related Task Items" dated January 31, 2007 dam maintenance and rehabilitation of existing water storage facilities is identified as a need. Addressing the Paonia Reservoir sedimentation problem is specifically listed as a needs item.

Promoting Collaboration and Cooperation

- a. Multiple Needs - Since the project will not change historic water use patterns or quantities, there will be no impact on consumptive use. The project is intended to protect existing water supplies which benefit a range of interests. These interests include direct beneficiaries such as the irrigators, and, less directly, those who use the reservoirs for recreation; fish, vegetation and wildlife that depend on the reservoirs and the steady stream flow that results from summer releases; other businesses in the community which rely on a stable local agricultural economy and anyone downstream who would be impacted by loss of either the reservoir storage or its operational capabilities. Paonia reservoir is an important storage facility in the lower Gunnison River basin with the potential to provide water for the increasing augmentation demands and for protection from the increasing likelihood of downstream calls.
- b. Cooperative Considerations – The project is being sponsored jointly by the North Fork Water Conservancy District (NFWCD) and the Fire Mountain Canal and Reservoir Company (FMCC). However, as described above, a number of other entities will benefit from these efforts and, as much as possible, the support and cooperation of other entities will be solicited. Study of the Paonia Reservoir sedimentation issue will likely include evaluations which are either the first of their kind in Colorado or extend to include new magnitudes in scope and, as a result, will provide a basis for considering sediment management needs at other Colorado storage facilities with similar sedimentation difficulties. Although many of the technical considerations will be independent of the Colorado location, other elements such as regulatory requirements, environmental factors, climatic issues and geologic conditions may include uniquely Colorado aspects.

Facilitating Water Activity Implementation

- c. Project Viability – The financial resources of the project sponsors are very limited. This is because revenue is primarily derived from farm ventures. Without this, or other funding support, it will be necessary to stretch the project years into the future, considerably reduce the scope of work or abandon the mitigation efforts.
- d. Timing Considerations - There is no specific time frame that must be met with this project. However, the consequences of continued sedimentation are serious and each year that sediment is allowed to accumulate unchecked exacerbates the problem.
- e. Completion Time – It is anticipated that the proposed project can be completed within two years from start of the work.
- f. Technical Ability – The project work will be led by Western Engineers, Inc. Western Engineers has specialized in water resource development and, in particular, earthfill dams, since 1952 and has considerable experience in the Western Colorado and Eastern Utah region on numerous dam projects. Consultation will be solicited from experts in the areas of

reservoir sedimentation, sediment transport modeling, regulatory and permitting requirements, drainage basin erosion stabilization, land acquisition and dredging.

- g. Other Funding Sources – The North Fork Water Conservancy District and Fire Mountain Canal and Reservoir Company are each contributing \$5,000 to the project. The U.S. Bureau of Reclamation has performed three sediment surveys since commissioning of the project, with a present estimated dollar value of \$14,000 per survey. It is anticipated that they will continue to provide some survey and technical support services. The Colorado River Water Conservation District has contributed \$17,000 for previous studies and future financial, political and technical support is expected from this agency.
- h. Financial Needs – No other funding sources have been pursued.

Meeting Water Management Goals and Objectives and Identified Water Needs

- i. Needs Assessment – The need for reservoir rehabilitation and maintenance is recognized in the Gunnison Basin Roundtable (GBRT) needs assessment and the Paonia Reservoir sedimentation problem is included specifically as an item (Category II, item No. 14) in the GBRT needs assessment memorandum. The ultimate goal of the project is to maintain existing storage capacity in Paonia Reservoir.
- j. SWSI Objectives and Gunnison Basin Round Table (GBRT) Needs Assessment:
 - 1. Long term sustainability of the existing Paonia Reservoir storage volume is the ultimate intent of the project. The proposed project is a major step toward implementing capital and operational measures which will partially or fully mitigate the sedimentation problem.
 - 2. The Paonia project provides irrigation water to approximately 15,300 acres of unique farmland in the North Fork Valley of the Gunnison. There are currently nearly 500 water users who apply stored water from the subject reservoir to lands in the North Fork areas. The project is intended to develop measures which will offset, abate or eliminate the inevitable loss of that storage volume if no action is taken.
 - 3. Optimization of existing and future water supplies includes sustaining existing storage capacity that will otherwise be lost or that must be replaced with less effective facilities at much greater cost and with greater environmental impacts. The Paonia reservoir site is unique in its location in the Gunnison River basin (its service area and its tributary basin area) and in its efficiency as a storage site. Therefore, it will not be possible to find an equivalent replacement dam site.
 - 4. By assuring the long term sustainability of Paonia Reservoir and the stable stream flow that results from summer releases, recreational opportunities in the area are protected. The ultimate outcome of the no-action alternative will be a reservoir basin fully filled with sediment, land of questionable usefulness and complete loss of current recreational opportunities associated with the reservoir and its storage releases.

5. Environmental enhancements will result from this project in relation to the potential destructive consequences that will otherwise occur as a result of continued, unrestrained sedimentation. As mentioned above, continued sedimentation will result in a completely sediment filled reservoir basin and may necessitate replacement of the storage capacity at one or more other sites with the attendant environmental repercussions. Additionally, if no action is taken, the sedimentation delta will eventually surround the intake structure, and the ability to control the rate for release of sediment from the reservoir will be decreased. Sediment releases may occur episodically, in slugs and with unavoidable negative environmental impacts.
 6. The most easily developed and productive reservoir sites are always used first. One rule of thumb is that the difficulty of developing the second generation of storage facilities to provide similar function increases by a factor of 2 or 3. Therefore, instituting a sustainability plan for Paonia Reservoir will avoid the costs, disruption and environmental impacts of developing one or more alternative storage sites. In fact, due to geographical, geologic, environmental or other constraints it may not even be possible to locate and develop alternate storage sites that will produce the same benefits, storage volume, etc. Also, sediment loads against the dam reduce its stability and increase safety risks. Reduction of these loads will avoid costly dam modifications which may be otherwise necessary to buttress the embankment against potential failure
 7. If the sedimentation continues at current rates, the impact on the dam's outlet works may start to restrict the range of allowable operational flexibility due to downstream environmental and other considerations. Therefore, one of the benefits of developing a plan to control sedimentation impacts will be to maintain current operational versatility.
 8. The project will comply with all applicable laws, regulations and will protect all existing water rights.
- k. Water Conservation and Efficiency – Enhancement of water conservation and use efficiency is not a direct goal of this project. However, increasing the security of existing water storage capacity is a means to conserve existing water supplies and protect existing water rights. Improving long term viability of the storage capacity can be considered a step to improve the efficient use of existing facilities.
 - l. Water Conservation Plan – The Delta Soil Conservation District prepared a water management plan for the NFWCD. This plan is entitled "North Fork Water Management Plan" and is dated July, 2001. The plan was prepared in coordination with and was funded by the U.S. Bureau of Reclamation and included Paonia Reservoir. This plan includes water conservation aspects.
 - m. Development of New Water – No new water supplies will be made available as a direct result of this project. However, relative to the unavoidable loss of storage that will occur without mitigation efforts, there is an aspect of new storage development. For example, dredging sediments from the basin is similar in effect to enlarging the reservoir capacity.

- n. The project includes evaluation of operational practices. Alleviation of existing sedimentation impacts is considered a rehabilitative effort. In the event that the sedimentation process cannot feasibly be fully offset using the measures investigated in the proposed study, replacement of lost storage will need to be considered, either by enlargement of the existing reservoir or by providing substitute storage at other sites.

The Water Activity Addresses Issues of Statewide Value

- o. Sustaining Existing Benefits – The primary goal of the project is to sustain existing water supplies and the benefits that are produced by those supplies. These benefits accrue directly to the individuals and families who use the water from the reservoirs for domestic and agricultural supplies and less directly to those who use the reservoirs for recreation; fish, vegetation and wildlife that depend on the reservoirs and the steady stream flow that results from summer releases; other businesses in the community which rely on a stable local agricultural economy.
- p. Water Compact Considerations – The project promotes maximum utilization of state waters by increasing the long term viability of facilities necessary for continuation of historic use.
- q. Threatened and Endangered Species – Operation of the existing water system includes release of water during low-flow periods and, therefore, enhances fish habitat during those times. The project will improve the security of those flows.
- r. Cost-Benefit Relation - Since the primary purpose of this project is loss avoidance, it is impossible to provide an estimate for the dollar value of benefits. However, the dollar value of benefits that may result from implementation of the measures evaluated by this study can be estimated based on one of the two following considerations:
 - 1. Avoidance of lost direct local economic benefits resulting from removal of agricultural land from production and/or substantially reduced agricultural productivity. Stored water is an essential component for overall agricultural production because it provides a source of irrigation water during the critical mid to late summer period. Without this water, some lands would have to be removed from production, and the revenue from remaining irrigated lands would be reduced in an amount greater than the proportion of stored water to total irrigation water. This benefit is estimated at \$500 to \$1,000 per acre annually or a minimum of \$200 to \$400 per acre foot annually.
 - 2. Replacement costs for the storage lost, estimated at \$3,000 to \$10,000 per acre foot.

The non-quantifiable potential losses are substantial and can have wide-reaching impacts. These losses include property damage resulting from lost flood control, damage to infrastructure, lost water, reduced agricultural production, lost recreational opportunities, environmental damage, repair costs, costs associated with capital modifications, dam stabilization costs, storage replacement costs, legal costs and costs incurred by regulatory agencies. Effective reduction or elimination of sedimentation impacts can avoid those losses.

- s. Relation to Other CWCB Programs – The project fits well within the stated CWCB mission to “conserve, develop, protect and manage Colorado’s water for present and future generations”. The intent of the project is to enhance the protection of and the ability to manage the existing Paonia Reservoir storage facility. It also will provide a foundation for evaluation of existing similar problems elsewhere in Colorado.
- t. Economic Contribution – The economy in the area surrounding the project is critically dependent on water supplied by Paonia Reservoir. This economy includes agricultural production and residential and commercial activities. The viability of the overall community in the area is linked to water supplies. All of the residential and business activities contribute to State and national economic conditions.

COLORADO WATER CONSERVATION BOARD

WATER SUPPLY RESERVE ACCOUNT 2006-2007 GRANT APPLICATION FORM SEDIMENTATION MANAGEMENT STUDY FOR PAONIA RESERVOIR

WATER RIGHTS SUPPLEMENT

Adjudication Date	Appropriation Date	Amount (acre-feet)	Designated Use	Court Case	Water Source	Comments
3/20/1954	6/1/1935	18,000	Irrigation, Domestic, Stock, Industrial	CA 4808	Muddy Creek	Made absolute 3/18/1966
1/31/1964	4/5/1949	3,000	Irrigation, Domestic, Stock, Industrial	CA 4808	Muddy Creek	Made absolute 3/18/1966
3/23/1971	10/31/1969	7,424	Irrigation, Domestic, Stock, Industrial	W-206	Muddy Creek	"Inferior to all other present priorities"
3/23/1971	10/31/1969	2,576	Irrigation, Domestic, Stock, Industrial	W-206	Muddy Creek	Conditional, "Inferior to all other present priorities"
12/31/1992	12/31/1963	18,000	All uses	92CW 153	Muddy Creek	Re fill right
Totals		21,000			Muddy Creek	Storage rights
		28,000			Muddy Creek	Refill rights

Summary of Fire Mountain Canal Water Rights

Adjudication Date	Appropriation Date	Amount (acre-feet)	Designated Use	Court Case	Water Source	Comments
2/20/1904	9/14/1896	50.0	Irrigation	346	North Fork	
6/23/1914	6/1/1909	44.5	Irrigation	617	North Fork	Location correction
2/10/1930	1/1/1903	70.0	Irrigation	2030	Terror Creek	5,721 total acreage irrigated
2/10/1930	1/1/1903	40.0	Irrigation	2030	Roatcap Creek	
2/10/1930	6/24/1914	7.5	Irrigation	2030	North Fork	Cumulative diversion limited to 125.0 cfs
8/16/1936	6/1/1935	16.0	Irrigation	W-2711	North Fork	Made absolute 7/29/1976
3/20/1954	6/1/1935	90.0	Irrigation	3503	North Fork	Leroux Creek exchange
3/20/1954	9/14/1896	30.0	Domestic, Stock	3503	North Fork	Limited to 30.0 cfs for both sources, non-irr. season use
3/20/1954	1/1/1903			3503	Terror Creek	
Totals		208.0	Irrigation		North Fork	
		70.0	Irrigation		Terror Creek	
		40.0	Irrigation		Roatcap Creek	
		30.0	Domestic, Stock		North Fork	Cumulative, non-irrigation season
					Terror Creek	

The Gunnison Basin Roundtable