



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
NORTH ATLANTIC DIVISION, US ARMY CORPS OF ENGINEERS
FORT HAMILTON MILITARY COMMUNITY
BROOKLYN, NEW YORK 11252-6700

APR 26 2011

CENAD-PD-PP

MEMORANDUM FOR Chief, Water Resources Division, ATTN: CENAO-WR-PR

SUBJECT: Review Plan Approval for Gathright Dam and Lake Moomaw, Virginia

1. The attached Review Plan for the subject study has been prepared in accordance with EC 1165-2-209, Civil Works Review Policy.
3. The Review Plan has been coordinated with the Ecosystem Restoration Planning Center of Expertise of the Mississippi Valley Division, which is the lead office to execute this plan. For further information, contact Ms. Jodi Staebell at 309-794-5448. The Review Plan does not include independent external peer review, as it is not applicable to this study.
4. I hereby approve this Review Plan, which is subject to change as study circumstances require, consistent with study development under the Project Management Business Process. Subsequent revisions to this Review Plan or its execution will require new written approval from this office.

Encl

A handwritten signature in black ink, appearing to read "C. Vietri".

Joseph R. Vietri
Chief, Planning & Policy Division
Programs Directorate

**REVIEW PLAN
GATHRIGHT DAM AND LAKE MOOMAW, VIRGINIA**

SECTION 216

LOW FLOW AUGMENTATION

FEASIBILITY REPORT



**US Army Corps
of Engineers®**

**U.S. ARMY CORPS OF ENGINEERS
NORFOLK DISTRICT
803 FRONT STREET
NORFOLK, VIRGINIA 23510-1096
SEPTEMBER 7, 2010**

REVIEW PLAN

GATHRIGHT DAM AND LAKE MOOMOW, VIRGINIA

SECTION 216

LOW FLOW AUGMENTATION

FEASIBILITY STUDY

TABLE OF CONTENTS

| | | |
|-----|---|----|
| 1. | PURPOSE AND REQUIREMENTS | 1 |
| 2. | STUDY INFORMATION | 2 |
| 3. | AGENCY TECHNICAL REVIEW (ATR) | 4 |
| 4. | INDEPENDENT EXTERNAL PEER REVIEW (IEPR) | 7 |
| 5. | MODEL CERTIFICATION AND APPROVAL | 9 |
| 6. | REVIEW SCHEDULES AND COSTS | 11 |
| 7. | PUBLIC PARTICIPATION | 12 |
| 8. | PCX COORDINATION | 12 |
| 9. | MSC APPROVAL | 12 |
| 10. | REVIEW PLAN POINTS OF CONTACT | 12 |
| | ATTACHMENT 1: TEAM ROSTERS | 15 |
| | ATTACHMENT 2: ATR CERTIFICATION TEMPLATES | 16 |
| | ATTACHMENT 3: ACRONYMS AND ABBREVIATIONS | 14 |
| | ATTACHMENT 4: STUDY AREA MAP | 20 |

1. PURPOSE AND REQUIREMENTS

a. **Purpose.** This Review Plan defines the scope and level of peer review for the Gathright Dam and Lake Moomow, Virginia, Section 216 Low Flow Augmentation Feasibility Study.

b. References

- (1) Engineering Circular (EC) 1165-2-209, Water Resources Policies and Authorities, CIVIL WORKS REVIEW POLICY, 31 Jan 2010
- (2) EC 1105-2-407, Planning Models Improvement Program: Model Certification, 31 May 2005
- (3) Engineering Regulation (ER) 1110-2-12, Quality Management, 30 Sep 2006
- (4) Project management Plan, Gathright Dam and Lake Moomow Low Flow Augmentation Feasibility Study, Virginia, January 2010
- (5) *Other reference(s) if applicable (e.g., MSC Quality Management Plan)*

c. **Requirements.** This review plan was developed in accordance with EC 1165-2-209, which establishes the procedures for ensuring the quality and credibility of U.S. Army Corps of Engineers (USACE) decision documents through independent review. The EC outlines three levels of review: District Quality Control, Agency Technical Review, and Independent External Peer Review. In addition to these three levels of review, decision documents are subject to policy and legal compliance review and, if applicable, safety assurance review and model certification/approval.

- (1) District Quality Control (DQC). DQC is the review of basic science and engineering work products focused on fulfilling the project quality requirements defined in the Project Management Plan (PMP). It is managed in the home district and may be conducted by staff in the home district as long as they are not doing the work involved in the study, including contracted work that is being reviewed. Basic quality control tools include a Quality Management Plan providing for seamless review, quality checks and reviews, supervisory reviews, Project Delivery Team (PDT) reviews, etc. Additionally, the PDT is responsible for a complete reading of the report to assure the overall integrity of the report, technical appendices and the recommendations before approval by the District Commander. The Major Subordinate Command (MSC)/District quality management plans address the conduct and documentation of this fundamental level of review.
- (2) Agency Technical Review (ATR). ATR is an in-depth review, managed within USACE, and conducted by a qualified team outside of the home district that is not involved in the day-to-day production of the project/product. The purpose of this review is to ensure the proper application of clearly established criteria, regulations, laws, codes, principles and professional practices. The ATR team reviews the various work products and assure that all the parts fit together in a coherent whole. ATR teams will be comprised of senior USACE personnel (Regional Technical Specialists (RTS), etc.), and may be supplemented by outside experts as appropriate. To assure independence, the leader of the ATR team shall be from outside the home MSC.
- (3) Independent External Peer Review (IEPR). IEPR is the most independent level of review, and is applied in cases that meet certain criteria where the risk and magnitude of the proposed project are such that a critical examination by a qualified team outside of USACE is warranted. IEPR is generally for feasibility and reevaluation studies and modification reports with Environmental Impact Statements (EISs). IEPR is managed by an outside eligible organization (OEO) that is described in Internal Revenue Code Section 501(c) (3), is exempt from Federal tax under section 501(a), of the Internal Revenue Code of 1986; is independent;

is free from conflicts of interest; does not carry out or advocate for or against Federal water resources projects; and has experience in establishing and administering IEPR panels. The scope of review will address all the underlying planning, engineering, including safety assurance, economics, and environmental analyses performed, not just one aspect of the project.

- (4) **Policy and Legal Compliance Review.** Decision documents will be reviewed throughout the study process for their compliance with law and policy. These reviews culminate in Washington-level determinations that the recommendations in the reports and the supporting analyses and coordination comply with law and policy, and warrant approval or further recommendation to higher authority by the Chief of Engineers. Guidance for policy and legal compliance reviews is addressed further in Appendix H, ER 1105-2-100, Planning Guidance Notebook. When policy and/or legal concerns arise during DQC or ATR that are not readily and mutually resolved by the PDT and the reviewers, the District will seek issue resolution support from the MSC and HQUSACE in accordance with the procedures outlined in Appendix H, ER 1105-2-100. IEPR teams are not expected to be knowledgeable of Army and administration policies, nor are they expected to address such concerns. The home district Office of Counsel is responsible for the legal review of each decision document and signing a certification of legal sufficiency.
- (5) **Safety Assurance Review.** In accordance with Section 2035 of Water Resources Development Act (WRDA) of 2007, EC 1165-2-209 requires that all projects addressing flooding or storm damage reduction undergo a safety assurance review of the design and construction activities prior to initiation of physical construction and periodically thereafter until construction activities are completed on a regular schedule sufficient to inform the Chief of Engineers on the adequacy, appropriateness, and acceptability of the design and construction activities for the purpose of assuring public health, safety, and welfare. The decision document phase is the initial design phase; therefore, EC 1165-2-209 requires that safety assurance factors be considered in all reviews for decision document phase studies.
- (6) **Model Certification/Approval.** EC 1105-2-412 requires certification (for Corps models) or approval (for non-Corps models) of planning models used for all planning activities. The EC defines planning models as any models and analytical tools that planners use to define water resources management problems and opportunities, to formulate potential alternatives to address the problems and take advantage of the opportunities, to evaluate potential effects of alternatives and to support decision-making. The EC does not cover engineering models used in planning. Engineering software is being address under the Engineering and Construction (E&C) Science and Engineering Technology (SET) initiative. Until an appropriate process that documents the quality of commonly used engineering software is developed through the SET initiative, engineering activities in support of planning studies shall proceed as in the past. The responsible use of well-known and proven USACE developed and commercial engineering software will continue and the professional practice of documenting the application of the software and modeling results will be followed.

2. STUDY INFORMATION

- a. **Decision Document.** The purpose of the Gathright Dam and Lake Moomow, Virginia, Section 216 Low Flow Augmentation Feasibility Study is to evaluate alternatives for restoring environmental resources downstream of the Gathright Dam by means of low flow augmentation from the dam. Evaluation of the alternatives will determine the Federal interest in an environmental restoration plan utilizing low flow augmentation at Gathright Dam and Lake Moomaw. The decision document will

be prepared for the Chief of Engineer's signature. It is expected that an Environmental Assessment will be prepared in support of the NEPA documentation that is required.

- b. Study Description.** Gathright Dam and Lake Moomaw are located in the western part of Virginia on the Jackson River, 43.4 miles upstream of its confluence with the Cowpasture River to form the James River. The city of Covington is 19 miles downstream of the dam. The dam and a portion of the reservoir are in Alleghany County with most of the reservoir in Bath County. Gathright Dam and Lake Moomaw is a multipurpose project, authorized by the Flood Control Act of 1946. It is regulated to reduce flood damages at downstream locations, to increase low flows for the improvement of the downstream water quality, and to provide the opportunity for water-based recreation. An additional purpose of regulation, although not a Congressionally-authorized purpose, is the creation of a habitat downstream suitable for maintaining a cold water trout fishery. The project became fully operational in April 1982, when filling of the reservoir was complete.

Water quality below the dam at various locations along the Jackson River has become a major concern. Virginia's Department of Environmental Quality (VADEQ) has indicated there are major concerns with high levels of bacteria and biological impairments, low dissolved oxygen and damage to fish tissue caused by point source waste loads from municipalities with scattered, but large industries. These water quality issues are indicators of impaired habitat functions downstream of the dam. In this connection, there is an urgent need to conduct a study to address problems, needs, and opportunities concerning restoration of environmental resources along the Jackson River below Gathright Dam which could be influenced by modifications and/or changes in the operation of the dam.

The Commonwealth of Virginia, acting through the Secretary of Natural Resources, has expressed a strong support for the study and has indicated its willingness to share in the cost of a Feasibility Study by signing an FCSA on December 21, 2009. Low flow augmentation for environmental purposes is in accordance with the Administration's Policy. There should be no cost incurred by the Federal Government for project implementation as the anticipated result of the study is a change of operations of the releases at the dam. Congressman Goodlatte, VA 06, also strongly supports this study.

- c. Factors Affecting the Scope and Level of Review.** There are no significant technical or policy issues that can be identified for anything other than ATR during the Feasibility phase and preparation of the Feasibility Report. In accordance with standard policy and procedures for conducting a Section 216 study, a Section 905(b) Analysis was prepared during Fiscal Year 2005 at full Federal expense, to evaluate the need for and Federal interest in modifying the existing project for Gathright Dam and Lake Moomaw or their operation. The Section 905(b) Analysis studied alternatives for low flow augmentation to improve and restore environmental resources downstream along the Jackson River to its confluence with the Cowpasture River to form the James River.

This study involves basically how we are changing the releases from the dam to maintain and improve downstream aquatic and benthic habitat. Alternatives under consideration involve a reduction in current monthly low flow augmentation requirements balanced by six pulse releases utilizing the existing authorized conservation storage. If during the course of the study additional volume is required for the six pulse releases it would be obtained from the current inactive storage. None of the alternatives will have any impact on the authorized flood control or dam safety storage for the project. Therefore, it is our preliminary determination that there should be no costs associated with project implementation, no changes to existing structures and our recommendation will not change any aspects of flood risk management. Additionally, based on initial analyses there should be no significant impacts to lake levels or upstream areas. The changes in lake levels, though minimal (positive and negative over period June through October), will be fully documented in the

Feasibility Report. As there are no costs to the Federal government associated with project implementation, a formal cost/benefit analysis will not be conducted. In connection with the test pulse releases and changes in the stratification within Lake Moomow, we will be comparing the thermal stratification to the project base condition which will be dependent on the project purposes in the three different layers of stratification (epilimnion, metalimnion, and hypolimnion). In that regard our lake model will be looking to line up with what the Game and Inland Fisheries and US Forest Service stakeholders mandate for acceptable thresholds e.g. for existing uses and purposes.

All effects/impacts will be considered in determining whether an Environmental Assessment (EA) should be included in the Feasibility Report. If required, this product will address all impacts related to the plans for the restoration of the study area. This includes scoping and preparation of the environmental document, public coordination and review, and notification of findings. An EA would be approved in conjunction with the Final Feasibility Report.

Any alternative recommended cannot compromise the authorized project purposes of the original project; to reduce flood damages at downstream locations, to increase low flows for the improvement of downstream environmental resources, water quality, and to provide the opportunity for water based recreation. If any alternative poses significant adverse effects as predicted by the WASP7.2 and CE-QUAL-W2 models, that alternative will not be carried forward for consideration. Of the remaining alternatives, the environmental benefits, as predicted by the Stream Condition Index for Virginia Non-Coastal Streams, will be analyzed, with the intent to maximize periphyton scouring and, thus, the associated environmental benefits.

As there are no costs to the Federal government associated with project implementation, a traditional cost-effective/incremental cost analysis cannot be conducted. As discussed previously, the environmental benefits will be analyzed, with the goal of maximization with no significant negative effects on other project purposes. Any trade-offs will be addressed in the formulation of alternatives, only carrying forward alternatives for consideration that have no risk from a cost, human health, or environmental perspective.

- d. **In-Kind Contributions.** The Commonwealth of Virginia, Virginia Department of Environmental Quality contractor will be conducting downstream and in-lake modeling. The local sponsor's in-kind work is subject to District Quality Control (DQC). The local sponsor supports the study with a Jackson River Benthic Study that will monitor and model demonstrate pulses (flow modifications) during critical periods to determine if remediation of current water quality problems is feasible. In this connection, the district will receive reports as indicated in the Scope of Work from the State's contractor.

3. AGENCY TECHNICAL REVIEW (ATR)

- a. **General.** ATR for decision documents covered by EC 1165-2-209 are managed by the appropriate Planning Center of Expertise (PCX) with appropriate consultation with the allied Communities of Practice such as engineering and real estate. The ATR shall ensure that the product is consistent with established criteria, guidance, procedures, and policy. The ATR will assess whether the analyses presented are technically correct and comply with published USACE guidance, and that the document explains the analyses and the results in a reasonably clear manner for the public and decision makers. Members of the ATR team will be from outside the home district. The ATR lead will be from outside the home MSC. The leader of the ATR team will participate in milestone conferences to address review concerns.

- b. Products for Review.** ATR is conducted for the Feasibility Scoping Meeting documentation, Alternative Formulation Briefing, and the Draft and Final Reports. DQC will occur and be provided to the ATR team. In accordance with ER 1105-2-100, Planning Guidance, dated 22 April 2000, documentation and certification of technical/legal review will accompany any decision documents that are submitted for policy compliance review. Therefore, a Quality Control Report will provide documentation on the district's efforts for continuous Quality Control and Technical Review throughout the entire duration leading up to the completion of the Section 216 Detailed Project Report on Gathright Dam and Lake Moomaw, Low Flow Augmentation. The local sponsor's in-kind work is subject to DQC.
- c. Required ATR Team Expertise.**

Plan Formulator/ATR Team Lead (1): The ATR Plan Formulator and Team Lead should be a Planning Technical Expert able to consider evaluation non-structural alternatives. They must be a leader and a mentor to the ATR team as well as the district PDT, willing and able to provide timely guidance and direction to both teams. They will need to be familiar with the ecosystem functions that the district demonstrates to be necessary for success of the effort. The plan formulation process for the Gathright Section 216 will involve the development of solutions utilizing existing conservation storage and habitat restoration and improvement measures in the formulation and evaluation of the project. The primary objective of the Feasibility Study is to formulate a recommended plan that maximizes environmental outputs and allows existing recreational users of Lake Moomaw to continue using the lake for those purposes. Additionally, the formulated plan will minimize negative impacts to existing recreational features on Lake Moomaw, and will be in accordance with NEPA requirements. The goal is also to produce effective solutions to the water resources problems immediately downstream along the Jackson River until it's confluence with Lick Run and the James River, a distance of approximately 43 miles. The alternative project plans will be evaluated using results from proposed models, studies, and habitat benefits.

Economist (1): The ATR Team Economist should possess the KSA's at the Technical Expert Level and be able to analyze existing and future Corps' economic capabilities while operating under delegated authority when making decisions. They will need to become familiar with how the district determined what was critical in our quest to gather the most recent data available to support an cost analysis of plans. The crux will be to determine which alternatives are most cost effective and which ones maximize environmental outputs. They will be able to establish and ensure the Norfolk District PDT acquired an up-to-date bank of economic, municipal industrial, recreational, and historical information utilized as a reference source, determined the viability of our projections, analyses, and project relationships that were documented

The ATR Team Economist will be familiar with cost effective/incremental cost analysis, biological indices, or other accepted methodologies and how they are used to determine environmental outputs. While a traditional cost effective/incremental cost analysis cannot be conducted on the study since there are no costs associated with implementation of any of the alternatives, there will still be an assessment of benefits, trade-offs with any of the other original project purposes, as well as an analysis of risk and uncertainty. Situations of risk and uncertainty will be defined and evaluated in the Feasibility Study. The project economist's assessments in project formulation are also critical for the ATR Team Economist to understand. It is important that the ATR Team Economist be able to interpret what is displayed in a manner that makes clear to decision makers the types and degree of risk and uncertainty.

Hydraulics and Hydrology (H&H) Engineer (1): The ATR Team member will be an expert in the field of hydrology & hydraulics and have a thorough understanding of hydrology & hydraulics

modeling for the accomplishment of informed decisions by the district PDT, various sponsors, and environmental agencies. The ATR H&H Engineer will be familiar with how to produce the environmental enhancement measurable parameters required for plan formulation from in-lake and downstream water quality modeling that will be accomplished in accordance a scope of work provided to the district. The ATR H&H Engineer will become familiar with the historic record and synthetic events to demonstrate its effect on pool elevations behind the dam (drawdown's, increased rises, etc.) for each of the storage and release schedule combinations.

Biologist/NEPA (1): While a traditional cost effective/incremental cost analysis cannot be conducted on the study since there are no costs associated with implementation of any of the alternatives, there will still be an assessment of benefits, trade-offs with any of the other original project purposes, as well as an analysis of risk and uncertainty. The ATR Biologist will be a technical expert with the habitat evaluation methods that the district performed in support of the habitat evaluation. They will be familiar with the biological indices or other accepted methodologies utilized for evaluating aquatic resources that were used to determine environmental "outputs"; i.e., benefits derived from alternative environmental restoration measures/projects. The environmental benefits, in this case, will be developed using the Stream Condition Index for Virginia Non-Coastal Streams. The environmental impacts unique to various alternatives will also be assessed. A thorough evaluation of the alternatives as they may affect fisheries and other biological resources will be required. A review of the PDT developed monitoring plan is required, and success criteria will be established. Suggest for consideration that the document reviewer and the model reviewer be qualified to provide reviews on both.

The alternatives considered in this study will utilize existing conservation storage in the project and will require no additional real estate actions, therefore there is no need for a Real Estate specialist on the ATR Team.

Reference the same conditions in the paragraph above and in connection with the USACE Walla Walla (Washington) District who is designated as the USACE's Cost Engineering Directory/Center of Expertise, there are no costs associated with this project and nothing for the Cost EX to review.

NAO requests ECO-PCX identify ATR Team for this study.

- d. Documentation of ATR.** DrChecks review software will be used to document all ATR comments, responses and associated resolutions accomplished throughout the review process. Comments should be limited to those that are required to ensure adequacy of the product. The four key parts of a quality review comment will normally include:
- (1) The review concern – identify the product's information deficiency or incorrect application of policy, guidance, or procedures;
 - (2) The basis for the concern – cite the appropriate law, policy, guidance, or procedure that has not be properly followed;
 - (3) The significance of the concern – indicate the importance of the concern with regard to its potential impact on the plan selection, recommended plan components, efficiency (cost), effectiveness (function/outputs), implementation responsibilities, safety, Federal interest, or public acceptability; and
 - (4) The probable specific action needed to resolve the concern – identify the action(s) that the reporting officers must take to resolve the concern.

In some situations, especially addressing incomplete or unclear information, comments may seek clarification in or to then assess whether further specific concerns may exist. The ATR

documentation in DrChecks will include the text of each ATR concern, the PDT response, a brief summary of the pertinent points in any discussion, including any vertical coordination, and lastly the agreed upon resolution. The ATR team will prepare a Review Report which includes a summary of each unresolved issue; each unresolved issue will be raised to the vertical team for resolution. Review Reports will be considered an integral part of the ATR documentation and shall:

- Disclose the names of the reviewers, their organizational affiliations, and include a short paragraph on both the credentials and relevant experiences of each reviewer;
- Include the charge to the reviewers;
- Describe the nature of their review and their findings and conclusions; and
- Include a verbatim copy of each reviewer's comments (either with or without specific attributions), or represent the views of the group as a whole, including any disparate and dissenting views.

ATR may be certified when all ATR concerns are either resolved or referred to HQUSACE for resolution and the ATR documentation is complete. Certification of ATR should be completed, based on work reviewed to date, for the AFB, draft report, and final report. A sample certification is included in ER 1165-2-209.

4. INDEPENDENT EXTERNAL PEER REVIEW (IEPR)

- a. General.** IEPR is conducted for decision documents if there is a vertical team decision (involving the district, MSC, PCX, and HQUSACE members) that the covered subject matter meets certain criteria (described in EC 1105-2-209) where the risk and magnitude of the proposed project are such that a critical examination by a qualified team outside the USACE is warranted. IEPR is coordinated by the appropriate PCX and managed by an Eligible Outside Organization (OEO) external to the USACE. IEPR panels shall evaluate whether the interpretations of analysis and conclusions based on analysis are reasonable. To provide effective review, in terms of both usefulness of results and credibility, the review panels should be given the flexibility to bring important issues to the attention of decision makers; however, review panels should be instructed to not make a recommendation on whether a particular alternative should be implemented, as the Chief of Engineers is ultimately responsible for the final decision on a planning or reoperations study. IEPR panels will accomplish a concurrent review that covers the entire decision document and will address all the underlying engineering, economics, and environmental work, not just one aspect of the study. Whenever feasible and appropriate, the office producing the document shall make the draft decision document available to the public for comment at the same time it is submitted for review (or during the review process) and sponsor a public meeting where oral presentations on scientific issues can be made to the reviewers by interested members of the public.
- b. Decision on IEPR.** An IEPR does not apply to this study. The PDT has assessed the potential risks that are associated with accomplishing the project activities, schedule and fiscal resources, project background information, customer/stakeholder expectations and their tolerance for risk. As a result of this assessment, the PDT has determined that the proposed study does not present a high risk of developing decisions or recommendations for implementation that may lead to non-performance of the existing project, particularly in the areas of economics, environment, public safety, and social justice. Further, this project does not meet the mandatory triggers, does not warrant an IEPR based on a risk-informed analysis, and is so limited in scope and impact that it would not significantly benefit from IEPR. Preliminary findings conclude that:

- Significant threat to human life: Implementation of this Section 216 project is not going to be a significant threat to human life and public safety. All of the alternatives utilize existing

conservation storage therefore there will be no increase in the top of the conservations pool elevation. The six flow releases/pulses will not result in significant, sudden drawdown of the reservoir (less than 1 foot over 8 hours) nor undue risk to downstream areas. The pulses will be well publicized and river level increases will be approximately 1 foot or less per hour which is less than the 2 foot per hour increase currently in the water control plan. Implementation of the alternatives will not impact Gathright's Dam Safety Action classification (DSAC II).

- Total project cost greater than \$45 million: There will be no project implementation costs associated with the project as the most likely recommendation will involve how we are changing the releases from the dam to maintain and improved downstream aquatic and benthic habitat.
- Request by the State Governor: The Governor of Virginia is not expected to request peer review of this study. The Commonwealth of Virginia strongly supports this study, the proposed alternatives and the evaluation measures outlined in the PMP as evidenced by the execution of the FCSA.
- Request by the head of a Federal or State Agency: The Commonwealth of Virginia, through the Department of Environmental Quality, supports this study with active participation at monthly meetings and coordination with its contractor, whose scope of work includes the Jackson River Benthic Study that supports the Gathright Dam and Lake Moomaw Low Flow Augmentation Feasibility Study. There have not been any requests from Federal or state agencies for IEPR. Study coordination will include the following agencies: US Fish and Wildlife Service, US Forest Service, National Marine Fisheries Service, US Environmental Protection Agency, Virginia Department of Environmental Quality, Virginia Department of Conservation and Recreation, Virginia Department of Forestry, Virginia Marine Resources Commission, Virginia Department of Game and Inland Fisheries, Virginia Institute of Marine Science, Virginia Department of Historic Resources, Central Shenandoah Planning District Commission, Roanoke Valley-Alleghany Regional Commission, and The Nature Conservancy.
- Significant public dispute as to size, nature, or effects of the project: With all of the alternatives utilizing existing authorized conservation storage, we do not anticipate that the Gathright Dam and Lake Moomaw Low Flow Augmentation Feasibility Study would meet the factors of controversy (public dispute as to size, nature, or effects of project) for the Chief of Engineers to determine the project is controversial in nature.
- Significant public dispute as to the economic or environmental cost or benefit of the project: Since all of the alternatives will utilize environmental evaluation measures proposed in the PMP and the project is not likely to include an Environmental Impact Statement, nor have adverse impacts on scarce or unique cultural, historic, or tribal resources, we do not anticipate that the Gathright Dam and Lake Moomaw Low Flow Augmentation Feasibility Study would meet the factors of controversy (public dispute as to the environmental costs or benefits of the project). It is anticipated we will use the Stream Index for Virginia Non-Coastal Streams to estimate the project benefits for each of the alternatives under consideration. Based on the low risk involved with implementation of this project and the screening of alternatives with engineering model data prior to benefit analysis, we do not anticipate that the study would meet the factors of controversy (public dispute as to the economic costs or benefits of the project) for the Chief of Engineers to determine the project controversial in nature.
- Methods are novel or complex: This study utilizes two, previously approved for use, models to determine any significant adverse impacts to Lake Moomaw and downstream along the Jackson

River. As there are no costs to the federal government associated with project implementation, we cannot conduct a traditional cost-effective/incremental cost analysis. We will analyze the environmental benefits with the goal of maximization and with no significant negative effects on other project purposes. In this connection, the ECO-PCX approved the Stream Condition Index for Virginia Non-coastal Streams model for single use to aid in determining our environmental benefits.

c. Products for Review. Not-applicable

- **Required IEPR Panel Expertise.** Not-applicable

Documentation of IEPR. Not-applicable

5. MODEL CERTIFICATION AND APPROVAL

a. General. The use of certified or approved models for all planning activities is required by EC 1105-2-412. This policy is applicable to all planning models currently in use, models under development and new models. The appropriate PCX will be responsible for model certification/approval. The goal of certification/approval is to establish that planning products are theoretically sound, compliant with USACE policy, computationally accurate, and based on reasonable assumptions. The use of a certified or approved model does not constitute technical review of the planning product. Independent review of the selection and application of the model and the input data and results is still required through conduct of DQC, ATR, and, if appropriate, IEPR. Independent review is applicable to all models, not just planning models. Both the planning models (including the certification/approval status of each model) and engineering models used in the development of the decision document are described below:

b. Planning Models. The following planning models are anticipated to be used:

It is anticipated that the Stream Index for Virginia Non-Coastal Streams (VSCI) will be used to estimate the project benefits for each of the alternatives under consideration. This index, which is an index of biotic integrity, can be used as a primary indicator of ecosystem health and can identify impairment with respect to the reference (or natural) condition. The index includes eight biological attributes that represent elements of the structure and function of the bottom-dwelling macroinvertebrate assemblage. This index was initially developed by TetraTech Inc. for VADEQ and USEPA, and validated and reviewed by the VADEQ, and USEPA. The model has been in use by the VADEQ since 2003.

As discussed above, it is anticipated that the Stream Index for Virginia Non-Coastal Streams will be used to estimate the project benefits for each of the alternatives under consideration. It is unknown at this time if this model would be applicable to other future study efforts so it is anticipated that this model will be applied as a single-use model. Based on the low risk involved with implementation of this project and the screening of alternatives with engineering model data prior to benefit analysis, this model should be reviewed in conjunction with the ATR for approval as a single use model. This single use model approval would require robust ATR specifically on the VSCI. However, as mentioned in the ATR team discussion above, would consider the document reviewer and the model reviewer be qualified to conduct both reviews. The documentation on the model will be provided to this reviewer upon request.

- c. **Engineering Models.** The alternative low flow augmentation releases and the six pulses will be evaluated utilizing results from the WASP7 and CE-QUAL-W2 engineering models.

The six pulse releases will be from a combination of the multi-level intake tower wet well water quality system and bottom releasing sluice gates.

These models are anticipated to be used to assess the impact of the flow pulses on the water temperature and water quality in Lake Moomaw, the tailwater of the Jackson River and the Lower Jackson River.

CE-QUAL-W2 will be applied to assess the potential impact of flow pulses on water temperature, dissolved oxygen (DO), and water levels in Lake Moomaw. Since the water releases for the flow pulses will consist of a blend of water from the epilimnion and hypolimnion, it is necessary to assess the potential change in thermal stratification that might be caused by the flow pulses since the change of the thermal stratification may lead to a destabilization of the thermal stratification and may adversely affect the environment for warm water and coldwater fish species. In fact, the current operating procedures require that the water temperature in the metalimnion must not exceed a maximum temperature of 68 °F to protect trout and alewives.

The CE-QUAL-W2 model is a two-dimensional water quality and hydrodynamic code supported by the USACE Engineer Research and Development Center in Vicksburg, Mississippi. The model has been widely applied to stratified surface water systems such as lakes, reservoirs, and estuaries and computes water levels, horizontal and vertical velocities, water temperature, and 21 other water quality parameters such as DO, nutrients, organic matter, algae, pH, bacteria, and dissolved and suspended solids. In CE-QUAL-W2, the river or reservoir is conceptualized as a laterally averaged two-dimensional model having horizontal segments and vertical layers.

CE-QUAL-W2 is based on the laterally averaged equations of momentum, continuity, and transport. The formulation includes the vertically varying, longitudinal momentum balance, vertical momentum in the form of the hydrostatic approximation, local continuity, the free-water surface condition based on vertically integrated continuity, and longitudinal and vertical transport of any number of constituents. Constituents that determine density such as water temperature are related to momentum through an equation of state. The vertically varying, longitudinal momentum balance includes local acceleration of horizontal velocity, horizontal and vertical advective momentum transfer, the horizontal pressure gradient, and horizontal and vertical shear stress.

WASP7.2 will be applied to assess the potential impact of flow pulses on the water temperature and water quality in the tailwater of the Jackson River as well as in the Lower Jackson River. Additional flow release from the hypolimnion (DO deprived water) could lead to low instream DO levels that may adversely affect macroinvertebrates and fish.

The water quality simulation program (WASP7) is a dynamic compartmental modeling program for aquatic systems that has been developed and maintained by the U.S. EPA. WASP includes time-varying processes of advection, dispersion, point and diffuse mass loading, and boundary exchange and can be used to analyze a variety of water quality problems in streams, lakes, reservoirs, and estuaries in one, two, or three dimensions. The key advantage of WASP 7 is that it can be linked easily to watershed models or other instream models such as CE-QUAL-W2. Problems studied using WASP include biochemical oxygen demand and DO dynamics, algae growth (phytoplankton and periphyton), nutrients and eutrophication, water temperature, bacterial contamination, and organic chemical and heavy metal contamination.

The EUTRO module of the WASP model includes nitrogen and phosphorus cycling, dissolved oxygen organic matter interactions, phytoplankton and bottom algae kinetics. The WASP HEAT Module has been recently developed to allow the dynamic simulation of processes affecting water temperatures, including surface heat exchange. The temperature routines are based upon those in the CE-QUAL-W2 model. In addition, the Heat Module allows the simulation of salinity, or total dissolved solids, coliform bacteria and two arbitrary materials, for a total of five state variables.

The WASP model temperature module (HEAT) will be used to assess the impact of the flow pulses on water temperature in the Jackson River tailwater and the lower Jackson River. Similarly, the WASP model eutrophication module (EUTRO) will be used to assess the impact of the flow pulses on water quality in the Jackson River tailwater and the lower Jackson River.

The WASP model was previously used in the development of the TMDL study that has been completed and approved by EPA for the lower Jackson River. During the TMDL development, the WASP eutrophication module was applied to the benthic impaired segment of the Jackson River within the study area over a five-month period during the growing season between June 1st and October 31st for 2006. Under this 216 study, those boundaries will be extended west up to the spillway of the dam, a distance of approximately 19 miles.

The TMDL findings led to study the feasibility of flow release from Gathright Dam under our 216 authority. In fact, the TMDL study indicated that six flow pulses of 3,000 cfs each were necessary during the growing season (June to October) to restore some natural stream flow variability and to remediate current instream habitat impairments caused by excessive periphyton growth. The six flow pulses were estimated using periphyton level output generated by the WASP model and a relationship between stream velocity and biomass levels, since the WASP model does not implicitly simulate the periphyton scouring.

The analysis under this current 216 study will also confirm the recommended number and magnitude of the flow pulses using the existing relationship between flow velocity and periphyton levels developed during the TMDL study. The team will attempt to refine this relationship using instream water quality data collected during the flow pulses.

6. REVIEW SCHEDULES AND COSTS

a. ATR Schedule and Cost.

| EVENT | COST (\$ in thousands) |
|---|------------------------|
| Feasibility Scoping Meeting (Feb 11 to Aug 11) | 12.0 |
| Alternative Formulation Briefing (Dec 11 to Apr 12) | 25.0 |
| Draft Report Review | 10.0 |
| Final Report Review | 5.0 |

b. IEPR Schedule and Cost. Not-applicable

Model Certification/Approval Schedule and Cost. As discussed above, it is anticipated that the Stream Index for Virginia Non-Coastal Streams will be used to estimate the project benefits for each of the alternatives under consideration. Based on the low risk involved with implementation of this project and the screening of alternatives with engineering model data prior to benefit analysis, this model should be reviewed in conjunction with the ATR for approval as a single use model. As mentioned in the ATR team discussion above, would consider the document reviewer and the model

reviewer be qualified to conduct both reviews. The documentation on the model will be provided to the reviewer upon request.

7. PUBLIC PARTICIPATION

This study will include a public involvement program designed to meet NEPA requirements; solicit public and government agency input about the Jackson River and its problems; ensure that public and agency concerns are addressed; and keep the public and agencies involved in the development of the study goals, study progress, and proposed projects. A study initiation letter dated May 7, 2010 has been provided to approximately 150 stakeholders. Initial background presentations will be made to civic and advisory groups active in the region. Community input will be solicited when establishing study goals and objectives and when developing project alternatives. Briefings will be conducted to discuss the scope and scheduling of the Feasibility Study. Civic, advisory, and neighborhood groups will be encouraged to actively participate in the development of alternatives and will be consulted throughout the study process. The public's commitment to a comprehensive restoration package will be sought. Agencies will be notified of public meetings, provided with copies of newsletters, and solicited for report review comments. Federal agencies to be solicited for comments include the FWS, U.S. Forest Service, National Marine Fisheries Service, and the Environmental Protection Agency. State and local agencies and organizations to be included in the coordination are the Virginia Department of Environmental Quality, Virginia Department of Conservation and Recreation, Virginia Department of Forestry, Virginia Marine Resources Commission, Virginia Department of Game and Inland Fisheries, Virginia Institute of Marine Science, Virginia Department of Historic Resources, Central Shenandoah Planning District Commission, Roanoke Valley-Alleghany Regional Commission, and The Nature Conservancy. Others to be coordinated with include the cities of Clifton Forge and Covington, as well as the Virginia counties of Alleghany, Bath, Botetourt, and Rockbridge.

8. PCX COORDINATION

Review plans for decision documents and supporting analyses outlined in EC 1105-2-209 are coordinated with the appropriate Planning Center(s) of Expertise (PCXs) based on the primary purpose of the basic decision document to be reviewed.

The lead PCX for this study is ECO-PCX, Jodi Staebell, 309-794-5448,

9. MSC APPROVAL

The MSC that oversees the home district is responsible for approving the review plan. Approval is provided the MSC Commander. The commander's approval should reflect vertical team input (involving district, MSC, PCX, and HQUSACE members) as to the appropriate scope and level of review for the decision document. Like the PMP, the RP is a living document and may change as the study progresses. Changes to the RP should be approved by following the process used for initially approving the RP. In all cases the MSCs will review the decision on the level of review and any changes made in updates to the project.

9. REVIEW PLAN POINTS OF CONTACT

Questions and/or comments on this review plan can be directed to the following points of contact:

Lawrence H. Ives, TTL
Civil Engineer

US Army Corps of Engineers

- PDT members and ATR Team members are provided as attachment 1
- ATR Certification Template (Example) is provided as attachment 2
- Certification of Independent Technical Review and Quality Assurance Review (Example) as attachment 3
- Project Map is attachment 4

ATTACHMENT 3: ACRONYMS AND ABBREVIATIONS

| <u>Term</u> | <u>Definition</u> | <u>Term</u> | <u>Definition</u> |
|-------------|---|-------------|--|
| AFB | Alternative Formulation Briefing | NED | National Economic Development |
| ASA(CW) | Assistant Secretary of the Army for Civil Works | NER | National Ecosystem Restoration |
| ATR | Agency Technical Review | NEPA | National Environmental Policy Act |
| CSDR | Coastal Storm Damage Reduction | O&M | Operation and maintenance |
| DPR | Detailed Project Report | OMB | Office and Management and Budget |
| DQC | District Quality Control | OMRR&R | Operation, Maintenance, Repair, Replacement and Rehabilitation |
| DX | Directory of Expertise | OEO | Outside Eligible Organization |
| EA | Environmental Assessment | OSE | Other Social Effects |
| EC | Engineer Circular | PCX | Planning Center of Expertise |
| EIS | Environmental Impact Statement | PDT | Project Delivery Team |
| EO | Executive Order | PAC | Post Authorization Change |
| ER | Ecosystem Restoration | PMP | Project Management Plan |
| FDR | Flood Damage Reduction | PL | Public Law |
| FEMA | Federal Emergency Management Agency | QMP | Quality Management Plan |
| FRM | Flood Risk Management | QA | Quality Assurance |
| FSM | Feasibility Scoping Meeting | QC | Quality Control |
| GRR | General Reevaluation Report | RED | Regional Economic Development |
| HQUSACE | Headquarters, U.S. Army Corps of Engineers | RTS | Regional Technical Specialist |
| IEPR | Independent External Peer Review | USACE | U.S. Army Corps of Engineers |
| ITR | Independent Technical Review | WRDA | Water Resources Development Act |
| LRR | Limited Reevaluation Report | | |
| MSC | Major Subordinate Command | | |
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