FINAL SUPPLEMENTAL WATERSHED PLAN #2
AND
ENVIRONMENTAL ASSESSMENT
FOR THE
REHABILITATION OF SITE 1
UPPER DECKERS CREEK WATERSHED
Preston and Monongalia Counties, West Virginia

PREPARED BY:

United States Department of Agriculture
Natural Resources Conservation Service

In Cooperation with the US Army Corps of Engineers, Pittsburgh District

SPONSORED BY:

Preston County Commission,
Monongahela Conservation District,
West Virginia State Conservation Committee

August 2012

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Cover photo: Upper Deckers Creek Site 1 in the Deckers Creek Watershed

This plan can be viewed at:

http://www.wv.nrcs.usda.gov/programs/watershed/upDeckers/UpDeckers.html

Final
Supplemental Watershed Plan Number 2 & Environmental Assessment
Rehabilitation of Site 1
Upper Deckers Creek Watershed
Preston and Monongalia Counties, West Virginia

Prepared By:

U.S. Department of Agriculture, Natural Resources Conservation Service
In Cooperation With:
Preston County Commission,
Monongahela Conservation District,
West Virginia State Conservation Committee

AUTHORITY

The original watershed work plan was prepared, and the works of improvement have been installed, under the authority of the Watershed Protection and Flood Prevention Act of 1954 (Public Law 83-566) as amended. The rehabilitation of floodwater retarding structure No. 1 is authorized under Public Law 83-566 (as amended), and as further amended by Section 313 of Public Law 106-472.

ABSTRACT

Upper Deckers Creek Site 1 (UDC1) was constructed in 1969 to address flooding in a relatively rural area. Since that time, there has been significant development downstream of the site. The site has been reclassified as a high hazard (c) dam that fails to comply with current performance and safety standards. Local project sponsors have chosen to rehabilitate the dam to address the identified safety deficiencies. The purposes of the proposed rehabilitation of UDC1 are to maintain the present level of flood control benefits, comply with current performance and safety standards, and provide a rural water supply under the purpose of agricultural water management. Rehabilitation of the site will require the following modifications to the structure: construction of a new excavated auxiliary spillway on the dam's left abutment, lining and extending the existing principal spillway pipe, constructing new principal spillway inlet and outlet structures, constructing a new internal embankment drainage system, modifying the embankment top width and height for multi-purpose use, and measures to increase stability of the embankment slopes. Project installation cost is estimated to be $8,044,100, of which $5,342,300 will be paid from the Small Watershed Rehabilitation funds and $2,701,800 from local funds.

Supplemental Subwatershed Work Plan Agreement Number 2

Between the

Monongahela Conservation District
Preston County Commission
West Virginia State Conservation Committee
(Referred to herein as sponsors)

And the

United States Department of Agriculture
Natural Resources Conservation Service
(Referred to herein as NRCS)

Whereas, application has heretofore been made to the Secretary of Agriculture by the sponsors for assistance in preparing a plan for works of improvement for the Upper Deckers Creek Watershed, State of West Virginia, under the authority of the Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. Sections 1001 to 1008, 1010 and 1012); and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, has been assigned by the Secretary of Agriculture to NRCS; and

Whereas, there has been developed through the cooperative efforts of the sponsors and NRCS a watershed project plan and Environmental Assessment for works of improvement for the Upper Deckers Creek Watershed, State of West Virginia, hereinafter referred to as the Watershed Project Plan or plan, which is annexed to and made a part of this agreement;

Whereas, the Supplemental Watershed Plan Agreement Number 1 for the Upper Deckers Creek Watershed, State of West Virginia, was executed by the Sponsors named therein and the NRCS, became effective November 2003; and

Whereas, in order to rehabilitate Site 1 of said watershed, it has become necessary to modify said agreement; and

Whereas, the rehabilitation of Site 1 has been authorized under the authority of Public Law 83-566, as amended, the Watershed Protection and Flood Prevention Act of 1954; and as further amended by Section 313 of Public Law 106-472; and

Now, therefore, in view of the foregoing considerations, the Secretary of Agriculture, through NRCS, and the sponsors hereby agree on this Watershed Project Plan and the works of improvement for this project will be installed, operated, and maintained in accordance with the terms, conditions, and stipulations provided for in this plan and including the following:

1. **Term.** The term of this agreement is for the installation period and evaluated life of the project (50 years) and does not commit NRCS to assistance of any kind beyond the end of the evaluated life.

2. **Costs.** The costs shown in this plan are preliminary estimates. Final costs to be borne by the parties hereto will be the actual costs incurred in the installation of works of improvement.

3. **Real Property.** The sponsors will acquire such real property as will be needed in connection with the works of improvement. The amounts and percentages of the real property acquisition costs to be borne by the Sponsors and NRCS are as shown in the cost-share table in section 5 hereof.

   The sponsors agree that all land acquired for measures, other than land treatment practices, with financial or credit assistance under this agreement will not be sold or otherwise disposed of for the evaluated life of the project except to a public agency which will continue to maintain and operate the development in accordance with the Operation and Maintenance Agreement.

4. **Uniform Relocation Assistance and Real Property Acquisition Policies Act**. The sponsors hereby agree to comply with all of the policies and procedures of the Uniform Relocation Assistance and Real Property Acquisition Policies Act (42 U.S.C. 4601 et.seq. as further implemented through regulations in 49 CFR Part 24 and 7 CFR Part 21) when acquiring real property interests for this federally assisted project. If the sponsor is legally unable to comply with the real property acquisition requirements, it agrees that, before any federal financial assistance is furnished; it will provide a statement to that effect, supported by an opinion of the chief legal officer of the state containing a full discussion of the facts and law involved. This statement may be accepted as constituting compliance.

5. The Preston County Public Service District 1, under the governance of the Preston County Commission, will have the responsibility, if necessary, to obtain and use a temporary alternative water supply during the rehabilitation construction. The cost associated with the subject rights are not eligible as part of the sponsors' cost-share requirements.

6. The sponsors will be responsible for maintaining a municipal water supply for the term of this agreement. The term of the agreements will be for 50 years.

7. **Cost-share for Watershed Project Plans**. The following table will be used to show cost-share percentages and amounts for Watershed Project Plan implementation.

Works of Improvement	NRCS	Sponsors	Total
Cost Sharable Items			
Rehabilitation of dam (Construction Costs)	$4,269,200	$1,930,800	$6,200,000
Relocation, Replacement in-kind	$0	$0	$0
Relocation, Required Decent, Safe, Sanitary	$0	$0	$0
Sponsors Planning Costs	NA	$0	$0
Sponsors Engineering Costs	NA	$0	$0
Sponsors Project Administration	NA	$0	$0
Land Rights Acquisition Cost	NA	$368,000	$368,000
Subtotal: Cost-Share Costs Cost-Share Percentages [a/]	$4,269,200 65%	$2,298,800 35%	$6,568,000 100%
Non Cost-Sharable Items [b/]			
NRCS Engineering & Project Administration	$1,073,100	NA	$1,073,100
Natural Resources Rights [c/]	NA	$399,500	$399,500
Federal, State, and Local Permits	NA	$3,500	$3,500
Relocation, Beyond Rqrd decnt, safe, sentry	NA	$0	$0
Subtotal: Non Cost-Share Costs	$1,073,100	$403,000	$1,476,100

[a/] Maximum NRCS cost-share is 65% of Cost-Sharable items not to exceed 100% of construction cost (including Replacement-in-kind; Required Decent, Safe, Sanitary; and flood proofing downstream properties).

[b/] If actual Non Cost-Sharable item expenditures vary from these figures, the responsible party will bear the change.

[c/] Water supply component, responsibility of Preston County Commission

8. **Land treatment agreements.** The sponsors will obtain agreements from owners of not less than 50 percent of the land above each multiple-purpose and floodwater-retarding structure. These agreements must provide that the owners will carry out farm or ranch conservation plans on their land. The sponsors will ensure that 50 percent of the land upstream of any retention reservoir site is adequately protected before construction of the dam. The sponsors will provide assistance to landowners and operators to ensure the installation of the land treatment measures shown in the Watershed Project Plan. The sponsors will encourage landowners and operators to continue to operate and maintain the land treatment measures after the long-term contracts expire, for the protection and improvement of the watershed.

9. **Floodplain Management.** Before construction of any project for flood prevention, the sponsors shall agree to participate in and comply with applicable federal floodplain management and flood insurance programs.

10. **Water and mineral rights.** The sponsors will acquire or provide assurance that landowners or resource users have acquired such water, mineral, or other natural resources rights pursuant to State law as may be needed in the installation and operation of the works of improvement. Any costs incurred shall be borne by the sponsors and these costs are not eligible as part of the sponsors cost-share.

11. **Permits.** The sponsors will obtain and bear the cost for all necessary Federal, State, and local permits required by law, ordinance, or regulation for installation of the works of improvement. These costs are not eligible as part of the sponsors' cost-share.

12. **NRCS assistance.** This agreement is not a fund-obligating document. Financial and other assistance to be furnished by NRCS in carrying out the plan is contingent upon the fulfillment of applicable laws and regulations and the availability of appropriations for this purpose.

13. **Additional agreements.** A separate agreement will be entered into between NRCS and the sponsors before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

14. **Amendments.** This plan may be amended or revised only by mutual agreement of the parties hereto, except that NRCS may deauthorize or terminate funding at any time it determines that the sponsors have failed to comply with the conditions of this agreement or when the program funding or authority expires. In this case, NRCS shall promptly notify the sponsors in writing of the determination and the reasons for the deauthorization of project funding, together with the effective date. Payments made to the sponsors or recoveries by NRCS shall be in accord with the legal rights and liabilities of the parties when project funding has been deauthorized. An amendment to incorporate changes affecting a specific measure may be made by mutual agreement between NRCS and the sponsors having specific responsibilities for the measure involved.

15. **Prohibitions.** No member of, or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this plan, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

16. **Operation and Maintenance (O&M).** The sponsors will be responsible for the operation, maintenance, and any needed replacement of the works of improvement by actually performing the work or arranging for such work, in accordance with an O&M Agreement. An O&M agreement will be entered into before Federal funds are obligated and will continue for the project life (50 years). Although the sponsors' responsibility to the Federal Government for O&M ends when the O&M agreement expires upon completion of the evaluated life of measures covered by the agreement, the sponsors acknowledge that continued

liabilities and responsibilities associated with works of improvement may exist beyond the evaluated life.

17. **Emergency Action Plan.** Prior to construction, the sponsors shall prepare an Emergency Action Plan (EAP) for each dam or similar structure where failure may cause loss of life or as required by state and local regulations. The EAP shall meet the minimum content specified in Part 500.52 of the NRCS Title 180, National Operation and Maintenance Manual (NOMM), Part 500, Subpart F, Section 500.52, and meet applicable State agency dam safety requirements. The NRCS will determine that an EAP is prepared prior to the execution of fund obligating documents for construction of the structure. EAPs shall be reviewed and updated by the sponsors annually.

18. **Nondiscrimination provisions.** The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, DC 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

19. **Certification Regarding Drug-Free Workplace Requirements** (7 CFR Part 3021). By signing this Watershed Agreement, the sponsors are providing the certification set out below. If it is later determined that the sponsors knowingly rendered a false certification, or otherwise violated the requirements of the Drug Free Workplace Act, the NRCS, in addition to any other remedies available to the Federal Government, may take action authorized under the Drug-Free Workplace Act.

    Controlled substance means a controlled substance in Schedules I through V of the Controlled Substances Act (21 U.S.C. Section 812) and as further defined by regulation (21 CFR Sections 1308.11 through 1308.15);

    Conviction means a finding of guilt (including a pleas of *nolo contendere*) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statutes;

    Criminal drug statute means a Federal or non-Federal criminal statute involving the manufacturing, distribution, dispensing, use, or possession of any controlled substance;

Employee means the employee of a grantee directly engaged in the performance of work under a grant, including: (i) all direct charge employees; (ii) all direct charge employees unless their impact or involvement is insignificant to the performance of the grant; and, (iii) temporary personnel and consultants who are directly engaged in the performance of work under the grant and who are on the grantee's payroll. This definition does not include workers not on the payroll of the grantee (e.g. volunteers, even if used to meet a matching requirement; consultants or independent contractors not on the grantees; or employees of sub recipients or subcontractors in covered workplaces).

Certification:

A. The sponsors certify that they will or will continue to provide a drug-free workplace by –

(1) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition.

(2) Establishing an ongoing drug-free awareness program to inform employees about –

(a) The danger of drug abuse in the workplace;

(b) The grantee's policy of maintaining a drug-free workplace;

(c) Any available drug counseling, rehabilitation, and employee assistance programs; and

(d) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace

(3) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (1).

(4) Notifying the employee in the statement required by paragraph (1) that as a condition of employment under the grant, the employee will –

(a) Abide by the terms of the statement; and

(b) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction.

(5) Notifying the NRCS in writing, within 10 calendar days after receiving notice under paragraph (4)(b) from an employee or otherwise receiving actual notice, including position title, to every grant officer or other designee on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification numbers of each affected grant.

(6) Taking one of the following actions, within 30 calendar days of receiving notice under paragraph (4)(b), with respect to any employee is so convicted –

(a) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or

(b) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by Federal, State, or local health, law enforcement, or other appropriate agency.

(7) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (1), (2), (3), (4), (5), and (6).

B. The sponsors may provide a list of the sites for the performance of work done in connection with a specific project or other agreement.

C. Agencies shall keep the original of all disclosure reports in the official files for the agency.

20. Certification Regarding Lobbying (7 CFR Part 3018) (for projects > $100,00)

A. The sponsors certify to the best of their knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the sponsors, to any person for influencing or attempting to influence an officer or employee of an agency, Member of Congress, an officer or employee of Congress, or an employee of an Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or an employee of any agency, a Member of Congress, an

officer or an employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The sponsors shall require that the language of this certification be included in the award documents for all sub awards at all tiers (including subcontractors, sub grants, and contracts under grants, loans, and cooperative agreements) and that all sub recipients shall certify and disclose accordingly.

B. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by U.S. Code, Title 31, Section 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

19. **Certification Regarding Debarment, Suspension, and Other Responsibility Matters – Primarily Covered Transactions (7 CFR Part 3017).**

A. The sponsors certify to the best of their knowledge and belief, that they and their principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(2) Have not within a 3-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph A(2) of this certification; and

(4) Have not within a 3-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

B. Where the primary sponsors are unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this agreement.

20. Clean Air and Water Certification.

(Applicable if this agreement exceeds $100,000, or a facility to be used has been subject of a conviction under the Clean Air Act (42 U.S.C. Section 7413(c)) or the Federal Water Pollution Control Act (33 U.S.C. Section 1319(c)) and is listed by EPA, or is not otherwise exempt.)

A. The project sponsoring organizations signatory to this agreement certify as follows:

(1) Any facility to be utilized in the performance of this proposed agreement is (____), is not (___) listed on the Environmental Protection Agency List of Violating Facilities.

(2) To promptly notify the NRCS-State administrative officer prior to the signing of this agreement by NRCS, of the receipt of any communication from the Director, Office of Federal Activities, U.S. Environmental Protection Agency, indicating that any facility which is proposed under this agreement is under consideration to be listed on the Environmental Protection Agency List of Violating Facilities.

(3) To include substantially this certification, including this subparagraph, in every nonexempt sub-agreement.

B. The project sponsoring organization(s) signatory to this agreement agrees as follows:

(1) To comply with all the requirements of section 114 of the Clean Air Act as amended (42 U.S.C. Section 7414) and section 308 of the Federal Water Pollution Control Act (33 U.S.C. Section 1318), respectively, relating to inspection, monitoring, entry, reports, and information, as well as other requirements specified in section 114 and section 308 of the Air Act and the Water Act, issued there under before the signing of this agreement by NRCS.

(2) That no portion of the work required by this agreement will be performed in facilities listed on the EPA List of Violating Facilities on the date when this agreement was signed by unless and until the EPA eliminates the name of such facility or facilities from such listing.

(3) To use their best efforts to comply with clean air standards and clean water standards at the facilities in which the agreement is being performed.

(4) To insert the substance of the provisions of this clause in any nonexempt subagreement.

C. The terms used in this clause have the following meanings:

(1) The term "Air Act" means the Clean Air Act, as amended (42 U.S.C. Section 7401 et seq.).

(2) The term "Water Act" means Federal Water Pollution Control Act, as amended (33 U.S.C. Section 1251 et seq.).

(3) The term "clean air standards" means any enforceable rules, regulations, guidelines, standards, limitations, orders, controls, prohibitions, or other requirements which are contained in, issued under, or otherwise adopted pursuant to the Air Act or Executive Order 11738, an applicable implementation plan as described in section 110 of the Air Act (42 U.S.C. Section 7414) or an approved implementation procedure under section 112 of the Air Act (42 U.S.C. Section 7412).

(4) The term "clean water standards" means any enforceable limitation, control, condition, prohibition, standards, or other requirement which is promulgated pursuant to the Water Act or by a State under an approved program, as authorized by section 402 of the Water Act (33 U.S.C. Section 1342), or by a local government to assure compliance with pretreatment regulations as required by section 307 of the Water Act (33 U.S.C. Section 1317).

(5) The term "facility" means any building, plan, installation, structure, mine, vessel, or other floating craft, location or site of operations, owned, leased, or supervised by a sponsor, to be utilized in the performance of an agreement or subagreement. Where a location or site of operations contains or includes more than one building, plan, installation, or structure, the entire location shall be deemed to be a facility except where the Director, Office of Federal Activities, Environmental Protection Agency, determines that independent facilities are collocated in one geographical area.

21. Assurances and Compliance.

As a condition of the grant or cooperative agreement, the sponsor assures and certifies that it is in compliance with and will comply in the course of the agreement with all applicable laws, regulations, Executive orders and other

generally applicable requirements, including those set out below which are hereby incorporated in this agreement by reference, and such other statutory provisions as specifically set forth herein.

State, Local, and Indian Tribal Governments: OMB Circular Nos. A-87, A-102, A-129, and A-133; and 7 CFR Parts 3015, 3016, 3017, 3018, 3021, and 3052.

Nonprofit Organizations, Hospitals, Institutions of Higher Learning: OMB Circular Nos. A-110, A-122, A-129, and A-133; and 7 CFR Parts 3015, 3016, 3017, 3018, 3019, 3021, and 3052.

22. Examination of Records.

The sponsors shall give the NRCS or the Comptroller General, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to this agreement, and retains all records related to this agreement for a period of three years after completion of the terms of this agreement in accordance with the applicable OMB Circular.

23. Signature

MONONGAHELA CONSERVATION DISTRICT
201 Scott Avenue
Morgantown, WV 26508

By: _____
Title: Chairman
Date: _____

The signing of this agreement was authorized by a resolution of the governing body of the Monongahela Conservation District adopted at a meeting held on _____.

By: _____

Date: _____

WEST VIRGINIA STATE CONSERVATION COMMITTEE
Guthrie Agricultural Center
Charleston, WV 25305

By: _____
Title: Chairman
Date: _____

The signing of this agreement was authorized by a resolution of the governing body of the West Virginia State Conservation Committee adopted at a meeting held on _____.

By: _____

Date: _____

PRESTON COUNTY COMMISSION
106 West Main Street
Suite 202
Kingwood, WV 26537

By: _____
Title: President
Date: _____

The signing of this agreement was authorized by a resolution of the governing body of the Preston County Commission adopted at a meeting held on _____.

By: _____

Date: _____

Natural Resources Conservation Service
UNITED STATES DEPARTMENT OF AGRICULTURE

Approved by:

_____

KEVIN WICKEY
State Conservationist

Date: _____

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SUMMARY

Supplemental Watershed Plan Number 2 & Environmental Assessment
For
Rehabilitation of UDC1
Upper Deckers Creek Watershed
Preston and Monongalia Counties, West Virginia
Congressional District 1

Authorization: Public Law 83-566 Stat. 666 as amended (16 U.S.C. Section 1001 et seq.) 1954

Sponsors: Preston County Commission
Monongahela Conservation District
West Virginia State Conservation Committee

Proposed Action: Rehabilitate Upper Deckers Creek 1 and add rural water supply.

Purpose and Need for Action: The purposes of the proposed rehabilitation of UDC1 are to maintain the present level of flood control benefits, comply with current performance and safety standards, and provide agricultural water management (rural water).

Project Purposes: Multipurpose, flood control and agricultural water management

Preferred Alternative: Federally-assisted rehabilitation of the dam for compliance to current standards and add rural water supply

Project Measures: Construct a new excavated auxiliary spillway on the dam's left abutment, line and extend the existing principal spillway pipe, construct new principal spillway inlet and outlet structures, construct a new internal embankment drainage system, modify the embankment top width and height for multi-purpose use, and add measures to increase stability of the embankment slopes.

Resource Information:

Latitude and Longitude – 39º30′09″N Latitude and 79º50′24″W Longitude

8-Digit Hydrologic Unit Number – 05020003

Climate and Topography – In winter the average temperature is 32° F, and the average daily minimum temperature is 24° F. In summer the average daily temperature is 72° F, and the average daily maximum temperature is 83° F. Of the total annual precipitation, 22 inches, or 56 percent, usually falls in April through September, which includes the growing season for most crops. The average seasonal snowfall is 32 inches. UDC1 is located in the Monongalia Glades area of the watershed. Topography relief is moderate compared to the watershed in general. Rolling hills and wide floodplains are favorable for agriculture. Watershed elevations range

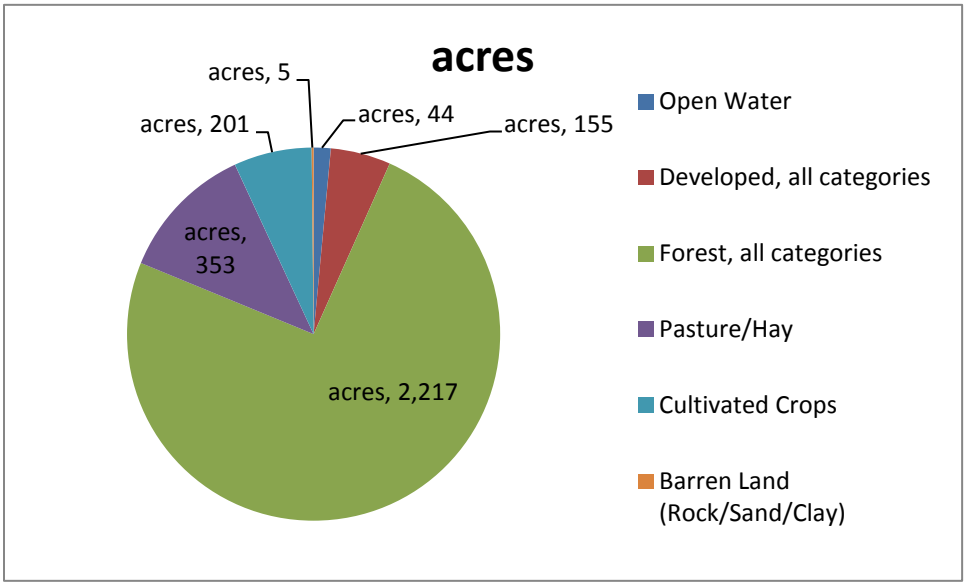
from about 2,285 feet msl at the upstream boundary to 1,720 feet msl at the downstream toe of UDC1's embankment.

Watershed Size – 2,975 acres

Land Ownership – 99% private, 1% state, No federal lands

Land Uses –

Figure 1 – Land Uses



Population and Demographics –

Tabulation 1 – Population and Demographics

	Preston County	West Virginia	US
Population growth 1970-2010	32%	34%	35%
Housing growth 1970-2010	75%	31%	62%
Percent below Poverty	15%	18%	14%
Percent White	98%	94%	73%
Percent with High School Education	82%	82%	86%
Percent Unemployment (April 2012)	5.8%	6.7%	8.1%
Median Household Income (2010)	$38,008	$37,423	$50,221

Scoping Concerns – Backup water supply for Preston County Public Service District #1 (PSD1), impacts to stream flow

Alternative Plans Considered –

No Action (Sponsors' Rehabilitation) - Federal funds would not be expended with this alternative. To meet the Purpose and Need of UDC1, the sponsors must develop a

dedicated rural water supply and modify UDC1 to safely pass the design hydrologic event for a High Hazard dam.

Decommissioning the Dam – Federal and non-federal funds would be expended to remove the embankment, restore the stream, replace or mitigate the lost flood damage reduction benefits afforded by UDC1, and construct a replacement rural raw water supply source. Some flood protection for roads, agricultural land, and other land improvements will be forfeited.

Rehabilitating the Dam without a Dedicated Rural Water Supply – Federal and non-federal funds would be expended to rehabilitate the dam as a single purpose structure. Sponsors would not secure a dedicated rural water supply.

Rehabilitating the Dam with a Dedicated Rural Water Supply – Federal and non-federal funds would be expended to rehabilitate the dam as a multi-purpose structure. Sponsors would secure a dedicated rural water supply by increasing the size of UDC1 to meet the rural water supply need. The water supply need is based on a 20-year demand.

Project Costs (Dollars): $8,044,100

Project Benefits (Annual Average): $189,300

Number of Direct Beneficiaries – 10,110

Other Benefits: Rural Water Supply for 1,534 customers (also included as direct beneficiaries)

Benefit Cost Ratio (authorized rate of 2.875%) – .6 to 1.0

Benefit Cost Ratio (current rate of 4.0%) – .5 to 1.0

Net Beneficial Effects (NED) – ($191,200)

Funding Schedule (budget year + 5)

Tabulation 2 – Funding Schedule (budget year + 5)

	FY2010-12	**FY2013**	**FY2014-2015**
	Planning Investigations	Design	Construction
Federal Funds	$607,200	$710,000	$4,269,200
Non-Federal Funds	$0	$0	$2,701,850

Period of Analysis - After rehabilitation: 50 years

Project Life – 50 years

Environmental Effects, Impacts - Potential environmental effects include the conversion of 0.9 acres of prime and 14.1 acres of statewide important farmland to non-agricultural uses,

permanent inundation of 2,470 linear feet of streams, elimination of up to 200 feet of stream at the principal spillway and outlet basin, inundation of 2.99 acres of palustrine scrub-shrub wetlands, elimination of 0.14 acres of emergent meadow wetland, replacement of 6,180 linear feet of shoreline with about 9,000 feet of shoreline, temporary elimination of aquatic habitat for up to two construction seasons while reservoir is drained, and the flooding of 11.4 acres of land resulting from the enlarged reservoir.

Major Conclusions – The recommended alternative is to rehabilitate UDC1 with federal assistance and to add rural water supply as a purpose

Areas of Controversy - None identified at the Draft Plan-EA phase

Issues to be Resolved - None identified at the Draft Plan-EA phase

Evidence of Unusual Congressional or Local Interest – None

Is this report in compliance with executive orders, public laws, and other statues governing the formulation of water resource projects? Yes √___ No ____

CHANGES REQUIRING PREPARATION OF A SUPPLEMENT

A supplement to the watershed plan is needed because this dam does not meet current Natural Resources Conservation Service (NRCS) design criteria and performance standards. The purpose of this document is to present information regarding alternatives that have been evaluated to upgrade UDC1 to current NRCS design criteria and performance standards. There is a need for continued flood protection up to the 100-year flood elevation for benefited areas in the Upper Deckers Creek Watershed. There is also a need to provide a dedicated rural water supply at the request of the PSD1.

This supplement only addresses the UDC1. This dam was built in 1969 under the authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566, as amended). The rehabilitation of floodwater retarding structure No. 1 is authorized under Section 14 of Public Law 83-566. A Rehabilitation Assessment Report was completed for this site in March 2006, which provided a total failure index, a population at risk index, and a total risk index. The site assessment was requested by the Monongahela Conservation District (MCD) by letter dated May 27, 2005. This supplemental plan documents the planning process by which the NRCS provides technical assistance to local sponsors, technical advisors, and the public in addressing resource issues and concerns within the Upper Deckers Creek Watershed, specifically within the UDC1 drainage area.

PURPOSE AND NEED

UDC1 does not meet current NRCS safety and performance standards. The dam is classified as High Hazard due to residential and commercial development, but the dam and its spillways are not capable of safely conveying the required High Hazard hydrologic events. It is necessary that UDC1 meet current safety standards to provide the required level of flood protection to homes, businesses, roads, and farmlands.

PSD1 has consent to use the sediment pool of UDC1 as a raw rural water source to supply its customers. With the degradation of groundwater in the region, UDC1's reservoir has become the sole source of water supply for PSD1. The sediment pool cannot provide a dedicated and secure source of water. The Sponsors request the rehabilitation of UDC1 to include adding rural water supply as an authorized project purpose. UDC1 is located in a rural area with less than 50,000 persons, therefore adding rural water falls under the purpose of agricultural water management.

The purposes of the project are to provide continued flood damage reduction up to the 100-year 24-hour storm event, in a safe and environmentally acceptable manner that meets state and federal standards; and to provide for a dedicated, dependable, water supply to the PSD1 customers for the next 20 years. There is a need to meet current federal and state safety standards and reduce the risk of loss of human life associated with the structure, and to continue to reduce flood damages to 384 structures in the affected downstream area. There is a need to provide 310 acre-feet of raw water storage to meet PSD1's projected need for the next 20 years.

Problems and Opportunities

Planning for flood prevention and watershed protection was authorized in 1962 for the Upper Deckers Creek Watershed under the authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended (16-U.S.C. 1001-1008). The original work plan included the construction of five single-purpose flood control dams, two mitigation impoundments for fish and wildlife habitat, 4,610 acres of conservation land treatment, and 35,300 linear feet of channel modification. All of the original project components were completed by 1975. A Supplemental Watershed Plan and Environmental Assessment was completed in the year 2000 to address water quality concerns in Deckers Creek caused by acid mine drainage from abandon coal mines. NRCS and the West Virginia Department of Environmental Protection (WVDEP) continue to address acid mine drainage sites in the watershed and the watershed project remains in active status. The purpose of this document is to present information regarding alternatives that have been evaluated to rehabilitate UDC1.

The following is a list of opportunities that will be realized through the implementation of this dam rehabilitation plan. Some quantification of these opportunities will be provided in other sections of the report, as appropriate.

- Minimize the potential for loss of life associated with the dam
- Eliminate the sponsors' liability associated with operation of an outdated dam
- Maintain the existing level of flood protection for downstream houses, businesses, and infrastructure
- Secure a dedicated water supply for PSD1
- Protect real estate values downstream of the dam
- Maintain existing wildlife habitat around the dam
- Protect water quality

<u>Location:</u> The Deckers Creek Watershed is located in Monongalia and Preston Counties, between Morgantown and Kingwood, in north-central West Virginia. The watershed's area is 40,251 acres, or 62.9 square miles. Deckers Creek originates in southeastern Monongalia County, flows south eastward into Preston County, then northwestward back into Monongalia County and into the Monongahela River in Morgantown. The major streams entering Deckers Creek are Aarons Creek, Tibbs Run, Laurel Run, Dillan Creek, Kanes Creek, and Back Run.

The headwater basin encompasses the communities of Arthurdale, Reedsville, and Masontown. This area was once known as the Monongalia Glades, and is characterized by gentle contours and the high agricultural value of its soils. As Deckers Creek approaches the Monongalia County line downstream of Masontown, it parallels State Route 7 and begins to change from a placid meandering stream to a rapidly flowing complex of falls and pools. Deckers Creek cuts a riparian corridor through a narrow gorge strewn with outcroppings of prevailing limestone, vegetated with rhododendron and laurel thickets to a point known as Pioneer Rocks. The remaining five miles descend through the communities of Dellslow, Rock Forge, and Sabraton to the Monongahela River in downtown Morgantown as a relatively gentle stream. UDC1 is located on Deckers Creek in Preston County, about 2.2 miles upstream of the confluence with Kanes Creek, near the community of Reedsville. The watershed upstream of the dam is 2,975 acres (4.65 square miles). Appendix B shows the location map for UDC1 and its watershed.

Topography: The Deckers Creek watershed is located in the Appalachian Plateau physiographic province. Steep hills, narrow divides, and narrow, relatively flat floodplains characterize the watershed. Deckers Creek is a perennial warm water stream, flowing generally northwest from its upstream watershed boundary to the Monongahela River. Elevations range from about 2,285 feet above mean sea level (msl) in the headwaters to about 800 feet msl at its confluence with the Monongahela River. The drainage pattern is dendritic.

UDC1 is located in the Monongalia Glades area of the watershed. Topographical relief is moderate compared to the watershed in general. Rolling hills and wide floodplains are favorable for agriculture. Elevations within the UDC1 drainage area range from about 2,285 feet msl at the upstream boundary to 1,720 feet msl at the downstream toe of UDC1's embankment.

Climate: In winter the average temperature is 32° F, and the average daily minimum temperature is 24° F. In summer the average daily temperature is 72° F, and the average daily maximum temperature is 83° F. Of the total annual precipitation, 22 inches, or 56 percent, usually falls in April through September, which includes the growing season for most crops. The average seasonal snowfall is 32 inches.

Soils: The soils in the watershed of UDC1 formed in the Conemaugh, Allegheny, and Pottsville Groups of the Pennsylvanian Geologic System. The Conemaugh Group consists of cyclic sequences of shale, siltstone and sandstone with some thin strata of limestone and coal. The Allegheny Group consists of cyclic sequences of sandstone, siltstone, shale, limestone and coal. The Pottsville Group consists of dominantly sandstone with thin strata of shale and coal.
The dominant residual soils found in this watershed include Gilpin, Rayne, Dekalb, Clymer, Lily, and to a much lesser extent, Latham and Cavode. Gilpin soils range from 20 to 40 inches in depth and are underlain by acidic, interbedded shale, siltstone and sandstone bedrock. They are well drained and have moderate permeability throughout the profile. Rayne soils are very similar to Gilpin soils except they are deeper, ranging from 40 to 60 inches to bedrock. Dekalb soils range from 20 to 40 inches in depth and are underlain by acidic, sandstone bedrock. Dekalb soils are well to excessively drained and have moderately rapid to rapid permeability. They have a large volume of rock fragments throughout the profile. Lily soils range from 20 to 40 inches in depth and are underlain by acidic sandstone bedrock. They are well drained and have moderate to moderately rapid permeability throughout the profile. Clymer soils are very similar to Lily soils except they are deeper, ranging from 40 to 60 inches to sandstone bedrock. Gilpin and Dekalb soils are found on gently sloping to moderately steep ridge tops and benches as well as steep and very steep side slopes. Rayne, Clymer and Lily soils occur on gently sloping to moderately steep ridge tops. Cavode soils range from 40 to 80 inches or more to acidic, interbedded shale, siltstone and sandstone bedrock. They are somewhat poorly drained and they have slow permeability in the subsoil. Latham soils range from 20 to 40 inches to acidic, interbedded shale and siltstone bedrock. They are well drained and have slow permeability in the subsoil. Latham and Cavode soils occur on nearly level to gently sloping ridge tops. They make up only a small percentage of the residual soils in the UDC1 watershed.

The dominant colluvial soils on foot slopes and to a lesser extent, benches, are Buchanan and Ernest. Buchanan and Ernest soils are both moderately well drained and both are greater than 80

inches in depth to bedrock. They have an extremely firm and brittle horizon, or fragipan, at a depth of 20 to 36 inches which has very slow permeability and restricts penetration of roots. Buchanan soils contain slightly more sand in the subsoil than Ernest soils.

Other very minor soils that occur in the northwest portion of the watershed are Udorthents, Bethesda, and Fairpoint. Udorthents are a mixture of soil and rock materials that have been drastically disturbed by human activity. This makes evaluation of soil properties impractical due to the variability of the source and placement of the materials. The Bethesda and Fairpoint soils consist of strip mine spoil that is a mixture of soil material and both acidic and neutral rock fragments of shale, siltstone and sandstone. Both the Bethesda and Fairpoint soils are very deep and well drained. Permeability is moderately slow in both soils in the lower parts of the profile. Areas of Bethesda and Fairpoint soils often have nearly vertical high walls consisting of sandstone, shale and mudstone rock strata.

Geology: UDC1 is underlain by the Pennsylvanian Age Allegheny Formation. When the original geologic investigation of UDC1 was completed in 1966, the published data at the time showed the dam site as being underlain by Conemaugh Group (Hennen and Reger, 1914). However, in the original investigation for UDC1, the Soil Conservation Service (SCS) geologists at the time (1966) labeled the coal encountered in both abutments as the Upper Freeport coal which marks the top of the Allegheny Formation. This would place the section of the embankment between the two points on the abutments where the coal was encountered on the Allegheny Formation instead of on the Conemaugh Group. Interestingly enough, in 1968, shortly after the investigation was complete, the West Virginia Geological and Economic Survey published the Geologic Map of West Virginia (Cardwell et *al*. 1968), which followed the outcrop pattern of the 1914 Preston County geological report and showed the site as underlain by the Conemaugh Group. The August 2009 collection of Individual Seam Shapefiles put out by the West Virginia Coal Bed Mapping Project, the West Virginia Geological and Economic Survey now shows the coal seams in the abutments of UDC1 as being the Lower Freeport coal. The same collection of shapefiles puts the Upper Freeport coal seam high on the abutments (60 feet higher in elevation) above the Lower Freeport seam. The investigation done by Gannett Fleming in 2010-2011 labeled the coal in the abutments at UDC1 as the Lower Freeport coal seam.

Seismic: The stability of an earthen embankment is dependent upon the presence of a stable foundation and adequate compaction and drainage of embankment materials. Foundation failure through consolidation, compression, or lateral movement can cause the creation of voids within an embankment, separation of the principal spillway conduit joints, or in extreme cases, complete collapse of the embankment. The Upper Deckers Creek watershed is not located within an area of significant seismic risk; therefore, there is low potential for slope failure due to seismic activity.

Land Use: The watershed drainage area of UDC1 is 2,975 acres. Delineation of the drainage area was determined based on the most recent United States Geologic Survey (USGS) elevation data available using ArcMAP GIS software. Land use types and quantities (Tabulation 3) were also obtained from the USGS National Land Cover Dataset 2006 (NLCD), which is a consistent land cover data layer for the United States. The NLCD is categorized based upon the National Land Cover/Land Use classification system. Most land is privately owned (99%) while less than

1% (30 acres) of the land is publically owned by West Virginia University at the Reedsville Farm. There is no federal land in the delineated area of UDC1.

Tabulation 3 – Land Use in the UDC1 Watershed

Land Cover Type	Drainage Area (ac.)	Percent of Total
Open Water	44	1.50%
Developed, Open Space	141	4.70%
Developed, Low Intensity	13	0.40%
Developed, Medium Intensity	1	0.00%
Deciduous Forest	2,181	73.30%
Evergreen Forest	18	0.60%
Mixed Forest	18	0.60%
Pasture/Hay	353	11.90%
Cultivated Crops	201	6.80%
Barren Land (Rock/Sand/Clay)	5	0.20%
Totals	**2,975**	**100.00%**

General Demographics: The watershed of UDC1 is rural and sparsely inhabited, but the population is growing in the area. The drainage area of UDC1 is mostly farmland, woodland, and rural home sites. There are no incorporated towns in the watershed. The community of Arthurdale is just downstream of the UDC1 impoundment. The nearest incorporated town is Reedsville, with a population of 593. Demographic information is not available for the UDC1 drainage area due to its small size, so statistics for the Town of Reedsville and Preston County are used for general descriptive purposes (Tabulation 4).

Tabulation 4 – Demographic Comparisons for County, State, and Nation

	Preston County	**WV**	**USA**
Population density per square mile	52	77	87
Race – White	98%	94%	73%
Median age	41.6 years	41.2 years	37.2 years
Completed high school	82%	82%	86%
Bachelor's Degree or higher	12%	17%	25%
Veterans	9%	9%	7%
Per capita income	$18,011	$20,891	$27,041
Median household income	$38,008	$37,423	$50,221
Poverty	15%	18%	14%
Unemployment rate (April 2012)	5.8%	6.7%	8.1%
Home ownership	82%	74%	67%
Median Home Value	$82,100	$91,400	$185,400
Home Vacancy Rate	14%	13%	9%

Population, Race, Age: Census statistics from the 2010 US Census Report were cited for Preston County. Statistics at the county geographic scale are representative of the residents of the UDC1 watershed. Preston County has a rural population of 33,520 persons, an increase of 32% since

the 1970 Census. The population density is 51.7 persons per square mile compared to 77 persons per square mile for West Virginia and 87 persons per square mile for the nation. Incorporated towns in the northern portion of Preston County experienced modest population increases while incorporated towns in the southern portion of Preston County saw modest decreases in residency. Preston County is 98% white, 1% black, and 1% other races. The median age is 41.6 years compared to 41.2 for West Virginia and 37.2 for the nation, indicating a slightly older population in Preston County.

Education and Veteran's Status: Educational levels in Preston County are lower than those of the state and nation. About 86% of the population nationwide has completed high school compared to 82% for West Virginia and Preston County. About 25% of the nation has completed a bachelor's degree or higher compared to 17% for West Virginia and 12% for Preston County. Veterans comprise about 9% of the county population.

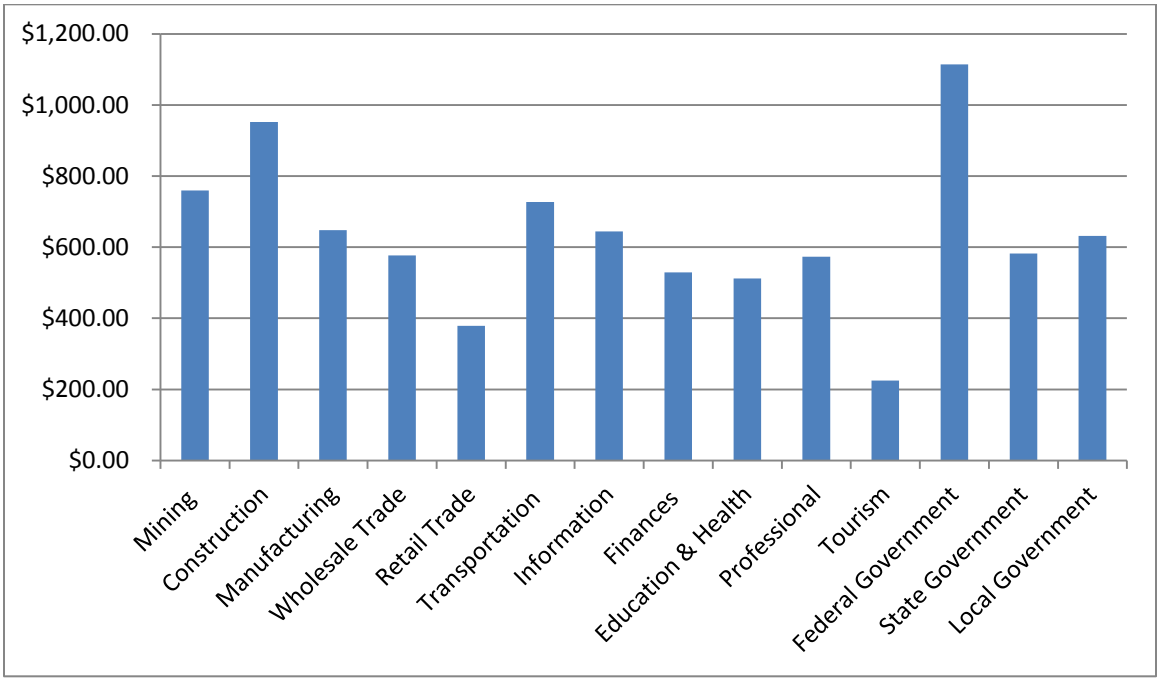
Income, Disability, and Poverty: Income levels in Preston County are depressed compared to the state and national benchmarks. Per capita income for the county is $18,011 while the state is at $20,891 and the nation is at $27,041. Median household incomes are $38,008 for Preston County, which is slightly higher than the median household income of $37,423 for West Virginia, but both values are substantially lower than the national figure of $50,221. Poverty rates are 15% at the county level versus nearly 18% for West Virginia and 14% for the nation.

Employment: Employment figures for calendar year 2010 show that 6,765 persons are working in Preston County and 66% of those are employed in the private sector. Figure 2 illustrates the major employment sectors and Figure 3 shows the average weekly wage per sector. Preston County has more residents who work outside the county than work within the county with a net migration of -3,905. Consequently, the mean travel time for workers is 30 minutes versus 25 minutes for the state and nation. Unemployment rates in Preston County have increased from 2008, when they were 3.8%, to 8.1% in 2010. This rate mirrors the state and national unemployment trends for this time period.

Figure 2 – Preston County's Top Ten Employers

- Preston County Board of Education
- Department of Justice Hazelton Prison
- Preston Memorial Hospital
- CW Wright Construction Company
- Wal-Mart Associates
- Hopemont State Hospital
- Heartland Employment Services (health care services)
- Superior Reedsville Filtration (manufacturing)
- Jennmar Corporation of WV (manufacturing)
- WV Military Authority

Figure 3 – Average Weekly Wage per Industry



Housing: The number of housing units in Preston County has increased by 75% since 1970. Home ownership is high (82%) in Preston County relative to the state (74%) and the nation (67%). Most homes are single units. The median home value is $82,100 compared to $91,400 for WV and $185,400 for the nation. Nearly 64% of the homes were built before 1970; 23% before 1939. 14% of homes are vacant compared to 13% for the state and 9% for the nation.

Recreation: No provisions for recreation were included during the initial planning and development of the UDC1 dam and impoundment. Access to the site is restricted due to a lack of public roads. Private property and the West Virginia University (WVU) farm would have to be crossed in order to reach the impoundment. While not prohibited, public access through the farm and adjoining private properties is discouraged. There is no management program in place to monitor or manipulate the impoundment's fishery. Hunting and wildlife viewing (bird watching) opportunities are limited by the lack of public access and the proximity of private lands adjacent to the project location.

Threatened and Endangered Species: Information pertaining to the rehabilitation project's potential area of effect for the various alternatives being considered was provided to the US Fish and Wildlife Service (USFWS). Upon reviewing this information, USFWS made a "no effect" determination that the project will not affect federally-listed endangered or threatened species and that no biological assessment or further Section 7 consultation is required under the Endangered Species Act. See USFWS correspondence in Appendix E.

Cultural Resources: A Phase I cultural Resources Investigation was conducted in February 2012, by The Ottery Group on the UDC1 Dam Rehabilitation project area. The investigation was conducted on about 81 acres of land surrounding the UDC1 dam and impoundment. This area encompassed the total potential area of effect from all rehabilitation alternatives combined. A

review of documentation housed by the WV Division of Culture and History revealed a limited number of records within two miles of the proposed project. One site was associated with historical buildings at Aurthordale, one was a cemetery at Reedsville and one site was a series of stone piles believed by the landowner to be prehistoric burials.

Two nomination forms for the National Register of Historic Places had been completed for properties near UDC1. One was for the town of Aurtherdale, constructed between 1933 and 1937 as one of about 100 "new towns" created by the New Deal. The other was for multiple properties owned by WVU. This nomination was not specific as to what properties were included; however, structures on the WVU Experimental Farm are described as having been built "by the university and homesteaders as part of the experimental community."

Pedestrian reconnaissance was conducted on the approximately 81 acre project area to determine potential to contain archaeological deposits (Figure 4). Shovel test pits (STPs) were excavated at 7-meter to 15 meter intervals at twelve areas. STPs producing artifacts were further examined by radial STPs placed at 5 and 10 meter intervals in each cardinal direction. Recovered artifacts were placed in bags and labeled for analyses at the Ottery Group laboratory.

In total, this Phase 1 cultural resources investigation resulted in two archaeological sites (46PR156 and 46PR157) and three isolated finds (46PR153, 46PR154 and 46PR155) being recorded. Four of these sites do not warrant further investigation and are not considered eligible for listing in the National Register of Historic Places. Site 46PR156 contained artifacts (including lithic tools) in possibly undisturbed contexts. As such, three additional 1- x 1-meter test pits were excavated. These excavations revealed only three additional artifacts and further evaluation of this site was not recommended by the Phase I contractor.

Four architectural resources were also identified as part of the WVU Experimental Farm. Three of the four structures were built during the period of ownership by the university. The fourth dates to the late 19th century, but was demolished in the 1980s following storm damage. Based on the Ottery Group findings, NRCS did not recommend any additional study. The Phase 1 report and recommendations were submitted to the WV Division of Culture and History, State Historical Preservation Office (WVSHPO) for their review and concurrence.

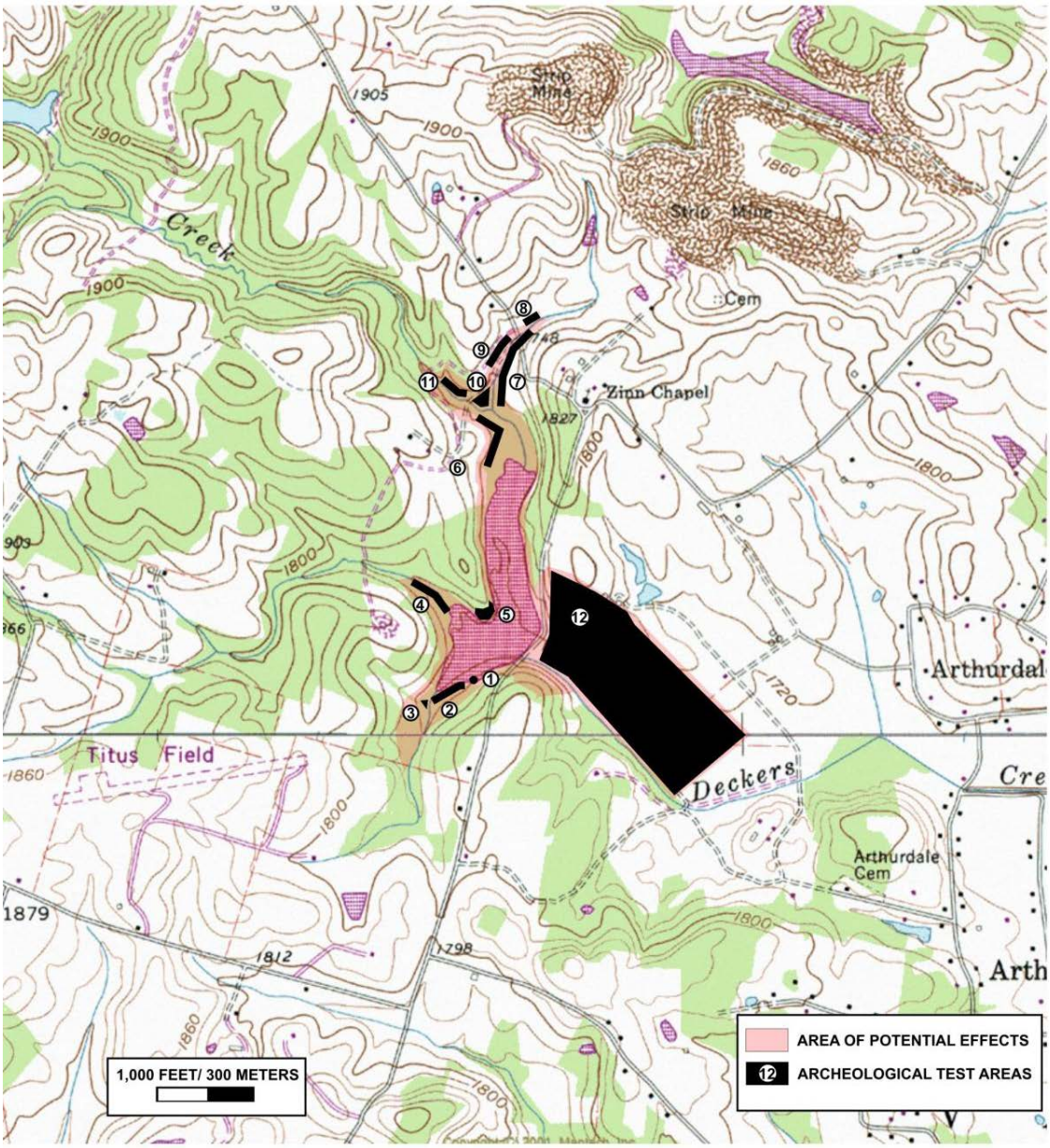


Figure 4 – UDC1 dam rehabilitation project Area of Potential Effect and archaeological test areas (Ottery Group, 2012).

Upon completion of their review, WVSHPO agreed that there are no archaeological resources within the project area that are eligible for, or listed on, the National Register of Historical Places. In its letter of May 3, 2012 (Appendix E) WVSHPO also agreed that no further investigation is necessary for these resources.

With regard to architectural resources, three farm buildings and an old barn foundation northeast of the dam are expected to be avoided. In the event that it is determined during the design phase of the project that some or all of these buildings cannot be avoided, further consultation with the

WVSHPO will be initiated. As for the dam, no historical protections or documentations are recommended. The dam is not yet 50 years of age, is not associated with any pattern of American history, is not structurally unique and is not associated with a master architect or artist. Concurrence was received from WVSHPO by letter dated June 22, 2012 (Appendix A).

Natural and Scenic Areas and Visual Resources: Coopers Rock State Forest is located in northeastern Monongalia and northwest Preston Counties about ten air-miles north of Aurtherdale. This state forest is situated on the western side of the Allegheny Front and offers scenic vistas of the Cheat River Valley and Cheat Lake. A remnant virgin hemlock forest is contained within the eastern edge of the state forest along tributaries of Laurel Run.

The northern limits of the Monongahela National Forest lie about 20 miles southeast of Aurtherdale. The national forest is operated by the U. S. Forest Service as a working forest and includes many scenic and recreational amenities.

Other nearby natural and scenic areas include the Cathedral State Park near Aurora in Preston County and Cranesville Swamp along the West Virginia and Maryland state border near Cranesville. Cathedral State Park also includes a remnant hemlock virgin forest stand and the Cranesville Swamp comprises one of the largest wetland complexes in West Virginia.

Water Quality: Water quality data was provided by PSD1 (Tabulation 5).
This data indicates that water quality from the existing UDC1 reservoir is good and that treated water meets or exceeds WV Drinking Water Standards.

Tabulation 5 – Raw water quality data for the UDC1 impoundment (PSD1 data)

Month	Turbidity		Ph		Iron		Manganese		Total Alkalinity		Ca Hardness	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Jun 2011	1.4 – 7.8	2.6	6.5 – 6.9	6.6	0.18 – 0.64	0.41	0.01 – 0.03	0.02	08 – 16	10.5	14 – 14	14
Jul 2011	2.1 – 7.4	3.4	6.4 – 7.2	6.9	0.25 – 0.63	0.40	0.01 – 0.03	0.01	10 - 26	13.3	14 – 14	14
Aug 2011	1.3 – 6.0	2.8	6.8 – 7.4	7.0	0.13 – 0.49	0.32	0.00 – 0.03	0.01	10 - 20	14.4	14 – 14	14
Sept 2011	1.7 – 18.0	3.6	6.4 – 7.1	6.8	0.11 – 0.47	0.25	0.00 – 0.03	0.01	08 - 20	12.6	14 – 14	14
Oct 2011	1.5 – 7.4	2.9	6.7 – 7.1	6.9	0.08 – 0.28	0.15	0.00 – 0.02	0.01	10 - 14	11.2	14 – 14	14
Nov 2011	1.5 – 13.6	3.4	6.7 – 7.1	6.8	0.07 – 0.19	0.11	0.01 – 0.06	0.02	08 - 12	9.7	14 – 14	14
Dec 2011	1.7 – 7.8	3.4	6.7 – 7.4	6.8	0.01 – 0.15	0.09	0.01 – 0.05	0.02	06 - 10	8.4	14 – 14	14
Jan 2012	1.1 – 10.1	4.0	6.7 – 7.2	6.9	0.03 – 0.12	0.08	0.02 – 0.04	0.03	06 - 14	8.3	14 – 14	14
Monthly Means	**1.1 – 18**	**3.3**	**6.4 – 7.4**	**6.8**	**0.01 – 0.64**	**0.23**	**0.00 – 0.06**	**0.02**	**06 - 26**	**11.0**	**14 – 14**	**14**

Wetlands: Wetland determination within the project's area of potential effect was conducted in April and May 2012 by an NRCS multidisciplinary wetland team. A total of 109 acres comprising the probable limits of the rehabilitation project's combined alternatives were evaluated. This investigation revealed 10.92 acres of wetland areas within the project area of potential effect. Of this total, 7.93 acres were Palustrine Emergent Marsh (PEM) and 2.99 acres Palustrine Scrub-Shrub (PSS) wetland types (See Wetland Delineation Map, Appendix C).

Streams within the project's area of potential effect were also identified. A total of 5,135 linear feet of stream channel falls between the existing permanent pool and the proposed new auxiliary spillway elevation. An additional reach of Deckers Creek below the current principal spillway (PSW) outlet may be affected by modifications to the dam that may require an extension of the PSW conduit downstream to accommodate the placement of fill and a new drainage system in the downstream face of the embankment.

Forest Resources: Approximately 75 percent of the UDC1 drainage area is comprised of forested land. Most of the forestland consists of mixed oak – hickory stands of various ages. In addition to the dominant oak and hickory species, black cherry, red maple, sugar maple, yellow-poplar, black walnut, white ash and black locust, among others, are present. The majority of land in the UDC1 drainage area is privately owned and therefore forest resources are subject to timber harvests and forest management activities.

Perimeter areas to the UDC1 reservoir appear to have been cleared in association with construction of the dam in 1969. Trees were cleared in order to diminish the amount of floating debris that might interfere with the operation of the principal spillway riser. Presently, the cleared area is vegetated with brush and other woody regrowth.

Wildlife Resources: Wildlife inhabiting the UDC1 drainage area is both abundant and diverse. Open farmland interspersed with forested areas provide for grassland species, forestland species and those that thrive in the edges and transitional areas between habitats. In addition, the reservoir area and shallow embayment areas provide for aquatic and riparian habitats.

Whitetail deer and turkey are abundant throughout the UDC1 drainage area. Forested areas support squirrels and other small mammals as well as a variety of neotropical songbirds, woodpeckers and other woodland songbirds. Open field areas support song and insectivorous birds and small mammals typical of open field areas. Transitional areas between field and forested areas are inhabited by song birds favoring early successional woody habitat and brush. Small mammals and cottontail rabbits also may utilize these habitats. Riparian areas around the reservoir are utilized by furbearing mammals including raccoons, muskrats, beaver and mink. The reservoir area is frequently used by resident waterfowl such as Canada geese and woodducks and is also used by migrating waterfowl, such as buffleheads, ringed-neck ducks, scaup, blackducks, mallards and others.

Watershed Problems

Floodplain management: The primary natural hazard in the project region is flooding. Significant floodplain development has occurred since the construction of UDC1, mostly in the form of residential homes. This floodplain development continues at the current time.

There has been no expressed interest in returning to the pre-project flood risk for areas downstream of UDC1. Removing the dam would have negative impacts associated with flood frequency and intensity downstream, including threats to life and public safety, decreased property values, increased flood insurance premiums, and disruptions to utilities and the transportation network.

Erosion and Sedimentation: As of Fall 2010, UDC1 had reached 41% of its planned service life. In the fall of 2010, a bathymetric survey was conducted which measured the water depth to the top of the sediment present in the pool. That survey determined that the size of the remaining pool is 92.3 acre-feet. Also, the survey data combined with as-built drawings and a new March 2012 survey data determined that there was 49.5 acre-feet of submerged sediment in the pool. Most of the sediment present is located near the inlet channel areas of the impoundment. That means that the average historic sediment accumulation rate for UDC1's submerged sediment pool is 1.2 acre-feet per year. The impoundment was originally designed for an inflow of 1.92 acre-feet per year of submerged sediment. At the historic sedimentation rate, 77 years of life remain in the submerged sediment pool as of the fall of 2010.

It was originally projected that there would be no deposition of aerated sediment during the first fifty years of the design life of UDC1. The projected deposition rate for the aerated sediment during the second fifty years of the design life of UDC1 was 0.35 acre-feet per year. Aerated sediment is sediment that is deposited above the normal pool during high flows. The estimated volume of aerated sediment in the pool in March 2012 was 1.2 acre-feet. The available aerated sediment storage capacity is 17.3 acre-feet. Based upon the historic accumulation rate of 0.02 acre-feet per year, there is more than adequate room for 50 more years of aerated sediment deposition.

Structural Appurtenances: The principal spillway intake structure is a reinforced concrete riser with a 2.5 ft. x 7.5 ft. interior, 12.1 feet high from the interior floor to the riser crest, 14.6 feet high from the floor to the top of the anti-vortex walls. This riser is a standard NRCS single-stage design with an open top, partially covered with metal grating; see Figure 5. The riser concrete is in good condition. The standard metal accessories; trash racks, ladder, and top grating; show normal, expected weathering of the metal parts. At least one ladder fastener is broken. A 30-inch by 30-inch drain gate is installed opposite the principal spillway pipe spigot; its lift mechanism is supported on a cantilevered slab on the upstream anti-vortex wall. The date of the most recent operation of the drain gate and its lift system is not known. The gate has not been exercised in recent inspections, being exempt because of its age for concern of failure.

A water supply intake structure is attached to the concrete riser. This structure is one 8-inch diameter perforated steel pipe, anchored vertically along the riser height to about 11 feet above the footer. The intake pipe is embedded in the riser footer and fastened to the riser with one metal pipe hanger assembly.

Figure 5 – Riser at UDC1 (March 2012)

The principal spillway pipe is 30-inch diameter reinforced concrete (AWWA C301), about 290 feet long, bedded its full length in a concrete cradle. Nine reinforced concrete anti-seepage collars are installed 24-feet center-to-center along the pipe alignment. The anti-seepage collars are articulated with respect to the pipe using a concrete yoke and steel plate design. A single 8-inch diameter water supply pipe is embedded in the concrete cradle parallel to the principal spillway pipe. Remote video inspection of the pipe interior in July 2010 shows concrete wear within expectations for its service life. Traces of precipitants at some pipe joints suggest minor seepage has occurred. Several pipe joints have uneven joint gaps, a possible indication that differential settlement has occurred along the pipe. The video record shows a difference in settlement of 1 to 1½ inches between the pipe and the riser.

The principal spillway outlet structure is a standard NRCS reinforced concrete impact basin; see Figure 6. The concrete structure is in good condition. Minor concrete breakage on the downstream edge of the principal spillway pipe is monitored annually. The metal grating of the basin is in good condition. At least two anchorage clips need replaced. An 18-inch layer of rock riprap is installed at the impact basin's outlet and 20 feet downstream in the outlet channel. The rock size is from a minimum 6-inch to a maximum 18-inch.

Figure 6 – Impact Basin at UDC1 (March 2012)

Two separate concrete monuments are positioned on the left abutment near the top of dam: a standard PL-566 dam plaque and a memorial plaque unique to this site. See Figure 7.

Figure 7 – Monument Photo UDC1 (March 2012)

SCOPE OF THE ENVIRONMENTAL ASSESSMENT

No long-term adverse environmental impacts were identified in the early planning meetings, agency consultations, and planning activities. Tabulation 6 (Summary of Scoping) lists environmental, economic and social concerns related to this project.

Tabulation 6 – Summary of Scoping

ITEM/ CONCERN	Relevant to the proposed action?		RATIONALE
	YES	NO	
SOILS			
Land use	X		Erosion rates important for determining sedimentation rates and sediment storage capacity.
Soil Resources	X		Soils to be evaluated for suitability for use in rehabilitating the dam and spillway systems.
Prime and Unique Farmland	X		Prime and unique farmland units to be evaluated in order to minimize conversion to non-agricultural uses.
WATER			
Sole Source Aquifers		X	Groundwater considered for water supply potential. Groundwater quality and quantity limited.
Water Resources	X		Surface water quantity important for water supply. Request to provide low flow augmentation (conservation release) submitted by stakeholder.
Waters of U.S., special aquatic sites	X		Stream and wetland impacts to be identified and evaluated for alternatives.
Water Quality	X		Important consideration for water supply.
Regional Water Mgt. Plans and Coastal Zone Management Areas	X		Rural water supply storage requested for new project purpose. Project not applicable to coastal management areas.
Floodplain Management	X		Important consideration for evaluating effects of rehabilitation alternatives for floodplain impacts.
Wetlands	X		Wetland determination and delineations to be conducted within the potential project areas of effect.
Wild and Scenic Rivers		X	Deckers Creek not listed on the Nationwide Rivers Inventory or the national list of study rivers.
AIR			
Air Quality (Clean Air Act)		X	Preston County, WV not included within any EPA air quality non-attainment areas.
PLANTS			
Ecologically critical areas		X	No ecologically critical plant habitats identified for potential project area of effect.
Forest resources		X	Minimal amount of forested areas expected to be affected by rehabilitation alternatives. No old-growth or unique forest communities identified.
Parklands		X	UDC1 reservoir area not designated for recreational use or parkland status.
Natural Areas		X	Project area not designated as a special natural area. Consideration to be given to maintain or improve habitat values.
Endangered and Threatened Species	X		Consultation with US Fish & Wildlife Service to identify potential for federally listed threatened and endangered species or habitats.
Invasive Species		X	Non-native and invasive plant species are present within potential project area. Provisions to be considered to minimize introduction or spread of invasive plant species.
Riparian Areas	X		Riparian areas may be temporarily eliminated during construction. Riparian habitats will be re-established or enlarged after project completed.
ANIMALS			
Fish and Wildlife	X		Aquatic and riparian wildlife habitat to be temporarily eliminated during construction. These habitats will be replaced or enlarged as a result of rehabilitation.
Essential Fish Habitat		X	Reservoir not managed as a fishery. Drainage area upstream of the reservoir is of limited size. Essential fish habitat not identified as a resource concern.
Coral Reefs		X	Not Applicable.
Endangered and Threatened Species	X		Consultation with US Fish & Wildlife Service to be conducted to identify potential effects to federally listed threatened and endangered species.
Invasive Species		X	No known non-vegetative invasive species identified for which dam rehabilitation may have an effect.
Migratory Birds/Bald and golden Eagles	X		Migratory waterfowl and neotropical songbirds are known to utilize the reservoir and surrounding area for nesting, feeding and resting. No known eagle nests on or adjacent to project area of potential effect.
HUMANS			
Public Health and Safety	X		Important consideration for dam rehabilitation and continued flood protection.
Scenic Beauty		X	Scenic attributes of the reservoir to be restored and maintained after construction.
Scientific Resources	X		Resources of concern considered. No resources of particular scientific interest identified.
Social Issues	X		Will identify and minimize effects to roads, utilities, private access and other social concerns.
Historic Properties	X		Historic and prehistoric properties will be identified throughout the project area. Will consult with WVSHPO upon evaluating cultural resources.
Environmental Justice	X		No known environmental justice issues identified.
Recreation		X	Reservoir area not available for designation as a recreational resource.
Parklands		X	Reservoir area not designated as a park or located near a designated park area that may be affected.

AFFECTED ENVIRONMENT

Planning Activities

The planning process initiated with collection of field data for the engineering analysis. A detailed topographic survey of UDC1, the pool storage area, and significant adjacent area was conducted to prepare mapping, compile data for volume calculations, key elevations, and dimensions for the Water Resources Site Analysis Program (SITES). The total area surveyed is about 43 acres. A bathymetric survey was included to estimate the actual sedimentation rate of the reservoir. For topography upstream of the dam and above the existing pool crest, contours from the design survey were digitized and merged with the new survey data. Mapping was generated using a 1-foot contour interval with 5-foot indexes matching the 5-foot intervals of the original design.

The floodplain areas downstream of UDC1 were mapped for the dam breach routing and floodplain inundation analysis. A floodplain model developed by AECOM for The Federal Emergency Management Agency (FEMA) was used with appended data from 3-meter Digital Elevation Model and orthophotography by the West Virginia Statewide Addressing and Mapping Board (SAMB). Sectional geometry from these sources was supplemented with field measurements of culverts and bridges.

A geologic investigation was conducted for subsurface data of the dam, its foundation, and existing auxiliary spillway. The left abutment (opposite the existing auxiliary spillway) was investigated for option considerations. Core drilling and seismic refraction of the left abutment area was conducted. Samples of soil and rock were extracted from the spillway, left abutment, and the dam for laboratory analysis. Piezometers were installed to monitor the dam's internal pore pressures; one piezometer was installed in the reservoir to correlate internal pressures with changes in the reservoir elevation. Thirteen holes were drilled totaling about 870 linear feet; and 10 piezometers were installed. The piezometers are instrumented to continuously monitor the embankment's performance.

A Safe Yield Study of UDC1 was prepared to consider the availability of source water for potential rural water use. Historical hydrologic and climate data was transposed from reference watersheds. Sufficient data was complied to simulate 100 years for the study. PSD1 provided records of water consumption. Recent trends in water use were used to predict future rural water needs.

Planning activities included observations of environmental resources including dominant plant and animal species. The US Fish and Wildlife Service was consulted regarding potential impacts of the rehabilitation on federally listed threatened and endangered species. Wetlands within the prospective project area were identified and mapped. Land use was inventoried and the quality of water and air was assessed. Cultural and historic resources were researched and a Phase I cultural resources investigation conducted.

The social and economic data research included human health and safety, population, education, employment, and housing. The effects of the potential alternatives were evaluated for cost-

effectiveness and for local acceptability. The benefits and the costs of the alternatives were computed and analyzed.

Physical Features

Existing Conditions: UDC1 is a typical earth-embankment dam of NRCS (SCS) design for a hazard class of Significant. The dam was designed as a single-purpose flood-control facility with a permanent reservoir for the storage of sediments from its watershed. The principal spillway is concrete pipe installed in the embankment foundation with reinforced concrete inlet and outlet structures (Figure 8). The auxiliary spillway is an excavated open channel and only functions during extreme storm events to protect the embankment from overtopping flows (Figure 9). Both spillways have fixed geometry, referred to as uncontrolled spillways.

The dam embankment is a zoned earth fill with upstream and downstream berms. The top of dam is 14-feet wide, with existing elevations of 1758.08 minimum and 1759.98 maximum. The upstream berm is 15-feet wide at about 1724.6; the downstream berm is 30-feet wide at about 1730.0. The maximum height of the dam from the outlet of the principal spillway is 50.7 feet; the effective height is 35.2 feet. The top of dam is about 520 feet long. The upstream dam slope is 3h:1v (Figure 8); the downstream slope is about 2.5h:1v. Following the geology investigation of this planning effort, the dam now has 10 piezometers to monitor embankment pore pressures.

Figure 8 – Embankment at UDC1 (March 2012)

The auxiliary spillway (ASW) is a 40-feet wide trapezoidal channel excavation in the right abutment of the dam site (Figure 9). The ASW includes a dike embankment between itself and the dam to protect the dam embankment from erosive forces of ASW flows. The crest elevation of the ASW channel is 1744.4 feet msl, with an inlet channel slope of +2.0% and outlet slope of -2.5%. The outside excavation slope is 2h:1v, the inside excavation slope adjacent to the dam is

3h:1v, and the dike embankment slope adjacent to the dam is 2.5h:1v. The vegetative cover of the dam, auxiliary spillway and its dike is dense grasses having a healthy appearance.

Figure 9 – Auxiliary Spillway at UDC1 (March 2012)

The dam and its spillways were designed for Significant Hazard hydrologic events of 1968 NRCS (SCS) criteria. The 100-year 10-day storm event is released through the principal spillway only, and 100% of the Probable Maximum Precipitation event would safely pass through the ASW without overtopping the dam embankment.

The development of housing in areas downstream of the dam prompted the reclassification of UDC1 to High Hazard in the year 2008. This action increases the intensity of the hydrologic event the dam is required to manage without overtopping. Along with increased design storm events by classification, NRCS criteria have also increased the performance requirements of Significant and High Hazard dams in general. Tabulation 7 is a summary of key inputs and output of the SITES model for dams.

Tabulation 7 – Comparison of Key SITES Input and Output

Parameter	Original Significant Hazard 1969 Design	100-Year ASW Crest	6-hr High Hazard Top of Dam	24-hr High Hazard Top of Dam
Key Input Data				
Watershed Area	3190 Acres	2975 Acres	2975 Acres	2975 Acres
Curve Number				
Subwatershed 1	-	76	76	76
Subwatershed 2	-	72.6	72.6	72.6
Subwatershed 3	-	72.6	72.6	72.6
CN used in the model	72	Individual CNs	Individual CNs	Individual CNs
Time of Concentration, T_c				
Subwatershed 1	-	0.33	0.33	0.33
Subwatershed 2	-	0.85	0.85	0.85
Subwatershed 3	-	0.56	0.56	0.56
Tc used in the model	2.51	Individual Tcs	Individual Tcs	Individual Tcs
100-Year Rainfall (P-100)	5.7 Inches	5.24 Inches	3.94 Inches	5.24 Inches
Freeboard Rainfall (P-FB)	13.3 Inches	-	27.3 Inches	34.2 Inches
Key Output Data				
Peak Inflow	12,072 cfs	-	43,248 cfs	29,282 cfs
Peak ASW Outflow	8,950 cfs	-	23,894 cfs	23,589 cfs
ASW Crest Elevation	1744.4 Feet*	1742.3 Feet	1744.4 Feet	1744.4 Feet
Top of Dam Elevation	1758.9 Feet*	-	1766.1 Feet	1766.0 Feet
Freeboard	-	2.1 Feet	-7.2 Feet	-7.1 Feet

* Elevations are from 2010 Gannett Fleming Topographical Survey (NAVD88).

The bottom line of the chart indicates UDC1's predicted performance using current hydrologic criteria for High Hazard dams. The existing crest elevation of the ASW exceeds requirements; the crest is 2.1 feet higher than the criterion minimum. However, the 6-hour and the 24-hour storm events will overtop the dam by over 7 feet with the dam's existing configuration.

Hydro-geology technology has improved since the design of UDC1, and the latest version of the SITES computer program includes modeling erosion of soil and rock from the ASW during major storm events. The parameters necessary to model erosion potential of the ASW channel bottom were determined from geologic data from boring logs and analysis of samples removed from three borings in the ASW. As the dam was overwhelmed with the new hydrologic requirements, the integrity of the ASW foundation materials is exceeded. Both design freeboard storm events are predicted to erode the ASW into the reservoir of UDC1, causing a rapid release of the reservoir's flood storage. Figure 10 is an example of the graphic output of the SITES program, revealing the predicted erosion of the ASW's control section.

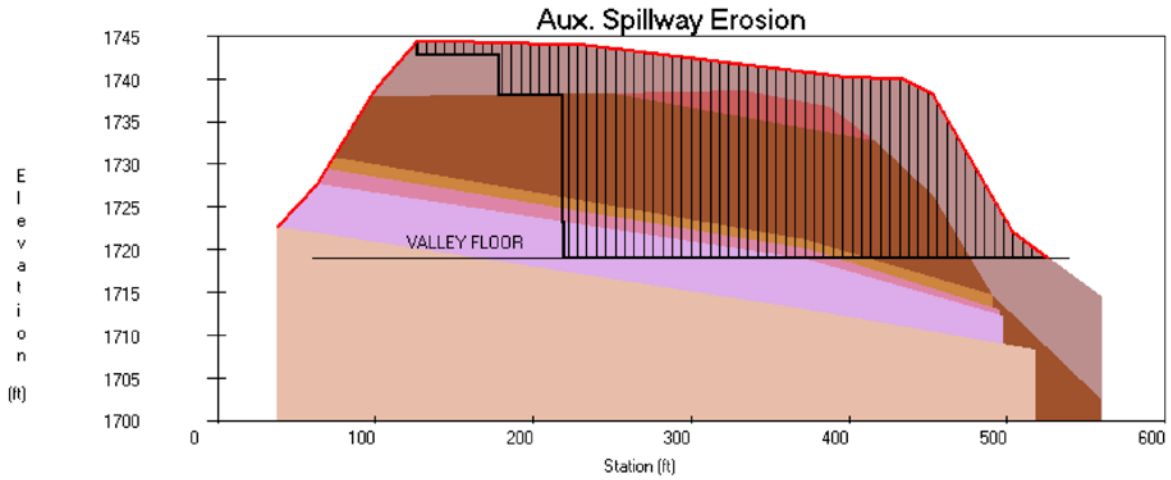


Figure 10 – Auxiliary Spillway Profile and Extent of Erosion from Integrity Analysis for 6-hour High Hazard Freeboard Hydrograph (PMP)

An analysis of the stability of the dam embankment slopes was not conducted. This planning study will assume that the upstream and downstream slopes will not meet existing stability criteria.

Status of Operation and Maintenance

Operation and maintenance of the structure is the responsibility of West Virginia Conservation Committee and the Monongahela Conservation District. This site receives an annual operation and maintenance inspection. The NRCS State Conservation Engineer certifies this dam biennially to WVDEP. Recent records indicate that the operation and maintenance of the structure has been kept current for the site. This has been verified through site assessments.

Structural Data

The structural data for UDC1 is displayed in Table 3.

Hydrologic Performance: The UDC1 watershed has not seen a storm event resulting in flows through the dam's auxiliary spillway. A study of the dam's performance with current hydrologic criteria shows the existing auxiliary spillway crest is two (2) feet higher in elevation than is required. The Probable Maximum Precipitation (PMP) analyses; however, reveal a deficiency in the freeboard elevation of the top of dam. The 6-hour PMP storm, using the standard NRCS 6-hour rainfall distribution, results in an overtopping of the existing dam by 7.2 feet above the minimum top of dam elevation.

Breach Analysis

The current Emergency Action Plan (EAP) for the UDC1 floodplain is dated October 8, 2009. The Project Sponsors are responsible for developing and maintaining the EAP, which describes response procedures in the event the dam fails. The EAP inundation maps were prepared by the West Virginia Conservation Agency using data supplied by the NRCS in 1992. Current inundation maps were prepared by Gannett Fleming in October 2011, and will be incorporated

into the EAP at the upcoming revision. The inundation zone for the existing structure was checked during the planning process using the unsteady flow option of HEC-RAS for a Hydrologic Loading Failure and a Sunny Day failure.

1. Hydrologic Loading Failure: The flood wave produced by a simulated sudden breach of the dam assuming the Freeboard Hydrograph (FBH) storm occurs upstream of the dam with failure occurring at the Top of Dam elevation or within 0.5 feet of the peak reservoir stage resulting from this storm. The FBH storm was assumed to occur only in the watershed upstream of the dam with normal base flow occurring downstream of the dam.

2. Sunny Day Failure: The flood wave produced by a simulated sudden breach of the dam assuming "Sunny Day" conditions both upstream and downstream of the dam with failure conservatively beginning with the reservoir pool level at the auxiliary spillway crest elevation.

Flood elevations were tracked downstream until they came largely within the stream bank or when the flow rate was less than 10 percent of the peak breach flow rate at the dam. The downstream limit of the model is located at Brookhaven, West Virginia, approximately fifteen miles downstream of UDC1.

Technical Release No. 60 (TR-60) provides criteria for determining the maximum peak discharges of the breach hydrograph, regardless of the technique used to analyze the downstream inundation area. According to these criteria, the maximum and minimum peak discharges of the Hydrologic Loading Failure breach hydrograph are approximately 42,370 cfs and 20,320 cfs, respectively. For the Sunny Day Failure event, the maximum and minimum peak discharges of the breach hydrograph are 15,530 cfs and 5,237 cfs, respectively. The size and time of formation of the dam breach in each model scenario were varied in order to match the appropriate TR-60 peak discharge. In order to provide a more reasonable estimate of breach formation and flow, time of breach formation for both events was assumed to be 1 hour. This assumption results in maximum peak discharges that are close to the range determined using TR-60 (48,000 cfs for FBH Failure; 14,000 cfs for Sunny Day Failure).

The primary input data necessary to assemble the hydraulic computer model consists of stream channel and overbank geometry (sectional geometry), bridge geometry, estimates of Manning's n (roughness coefficient), inflow hydrographs, and breach parameters. The sectional geometry necessary for modeling the floodplain was obtained from a FEMA model developed by AECOM dated December 2009. The FEMA model extended from UDC1 Dam to a location about 9 miles downstream of the dam. This FEMA model was appended with sectional geometry developed using a three-meter (3-meter) Digital Elevation Model (DEM) and orthophotography developed by the SAMB. A total of 156 cross-sections were created using the aforementioned data to represent the 15+ miles of modeled river valley. Within the HEC-RAS computer model, sections were interpolated as needed to improve model stability. The cross-sectional data were supplemented with approximate measurements of downstream culverts and bridge openings. Dimensions of all structures within the modeled reach were determined based on photographs, measurements from available topographic mapping, and approximate field measurements. A total of 18 bridges and culverts were included in the HEC-RAS model.

Manning's Roughness Coefficients used in the model for both dam failure scenarios range between 0.035 and 0.06 in the main river channel and between 0.035 to 0.14 in the overbanks. Manning's n values were assigned based on site topography as observed from aerial photos and field reconnaissance.

The Inflow Hydrograph developed previously by Gannett Fleming and documented in the Hydrology Report dated October 2011 for UDC1 was used as input to the UDC1 reservoir for the Hydrologic Loading Failure scenario. The freeboard hydrograph input for the Hydrologic Loading Failure model run is shown in Figure 11 and is also included in the SITES model output in Appendix C. Minimal inflows were assumed for the Sunny Day Failure run.

The inundation maps and breach summary sheets are located in Appendix C. A new breach analysis will be performed during the design phase of the UDC1 rehabilitation and revised inundation data will be provided for use in the preparation of new floodplain inundation maps and the EAP.

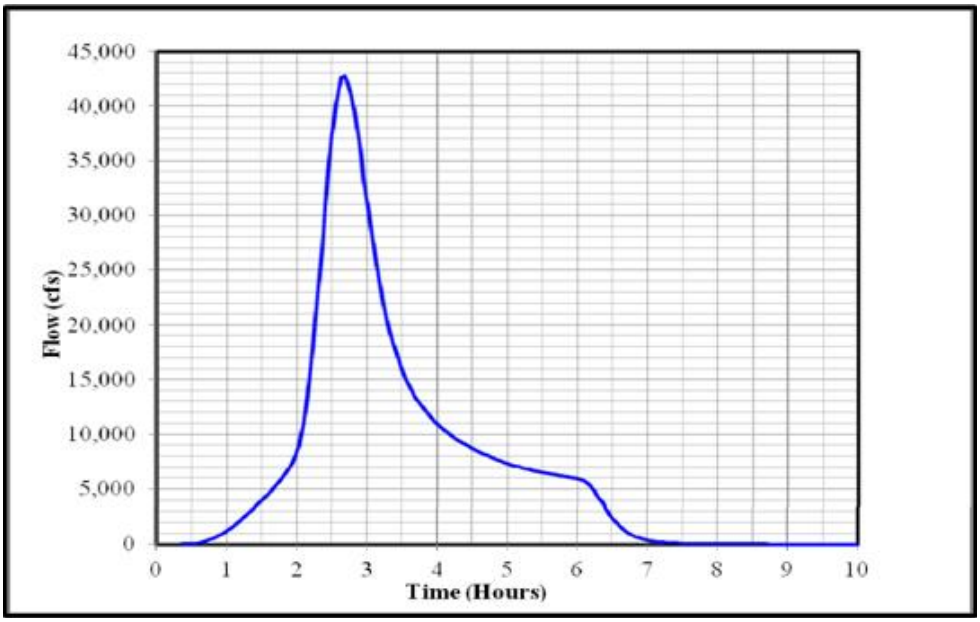


Figure 11 – HEC-RAS Inflow Hydrograph for Extreme Hydrologic Loading Event

Hazard Classification

UDC1 was constructed in 1969 as a single purpose flood control structure. It was built as an SCS Significant Hazard structure with a 100-year design life. The structure was reclassified to High in October 2008 as a result of downstream development which may result in loss of life and serious infrastructure damage. The classification is the same under NRCS TR-60 and the West Virginia Dam Control and Safety Act.

Evaluation of Potential Failure Modes

Hydrologic Capacity: Hydrologic failure of a dam can occur by breaching the auxiliary spillway or by overtopping and breaching the dam. The integrity and stability of the auxiliary spillway and dam embankment are dependent on the depth, velocity, and duration of the flow, the vegetative cover, and the resistance of the soil in the auxiliary spillway and dam embankment to erosion. Current NRCS criteria for high hazard dams require the auxiliary spillway to have sufficient capacity to pass the full PMP storm event without breaching the spillway or overtopping the dam.

Dam Failure by Erosion of the Auxiliary Spillway: The existing auxiliary spillway was analyzed to evaluate its potential to breach by erosion of the soil and rock into which it is excavated. Geology data from a geotechnical investigation conducted by Gannett Fleming from September 2010 to April 2011 was utilized to model the soil and rock formations of the auxiliary spillway. Results from the drilling data and laboratory soil and rock testing were used to establish the geologic parameters.

The spillway erosion model of the SITES program was input with the profile data and the soil and rock character parameters required for the model. The sharp dip of the geology is not conducive to the SITES program protocol for modeling erosion. The headcut erodibility index for each layer in the generalized geologic profile was determined using *Field Procedures Guide for the Headcut Erodibility Index* as specified *in Part 628, Chapter 52 of the NRCS National Engineering Handbook (August 1997).*

The TR-60 criteria storms were routed through UDC1. These included the 6-hour PMP quantity of 27.3 inches and the 24-hour PMP quantity of 34.2 inches. The flows resulting from the 24-hour storm modeled the most erosion damage to the exit channel and out-slopes and resulted in a breach of the ASW control section. Having used conservative values of headcut erodibility and all other soil and rock properties, dam failure by erosion of the auxiliary spillway is highly likely.

Dam Failure by Overtopping of the Embankment: Further SITES analyses examined the maximum crest elevation of the pool during the two criteria PMP storm events, comparing the resulting crests with the minimum top of the dam embankment elevation, 1758.9 feet MSL. The 24-hour PMP hydrologic event caused a pool elevation of 1766.0, and overtopped the dam by 7.1feet. The 6-hour PMP hydrologic event produced a pool elevation of 1766.1, and overtopped the dam by 7.2 feet.

The SITES program's routines for analyzing the erosive force of flowing water on soil and rock are limited to the study of open channel auxiliary spillways. Without a model to predict the erosion of the top of dam, any overtopping is considered a potential failure, whether it is 7.1 or 7.2 feet deep at its maximum crest elevation. Therefore, dam failure by overtopping of the embankment is considered highly probable for UDC1.

Material Deterioration: The materials of the principal spillway system are subject to weathering and chemical reactions with natural elements occurring in the soil, water, and atmosphere. The principal spillway system of UDC1 includes:

1. A 14.6-feet high reinforced concrete riser with metal accessories, a drain gate system, a water supply intake structure;
2. 290-feet of 30-inch diameter reinforced concrete pipe in concrete bedding cradle and an 8-inch diameter water supply pipe also embedded in the cradle; and,
3. A reinforced concrete impact basin at the PSW outlet with a rock riprap apron adjacent to the impact basin.

Concrete risers and conduits are subject to surface deterioration and structural cracking. Metal components of the principal spillway are subject to corrosion. The drain gate stem is susceptible to damage by ice loading during winter storms. Embankment failure has been known to occur from internal erosion initiated by leaks in a principal spillway conduit resulting from deteriorated joint seals or over-extended (separated) pipe joints due to unpredicted foundation settlement.

Inspection of the principal spillway components at UDC1 revealed the concrete of the riser and the impact basin to be in good condition, having no significant deterioration or structural deficiency. Metal accessories have minor amounts of surface rust and some breakage of anchoring fasteners. There is no record of operation of the drain gate and it is conservatively considered to be inoperable.

The interior of the 290-foot long principal spillway conduit was inspected with a remotely-operated mobile video camera in July, 2010. The interior surfaces of the pipe showed no remarkable wear of the concrete. Several pipe joints appeared to be accepting small amounts of seepage from the adjacent backfill. There is evidence of settlement in excess of predicted amounts, but all pipe joints appear to be within their extension limits.

Giving consideration to the existing condition of the principal spillway materials, failure of the dam because of material deterioration is highly improbable during normal conditions and while passing design storm events.

Consequences of Dam Failure by Overtopping

A worst-case scenario is assumed in the analysis of a possible dam failure. This scenario assumes a Hydrologic Loading Failure with no advance warning under “sunny day” conditions in the remainder of the watershed. Dam failure is assumed to occur when water begins to overtop the structure due to an unresolved blockage of the principal and auxiliary spillways. It is assumed that structural collapse would occur quickly and result in a release of water and sediment, beginning with a wall of water equal to the dam height. For UDC1, 1,581 acre-feet of water and 42,429 acre-feet of sediment would be released at an initial height of 27.8 feet.

Resource inventories performed during the planning process indicate that a sunny day failure of UDC1 would jeopardize 62 homes, businesses, and major buildings with various water depths. The flood inundation zone would include the communities of Arthurdale, Reedsville, Masontown, Cascade, and Dellslow, extending 14.6 miles downstream, and would place about 155 residents at some degree of fatal risk. An undetermined number of businesses, along with their employees and clients, would also be exposed to some degree of fatal risk. Access to emergency services would be limited for the 62 homes and businesses directly impacted by a sunny day breach.

Daily traffic counts from West Virginia Department of Transportation (WVDOT) indicate that an additional exposure to loss of life could occur because of the 2,650 vehicles that use the Kingwood Pike (County Route 27) and the 5,000 vehicles that use State Route 7. Along with the major and secondary routes, a number of local roads would have restricted access. The utilities associated with the transportation routes could also be at risk.

The economic losses associated with dam failure would include damages to homes, businesses, roads, utilities, the loss of business activity, the loss of PSD1 water supply and the corresponding decrease in property values. The residences and business properties at risk in the area of the floodplain subject to a breach of UDC1 have structure and content values estimated at over $7,365,600. In addition, potentially impacted infrastructure is valued at over $20,000,000. Infrastructure damage caused by a catastrophic breach would include the loss of roads, bridges, and several utilities. Economic losses resulting from these damages would exceed $27,365,600. Long-term costs of the loss of these infrastructure components would also be incurred due to the need for alternate routes during the replacement period. Other economic losses from a catastrophic breach would be:

a) Changes in real property values and the tax base associated with increased flooding in the future; and

b) Increased flood damages in the future for remaining properties due to the absence of the dam and its flood protection benefits.

In addition to the damage caused by the water, a significant volume of sediment would initially be flushed downstream in the event of a catastrophic breach. At its full capacity, UDC1 has a sediment storage volume of 113 acre-feet. Highly erodible sediment remaining in the sediment pool would continue to cause persistent sediment deposition problems for the downstream channel and floodplain. It is likely that a catastrophic breach would remove nearly all of the fill material used to build the dam. The embankment material remaining after a breach would also eventually erode into the stream, contributing to the downstream sediment deposition. Sediment would be deposited in the stream channels and on the floodplain. This would constrict the floodplain and cause additional flooding in subsequent flood events. Deposition in the floodplain would also restrict the normal use of the land. The nutrients in the sediment could cause water quality problems in the future. At a minimum, sediment would initially be transported for the entire length of the breach inundation zone. Over time, the sediment would migrate downstream into the Monongahela River. There is also the potential for stream degradation upstream from the dam site. The abrupt removal of the water and sediment could cause instability in the streams feeding the reservoir. These streams could develop headcuts that would migrate upstream through the watershed, eroding the banks and channel bottoms and adding more sediment into the stream system.

<u>Sedimentation:</u> The reservoir is designed to store sediment in the pool below the elevation of the proposed water supply gate invert and to detain floodwater in the 3-dimensional space between the principal spillway inlet crest and the crest of the auxiliary spillway. The volume between the proposed water supply gate and the principal spillway crest would be rural water supply storage. As the lake fills with sediment, the quantity of water in the lake decreases. When the sediment pool has filled to the elevation of the proposed water supply gate invert, the pool no longer has

permanent sediment storage, but the designed water supply and flood detention storage are still intact. If the actual sedimentation rate is greater than the designed sedimentation rate, the sediment storage volume will be filled before the design life of the structure has been reached. The additional sediment would begin to fill the water supply volume and reduce the quantity of available rural water storage.

It is highly improbable that this reservoir will fill with sediment to the point of compromising the available flood water storage. The severe loss of rural water supply would prompt the Preston County Commission to initiate action to preserve their water storage, namely the removal of sediment from the water supply pool. This work would be conducted under the Operation and Maintenance agreement.

The land use in the UDC1 watershed is 74.5% woodland, 11.9% pasture/hay, 6.8% cultivated crops, 5.1% developed, 1.5% open water and 0.2% barren land (see Tabulation 3). These conditions are not expectedly to change appreciably. When originally designed, UDC1 was projected to capture 1.92 acre-feet per year of submerged sediment. Based on the historic average, the future submerged sediment accumulation rates are expected to be 1.2 acre-feet per year, which is 37.5% lower than the originally projected rate. Therefore, the remaining sediment storage life of the reservoir is approximately 77 years. The potential for failure due to inadequate reservoir capacity is negligible.

Seepage: Embankment and foundation seepage can contribute to failure of an embankment by removing (piping) soil material through the embankment or foundation. As the soil material is removed, the voids created allow even more water flow through the embankment or foundation, until the dam collapses due to the internal erosion. Seepage that increases with a rise in pool elevation is an indication of a potential problem, as is stained or muddy water or “sand boils”. Foundation and embankment drainage systems can alleviate seepage problems by removing the water while preventing soil particles from being transported away from the dam.

Seepage is evident on the downstream slope of the UDC1 embankment, especially on the berm at an elevation of approximately 1,730’ above msl. Knowing the normal pool elevation is 1724.5, this seepage is highly likely to be poor surface drainage of the berm. There is no evidence of soil movement and the seepage does not affect mowing operations as part of the maintenance plan.

The potential for dam failure due to seepage is minimal. Surface drainage measures are planned for the rehabilitation of this dam to alleviate the safety hazard of mowing on saturated embankment slopes.

Seismic: The stability of an earthen embankment is dependent upon the presence of a stable foundation and adequate compaction and drainage of embankment materials. Foundation failure through consolidation, compression, or lateral movement can cause the creation of voids within and area of significant seismic risk; therefore, there is low potential for slope failure due to seismic activity. The riser was not designed to withstand a specified seismic event. A seismic analysis using estimated foundation soil data was performed. With the reservoir at the riser crest, the riser is predicted to fail when subject to current design acceleration for a seismic event.

Stability: Stability for earth dams speaks of the strength of the earth and rock foundation to support the dam and its structures, and the strength of embankment soils and excavated slopes to resist sliding failures. The existing slopes of the dam are 3h:1v upstream and 2.5h:1v downstream; a common combination for earth dams built through the PL-566 watershed program. The auxiliary spillway excavated slopes are 3h:1v (inside slope) and 2h:1v (outside slope). The earth dike between the dam and spillway has embankment slopes of 3h:1v (spillway side) and 2.5h:1v (dam side). A detailed geotechnical investigation and analysis of the embankments and excavations was not conducted for this planning study. For the alternatives analysis, this study assumes the slopes of the dam will require additional stabilization to meet current safety standards. However, considering the dam's 43-year record of stable slopes and foundations, dam failure by instability would probably require a significant seismic event to occur simultaneously with a major storm event, and is considered highly improbable.

Conclusion: The Failure Mode having the highest potential of occurring at UDC1 is insufficient hydrologic capacity. With the existing spillway and embankment configuration, the design freeboard storm events will overtop the dam embankment and erode the foundation of the auxiliary spillway into the reservoir. This study assumes the dam embankment will also fail; a slope failure of the downstream face due to erosion of the berm and foundation is considered likely with over 7-feet of overtopping energy head.

The sediment capacity of UDC1 is scarcely diminished from its original volume; the embankment has no evidence of detrimental seepage; the probability of a seismic event with sufficient energy to cause failure is very low; and material components of the dam are in good condition.

FORMULATION AND COMPARISON OF ALTERNATIVES

Formulation of alternative rehabilitation plans followed procedures outlined in the NRCS *National Watershed Manual, Part 505*. Other guidance incorporated into the formulation process included the NRCS *National Planning Procedures Handbook, Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G)*, and other NRCS watershed planning policies. Each alternative evaluated in detail used a 50-year period of analysis. This period was chosen because the lifespan of UDC1 will be extended a minimum of 50 years with any rehabilitation measure. It is anticipated that the dam will continue to be in service beyond 50 years with proper maintenance.

The formulation process began with formal discussions between the Sponsors and NRCS. NRCS explained agency policy associated with the Small Watershed Dam Rehabilitation Program and related alternative plans of action. As a result, alternative plans of action were developed based on NRCS planning requirements and the ability of the alternatives to address the objective of bringing UDC1 into compliance with current design criteria and performance standards. The following alternatives were considered:

- No Federal Action (Sponsors' Rehabilitation)
- Decommission the Dam
- Rehabilitate the Dam for Compliance to Current Standards
- Rehabilitate the Dam for Compliance to Current Standards and add a Dedicated Water Supply

Alternatives Considered But Eliminated From Detailed Study

Some of the alternatives considered in the planning process were eliminated from detailed consideration because they did not meet the needs of the Sponsors. Alternatives were considered independently and in combinations that would meet the Sponsors' combined need for continued flood protection and rural water supply.

Decommissioning: Decommissioning is a mandatory rehabilitation alternative under NRCS policy. It is an alternative which includes a plan to remove the flood detention capacity of the dam by removing a portion (or all) of the existing embankment down to the valley floor and restoring the function and stability of the stream channel and the 100-year floodplain. Decommissioning may require grading of the sediment pool to remove accumulated sediment. The removal of the principal spillway riser and pipe is also necessary. The flood damage reduction benefits that were being provided by UDC1 must also be replaced by some alternative means. Downstream properties could be raised, flood proofed, or protected by some other means. These costs are added to the cost of removing the structure itself. In the case of UDC1, decommissioning would also involve replacing the raw water source that will be lost if the dam is decommissioned. The cost of decommissioning UDC1 includes all of these components.

The on-site construction cost associated with decommissioning UDC1 is estimated at $850,000. This estimate is based on planning level analysis.

The cost for replacing the flood damage reduction benefits of UDC1 relates to the amount of property improvements downstream. There are approximately 62 structures in the breach zone of UDC1. A visual and map inspection of the watershed below UDC1 indicates that approximately 75% of these properties are within the 100 year floodplain as well. The types of structures include single family homes, modular homes, mobile homes, private garages, barns and sheds. There are some commercial and industrial structures as well, such as a multiple storage unit business, a trucking firm, and a few small businesses.

The cost to raise, flood proof, relocate or otherwise protect downstream structures from flooding is estimated at $106,200 per structure or $4,938,300 for the structures in the breach zone. This estimate is based on planning level analysis of structures in a similar watershed in West Virginia.

Other private property subject to flooding includes roads, bridges, fences, gardens, landscaping, lawn accessories, and miscellaneous improvements. Public property such as state and county roads and bridges, utility infrastructures such as water lines, electric lines, electric poles, meters, and communication investments will also be subject to flooding if UDC1 is decommissioned. These properties are not conducive to flood proofing so flood damages will occur. Damages are assumed to be equal to or greater than the structural damage. For planning purposes, an estimated $5,000,000 would be incurred to flood proof improved property.

The removal of UDC1 by decommissioning the structure will eliminate the water supply source for PSD1. A replacement water supply would be needed to service PSD1's customers. As discussed elsewhere in this document, there are limited options for PSD1 with regard to securing the quantity and quality of water that is currently available in UDC1. PSD1 would likely have to

build another impoundment for the sole purpose of providing rural water. The estimated cost of a single purpose rural water supply only structure is $1,337,000.

The total cost of the decommissioning alternative is $12,125,300. This alternative was not cost-effective and it did not meet the needs of the Sponsors. It was eliminated from further consideration.

Nonstructural: Relocation or Flood Proof Structures in the 100-year Floodplain: UDC1 was originally classified as a Class B structure. However, due to the downstream development of homes and businesses, the structure will be reclassified as a Class C, or high hazard, structure. Class C structures provide significant downstream flood damage reduction to homes, buildings, transportation corridors, agricultural properties, and other improvements. It is not feasible to relocate the roads, bridges, and utilities protected by UDC1. The cost of implementing a nonstructural alternative for those properties where such measures are applicable is $9,938,300. Furthermore, Sponsors rely on UDC1 as the source of water supply for PSD1. Without UDC1, Sponsors would not have a reliable water supply for their customers. The cost to secure a dedicated rural water supply is estimated at $1,337,000. The total cost of this alternative is $11,275,300. This alternative was eliminated from further consideration.

Measures Considered for High Hazard Flood Control

The most significant deficiency of UDC1 is the existing auxiliary spillway's lack of necessary flow capacity which would prevent overtopping of the dam during design high hazard storm events. There were 2 options to address this deficiency:

Option 1 – Construct Auxiliary Spillway on Left Abutment

The topography of UDC1 is very conducive to a new auxiliary spillway on the left. A significant layer of rock having suitable elevation and high resistance to hydraulic erosion was identified. The left abutment has sufficient area to excavate a spillway with a 150-foot bottom width, 3:1 side slopes, and with a generous amount of undisturbed earth between the spillway excavation and the embankment. SITES models predict armoring this spillway with a concrete product will not be necessary. The existing auxiliary spillway near the right abutment is planned to be backfilled.

Option 2 – Construct Auxiliary Spillway over Dam Embankment

The dam embankment and adjacent areas downstream provide sufficient area to install a concrete auxiliary spillway over the embankment. This spillway would be about 290 feet wide, constructed with reinforced concrete training walls and roller compacted concrete step-type flow surface. The spillway crest is level; training walls at the crest are about 12 feet high. The spillway outlet would consist of a concrete stilling basin across the full width and be 80 feet long. The outlet basin would be constructed similar to the spillway using reinforced and roller compacted concrete. The existing impact basin would be demolished and the existing principal spillway pipe would discharge into the new concrete basin. A notch will concentrate low flows entering Deckers Creek. The existing auxiliary spillway will be backfilled.

Option 1 is the selected auxiliary spillway configuration. The excavated spillway option is $500,000 less construction cost, about an 8% savings over Option 2. Other significant advantages are fewer disturbances to the existing dam embankment and a minimal increase of overburden weight over the existing principal spillway pipe. This is an important concern with the pipe's yielding foundation. The excavated auxiliary spillway's maintenance will be routine for the Sponsors, an advantage over maintaining a massive concrete structure.

To ensure full compliance with NRCS criteria for high hazard dams, the following work will also be necessary:

- Place earth and rock fill to increase stability of upstream and downstream embankment slopes;
- Excavate and remove the existing embankment drainage system and install new chimney and toe drains compatible with embankment soils;
- Install a liner in the existing principal spillway pipe, and;
- Replace the riser to meet seismic stability requirements.

Measures Considered for Rural Water Supply

Alternatives that would meet the present and projected rural water supply needs were considered during the planning phase. At present, the PSD1 serves 1,534 customers by using the water from the sediment pool of UDC1. The current rural water supply demand is 250,000 gallons per day. Population increases and extension of water lines are causing water demand to increase by about 7% per year. By the year 2020, the demand is expected to reach nearly 550,000 gallons per day. PSD1 does not differentiate between residential, commercial, and industrial demand so the projections include overall increase in water demand from all sectors. In the event that a large industrial or commercial water user moves into the PSD1 service area, water supply needs will be even greater than projected.

Groundwater: Two types of ground water sources, wells and springs, were evaluated as to their potential to meet water supply demands in the area. However, these sources have been heavily impacted by coal mining, specifically from the Upper Freeport coal seam. Water associated with the Freeport coal is highly acidic and cannot be economically treated with current treatment plant technologies. As a consequence, PSD1 is extending water lines to new service areas where the groundwater has been rendered unusable due to mining. Consequently, wells and springs are not viable alternatives so they were eliminated from further analysis.

Surface withdrawals from Rivers and Streams: Streams were also evaluated as to their potential to meet water supply needs. Deckers Creek and its tributaries are at base flow during many of the late summer/fall seasons. Base flow condition exists when the streams are totally recharged by groundwater. Under these conditions, placing an intake in Deckers Creek or its tributaries for removal of any additional water from the stream system would not meet demand and would be detrimental to the aquatic ecosystem. Surface water withdrawals from Deckers Creek or its tributaries are not viable alternatives and were eliminated from further analysis.

Water Purchase Agreements: Water purchase agreements were considered as another option to meet the water supply needs of the area. A water purchase agreement is an arrangement in

which one community enters into an agreement to purchase water from another nearby municipality. PSD1 has utilized water from the Clinton District Public Service District in adjacent Monongalia County, but this is not a cost-effective, long term option. Water from adjacent suppliers must be pumped to the PSD1 treatment plant, adding substantial cost. Clinton District PSD is also seeking a rate increase, which will impact the cost-effectiveness of this option for Preston County PSD1. Uncertainty regarding the availability and cost of utilizing water from Clinton District makes this option undesirable as a long term solution for PSD1. This alternative was eliminated from further consideration.

Water Conservation: In some situations, water conservation measures are a reasonable means of increasing the efficiency of an available water supply. Water conservation measures include reduction of excessive unaccounted for water (i.e., water lost in water systems due to leakage and unmetered use) and use of more efficient appliances and water conservation devices (e.g. low-flow toilets and showerheads, etc.). These measures typically apply to communities which are being serviced by older systems that are in need of upgrading. This is not the case with PSD1. This alternative was eliminated from further analysis.

Impoundments: There are no other impoundments in the vicinity of PSD1 that could be used as a raw water supply. Upper Deckers Creek Site 6, another flood control structure in the Upper Deckers Creek Watershed Project, is nearby but it does not contain a dedicated water supply pool. The drainage area of Site 6 is 1.27 square miles compared to 4.64 square miles for UDC1. Based on the results of the safe yield analysis for UDC1, Site 6 would yield significantly less water. Site 6 is not slated for rehabilitation work at this time, so modifications to add rural water supply would not be done in conjunction with other rehabilitation work. This would be less cost-effective than adding rural water supply to UDC1 during rehabilitation.
The cost to construct a single purpose water supply structure is estimated at $1,337,000 (landrights not included). This amount exceeds the incremental cost of adding water supply to UDC1 during the federal rehabilitation.

This alternative was eliminated from further analysis.

Comparison of Alternative Plans

The following plan alternatives were fully developed and are discussed in detail throughout this report. These alternatives include:

1. No Federal Action (Sponsors' Rehabilitation)
2. Rehabilitation of UDC1 with Federal Assistance for Flood Control
3. Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply

No Federal Action (Sponsors' Rehabilitation): No Federal funds would be expended with this alternative. To meet the Purpose and Need of UDC1, the sponsors must develop an alternative dedicated rural water supply and modify UDC1 to safely pass the design hydrologic event for a High Hazard dam.

Analysis of the No Federal Action Alternative assumes the following scenario:

1. The Sponsors comply with the West Virginia Department of Environmental Protection, Dam Safety Section, to modify UDC1 to safely pass the design storm of a High Hazard dam.
2. The Sponsors consult with NRCS and organize a plan to complete the federal interest in UDC1 and modify the dam and spillways to comply with state law.
3. The Sponsors' plan includes providing dedicated rural water supply for Public Service District 1.

With the region's groundwater quality compromised and purchasing water from an adjacent municipality being cost prohibitive, PSD1 would likely be limited to constructing a facility to collect and store surface water.

In this scenario, the hypothetical decision to include water supply is based on the Preston County Commission and Public Service District 1 providing funds in the amount necessary to construct a single purpose dedicated water supply reservoir. The Safe Yield Study of this planning effort and historical records of NRCS-type dam construction costs may be used to estimate the cost of a single-purpose water supply dam. For comparison with other alternatives, such a single-purpose water supply dam is assumed to provide the PSD1's desired 0.5 MGD for six months, including through the region's drought of record.

The Safe Yield Study for UDC1 estimates 310 acre-feet of storage is necessary to provide the desired consumption rate for the conditions noted above. UDC1's watershed is 4.65 square miles; the required storage of a water supply dam will vary directly with a proposed site's drainage area. For comparison, assume a reservoir having storage of 310 acre-feet is constructed with an earthen dam having spillways similar to UDC1. From NRCS' inventory of dams in West Virginia, three dams in similar topography and capable of 310 acre-feet of flood storage were selected (a single-purpose water supply dam will have less freeboard than these flood-control dams). Construction costs of these representative dams were averaged and updated to 2012 values, and an estimate of current landrights costs similar to UDC1 was included. At present, PSD1 could expect to invest $1,705,000 to construct a representative dam. This cost estimate includes landrights expenses.

The Sponsors' rehabilitation is assumed to include the following work items:

1. Relocation of gas lines and other utilities
2. Excavate new auxiliary spillway in left abutment
3. Fill existing auxiliary spillway
4. Waste excess spillway excavations
5. Extend the upstream end of the principal spillway pipe
6. Raise the top of dam
7. Construct larger upstream embankment berm
8. Construct new riser for rural water supply purpose

The cost estimate to construct this hypothetical dam compliant to state law is $4,874,000. With landrights costs similar to this option with federal funding, the Sponsors may spend a total of $5,242,000.

This scenario fulfills the goals of the Purpose and Need statement. The likelihood of this course of action depends on the availability of non-federal funds and the Sponsors' ability to secure those funds. Without sufficient non-federal dollars, the No Federal Action may be limited to modifications that do not meet the Purpose and Need.

Rehabilitation of UDC1 with Federal Assistance for Flood Control: This rehabilitation alternative was formulated to address the safe operation under current high hazard performance criterion, to ensure compliance with all current NRCS design standards for High Hazard dams. The most significant deficiency of UDC1 is the existing auxiliary spillway's lack of necessary flow capacity which would prevent overtopping of the dam during designed high hazard storm events.

The topography of UDC1 is very conducive to a new auxiliary spillway on the left abatement. A significant layer of rock having suitable elevation and high resistance to hydraulic erosion was identified. The left abutment has sufficient area to excavate a spillway with a 135-foot bottom width, 3:1 side slopes, and with a generous amount of undisturbed earth between the spillway excavation and the embankment. SITES models predict armoring this spillway with a concrete product will not be necessary. The existing auxiliary spillway near the right abutment is planned to be backfilled.

To ensure full compliance with NRCS criteria for high hazard dams, the following work will also be necessary:

- Place earth and rock fill to increase stability of upstream and downstream embankment slopes;
- Excavate and remove the existing embankment drainage system and install new chimney and toe drains compatible with embankment soils;
- Install a liner in the existing principal spillway pipe, and;
- Replace the riser to meet seismic stability requirements.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: This rehabilitation alternative was formulated to address the safe operation under current high hazard performance criterion, to ensure compliance with all current NRCS design standards for high hazard dams, and to convert UDC1 to a multi-purpose dam with a dedicated raw water supply. The most significant deficiency of UDC1 is the existing auxiliary spillway's lack of necessary flow capacity which would prevent overtopping of the dam during designed high hazard storm events.

The topography of UDC1 is very conducive to a new auxiliary spillway on the left abutment. A significant layer of rock having suitable elevation and high resistance to hydraulic erosion was identified. The left abutment has sufficient area to excavate a spillway with a 135-foot bottom width, 3:1 side slopes, and with a generous amount of undisturbed earth between the spillway excavation and the embankment. SITES models predict armoring this spillway with a concrete product will not be necessary. The existing auxiliary spillway near the right abutment is planned to be backfilled.

To ensure full compliance with NRCS criteria for high hazard dams, the following work will also be necessary:

- Place earth and rock fill to increase stability of upstream and downstream embankment slopes;
- Excavate and remove the existing embankment drainage system and install new chimney and toe drains compatible with embankment soils;
- Install a liner in the existing principal spillway pipe,
- Replace the riser to meet seismic stability requirements, and;
- Provide a rural water supply

Effects of Alternative Plans

Alternative plans of action can affect resources upstream and downstream of UDC1. This section describes the anticipated effects on the environmental, economic, and social concerns identified by the Sponsors, the public, and agency personnel. No long term, adverse, environmental effects were identified.

Three alternatives were considered and evaluated in detail in the rest of this document. Alternatives considered include:

1. No Federal Action (Sponsors' Rehabilitation)
2. Rehabilitation of UDC1 with Federal Assistance for Flood Control
3. Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply

Upland Erosion

Existing Conditions: The upper portion (north) of the UDC1 drainage area is mostly forested with some farmland existing on the ridges comprising the watershed divide. Forested areas are privately owned and subject to occasional timber harvesting activities. Farmland areas are primarily grasslands and are used for grazing and hay production.

The lower portion (south) of the UDC1 drainage area is farmland interspersed with forested areas. As with the upper drainage area, farmlands are primarily grasslands used for grazing and hay production. Woodlots are subject to occasional timber sales, firewood harvests and other wood utilization.

Erosion rates from the drainage area appear to be minimal throughout most of the watershed. Timber harvests and grassland improvements (reseeding) may result in temporary increases in erosion from disturbed areas until suitable vegetative cover is reestablished. A limited amount of surface mining for coal has occurred within the drainage area in the past. These old mine sites may have eroding areas that have not been adequately revegetated. Unstable stream reaches within the UDC1 drainage may have eroding streambanks that contribute to the sediment load upstream of the impoundment.

No Federal Action (Sponsor's Rehabilitation): Under this alternative, any work to address improvements to the dam and reservoir would be performed by the project sponsors. Work performed by the local entities would likely be restricted to the dam, spillway systems and outlet and the addition of a dedicated water supply. This work would result in the disturbance of

surface areas and may result in a temporary increase in soil erosion from the site. Soil erosion from these construction areas would be expected to diminish to background levels upon completion of the work and the reestablishment of vegetative cover. Sponsor's rehabilitation would not be anticipated to include any work upstream of the impoundment and therefore erosion rates from the watershed would not be affected.

Rehabilitation of UDC1 with Federal Assistance for Flood Control: Rehabilitation of the dam with federal assistance to continue floodwater detention capabilities would result in soil disturbances at the dam and both abutments. In order to pass the design storm without overtopping the dam, the ASW would be relocated to the left abutment of the dam. The new spillway would be built in a previously unexcavated area on the left abutment of the dam. A large amount of earthen material will be excavated from this embankment in order to create this new ASW. Excavated material is expected to be used to fill the existing ASW and flatten the upstream and downstream slopes of the dam for slope stability. Additional earthen material is expected to be wasted immediately below the dam. No work upstream of the dam and reservoir area is anticipated to occur in the watershed as a result of this rehabilitation alternative.

A temporary increase in soil erosion is expected to result from this construction activity. Erosion and sediment control, in accordance with a required National Pollutant Discharge Elimination System (NPDES) storm water permit, will minimize soil erosion from this construction activity.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: Rehabilitation of the dam, with federal assistance, to continue floodwater detention capabilities and add a dedicated raw water supply to the reservoir pool would result in soil disturbances at the dam and both abutments. The surface water elevation of the reservoir pool would be raised about 10.8 feet above the current sediment pool elevation. As a result of increasing the pool elevation to add raw water supply, the ASW control elevation would also need to be raised by approximately 5.6 feet. This increase in the ASW elevation will result in a shallower excavation and, therefore; a lesser amount of earthen material to be incorporated into the project elsewhere. Excavated material is expected to be used to fill the existing ASW on the right abutment, raise the top of the dam approximately 7.7 feet and flatten the upstream and downstream slopes of the dam for increased stability. Remaining earthen material is expected to be wasted immediately below the dam.

A temporary increase in soil erosion is expected to result from this construction activity. Erosion and sediment control, in accordance with a required NPDES storm water permit, will minimize soil erosion from this construction activity. No work upstream of the dam and reservoir area is anticipated to occur in the watershed as a result of this rehabilitation alternative.

Sedimentation

Existing Conditions: The permanent pool of the existing reservoir was sized for sediment storage for the original evaluated life (50 years) of UDC1. Water occupying this pool that has not been replaced by accumulated sediment is utilized by the PSD1 as the water supply source for its water treatment and distribution system. Actual measured sediment accumulation in the reservoir is 50.7 acre-feet, less than the amount projected to occur during the original design process. Sediment produced by the UDC1 drainage area has accumulated in the reservoir at a

rate estimated to be 1.22 acre-feet per year. At this rate, approximately 77 years of sediment storage is estimated to remain in the existing reservoir.

No Federal Action (Sponsor's Rehabilitation): Under this alternative, any work to address improvements to the dam and reservoir would be performed by the project sponsors. Work performed by the local entities would likely be restricted to the dam, spillway systems and outlet, the addition of a dedicated water supply. If additional reservoir storage would not be included with the Sponsor's Rehabilitation alternative, raw water supply volume would gradually diminish as sediment continues to accumulate in the future. The accumulation of sediment produced by the upstream watershed would likely remain at or near the current rate (barring significant changes in future land use); however, sedimentation would not diminish the volume of water critical to sustaining the PSD1 treatment and distribution system for at least the next 20 years. Reservoir dredging or the development of an alternative water supply source would eventually be necessary to replace water supply at UDC1 that is lost to sediment accumulation.

Rehabilitation of UDC1 with Federal Assistance for Flood Control: Work to rehabilitate UDC1 for flood water detention would not result in the creation of additional reservoir storage behind the dam. Sediment accumulation at the historical rate would continue to diminish the amount of raw water supply available to the local PSD1. The accumulation of sediment produced by the upstream watershed would likely remain at or near the current rate (barring significant changes in future land use); however, sedimentation would not diminish the volume of water critical to sustaining the PSD1 treatment and distribution system for at least the next 20 years. Reservoir dredging or the development of an alternative water supply source would eventually be necessary to replace water supply at UDC1 that is lost to sediment accumulation.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: Rehabilitation of the dam and the addition of a dedicated raw water supply would increase the total storage volume of the reservoir. The accumulation of sediment produced by the upstream watershed would likely remain at or near the current rate (barring significant changes in future land use); however, sedimentation would not diminish the volume of water critical to sustaining the PSD1 treatment and distribution system for at least the next 20 years.

Prime and Unique Farmland

Existing Conditions: Many of the soils mapping units surrounding the UDC1 impoundment, including the total area of potential effect, are classified as prime or statewide important farmland (See Soils map, Appendix C). The permanent pool area above the dam and a few small ponds are excluded from these classifications. The open field below the dam is mapped as Atkins silt loam and is characterized as being poorly drained. Most of the reservoir's perimeter upstream of the dam is forested.

No Federal Action (Sponsor's Rehabilitation): Modification to the ASW to improve its function is expected to be the major activity to maintain compliance.

The most likely scenario for upgrading the ASW would be the construction of a new ASW on the left abutment similar to that described for the federally assisted rehabilitation alternative. This alternative would involve excavating the new ASW and the disposal of excavated earthen

material on the dam and downstream face. This activity would increase the area occupied by the dam and ASW by about 8.8 acres. Cost analyses suggest that adding additional raw water supply to the reservoir will reduce the size of the ASW and consequently reduce the cost of excavation. Calculations suggest that cost savings associated with raising the ASW control elevation are sufficient to more than offset the cost of adding water supply storage and replacing the riser structure. As such, the permanent pool will be enlarged to inundate an additional 11.4 acres of land around the existing reservoir. A total of 14.8 acres of farmland comprised of about 0.9 acres of prime farmland and 13.9 acres of state-wide important farmland will be converted to non-agricultural uses (Tabulation 8).

Rehabilitation of UDC1 with Federal Assistance for Flood Control: Rehabilitation of the dam with federal assistance for flood control only will bring the dam and ASW up to current design and performance standards. No changes to the permanent pool or flood storage reservoir would occur. This alternative would require the excavation of the new ASW with the disposal of waste to be incorporated on the dam and downstream face. This alternative would increase the footprint of the dam and ASW by about 10.3 acres. About 0.9 acres of prime farmland and 9.4 acres of state-wide important farmland will be converted to non-agricultural uses.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: Under this alternative, the excavation of the new ASW would comprise the source of earthen materials to be used to raise the top of the dam and flatten the upstream and downstream slopes of the dam. These modifications to the dam and ASW would increase the size of its footprint by 9.2 acres. About 0.9 acres of prime farmland soils and 5.9 acres of soils of state-wide importance will be converted to non-agricultural uses. Remaining earthen material not needed for the dam modifications is proposed for disposal downstream of the dam. This area would cover an estimated 3 acres of Atkins soils.

The addition of water supply storage to the reservoir will consist of adding about 10.8 feet of depth to the permanent pool. This additional depth will permanently inundate an additional 11.4 acres of land around the existing reservoir. About 8.2 acres of state-wide important farmland and 3.2 acres undrained Atkins soils will be converted to reservoir.

The flood storage capacity will remain essentially the same as the existing reservoir (1,777 acre-feet). The new ASW crest will be 14.7 feet above the new permanent pool elevation. At this elevation, the temporary flood storage pool will have a surface area of 57.9 acres. This area is 10.2 acres larger than the existing ASW pool. Soil survey mapping indicates this 10.9 acre area is comprised of state-wide important farmland.

Tabulation 8 – Permanent Affects of UDC1 rehabilitation plan alternatives on prime and state-wide important farmland (in acres).

Alternative	Prime Farmland Impacted	State-wide Important Impacted	Total Impacted
No Federal Assistance (Sponsor's Rehabilitation)			
Dam and ASW	0.9	5.7	6.6
Reservoir Pool	0.0	8.2	8.2
Alternative Total	0.9	13.9	14.8
Federal Rehab – Flood Control only			
Dam and ASW	0.9	9.4	10.3
Reservoir Pool	0.0	0.0	0.0
Alternative Total	0.9	9.4	10.3
Federal Rehab – add Water Supply Storage			
Dam and ASW	0.9	5.9	6.8
Reservoir Pool	0.0	8.2	8.2
Alternative Total	0.9	14.1	15.0

Surface Water Quality

Existing Conditions: Water quality data was obtained from the PSD1 for raw water from the UDC1 impoundment. A summary of this data for the period of June 2011 through January 2012 is presented in Tabulation 5. Water quality parameter analyses indicate good raw water quality and the PSD1 treatment plant is able to satisfactorily produce potable water meeting WV drinking water standards. PSD1 has been utilizing water from the UDC1 impoundment since water usage was granted to them in1972.

No Federal Action (Sponsor's Rehabilitation): Project effects upon water quality in the reservoir are anticipated to be minimal. Minor increases in turbidity (suspended sediment) may result following completion of construction until the re-establishment of vegetation on disturbed areas is achieved.

Rehabilitation of UDC1 with Federal Assistance for Flood Control: Project effects upon water quality in the reservoir are anticipated to be minimal. Minor increases in turbidity (suspended sediment) may result following completion of construction until the re-establishment of vegetation on disturbed areas is achieved.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: Project effects upon water quality in the reservoir are anticipated to be minimal. Minor increases in turbidity (suspended sediment) may result following completion of construction until the re-establishment of vegetation on disturbed areas is achieved.

Surface Water Quantity

Existing Conditions: The PSD1 was granted a Water-Rights Easement and Right-of-Way Agreement by the Soil Conservation Committee in January 1972. This document allowed PSD1 the right to use the water in the impoundment as a water supply source for municipal treatment and distribution and to use the water supply pipeline installed through the dam during its original construction. Water usage was granted from the sediment pool of the impoundment so long as it exists. No provisions for conservation release or low-flow augmentation are present in the existing dam structure.

No Federal Action (Sponsor's Rehabilitation): Water supply demand by PSD1 was evaluated using historical consumption records and growth rates. This, along with historical rainfall and runoff data, growth projections and other information, was used for the preparation of a Safe Yield Study for the UDC1 drainage area. This study estimated that 310 acre-feet of dedicated water supply storage is needed to meet the projected demand of 0.5 MGD for a six month period including conditions replicating the region's drought of record. This additional water supply storage will require an increase of 10.8 feet of depth to the reservoir and will increase the permanent pool surface area by 11.4 acres. The existing available sediment pool would remain as additional water supply if conditions should dictate.

Construction to install the necessary rehabilitation measures, including adding a dedicated water supply, will require the reservoir to be drained for a period of up to two construction seasons. During this period, the PSD1 will have to secure an alternative, temporary water supply source or enter into a water purchase agreement with other entities to maintain service through the period of construction.

During construction, while the reservoir is drained, water produced by the drainage area upstream of the UDC1 dam will flow through the principal spillway conduit and be discharged into Deckers Creek downstream of the dam. Once construction is complete, the reservoir will be refilled. Discharges from the reservoir during the refilling process will be minimal to allow for the reestablishment of the water supply pool. Once filling is complete and use of the reservoir is resumed by PSD1, flows into the reservoir that exceed the withdrawals will be discharged downstream. During the summer low flow periods, water supply withdrawals will likely exceed inflow and no flows will enter Deckers Creek from the principal spillway outlet. No additional storage to facilitate a conservation release to Deckers Creek during drought periods was included in this storage volume.

Rehabilitation of UDC1 with Federal Assistance for Flood Control: This rehabilitation alternative does not include any additional reservoir volume for a dedicated water supply source. Water supply would remain as the 92.3 acre-feet in the sediment pool of the existing reservoir.

Construction to install the necessary rehabilitation measures will require the reservoir to be drained for a period of up to two construction seasons. During this period, the PSD1 will have to secure an alternative, temporary water supply source or enter into a water purchase agreement with other entities to maintain service through the period of construction.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: Water supply demand by PSD1 was evaluated using historical consumption records and growth rates. This, along with historical rainfall and runoff data, growth projections and other information, was used for the preparation of a Safe Yield Study for the UDC1 drainage area. This study estimated that 310 acre-feet of dedicated water supply storage is needed to meet the projected demand of 0.5 MGD for a six month period including conditions replicating the region's drought of record.

This additional water supply storage will require an increase of 10.8 feet of depth to the reservoir and will increase the permanent pool surface area by 11.4 acres. The existing available sediment pool would remain as additional water supply if conditions should dictate.

Consultations with WVDEP were made regarding the need for a conservation release from the reservoir during times that water withdrawals by PSD1 exceeds inflow into the pool. These conditions may be realized annually during the late summer and fall months. In order to minimize low flow conditions in the segment of Deckers Creek below the dam, WVDEP recommended a conservation release equal to or greater than the 7Q10 value be provided. The 7Q10 value, by definition, is the seven-day consecutive low flow expected to occur during a ten year period. The 7Q10 value at the UDC1 location has been calculated by WVDEP to be 0.095 cfs. Based on a rate of 0.10 cfs, approximately 35 acre-feet of reservoir capacity would be required to sustain this conservation release.

The current submerged sediment accumulation at a rate of 1.2 acre-feet per year for the new evaluated life of 50 years, plus five additional years to complete project initiation and construction, leaves a requirement of 66 acre-feet of sediment storage. Currently, it is estimated that 92.3 acre-feet of sediment storage remains in the existing reservoir. If the 26.3 acre-feet difference in sediment storage capacity is reallocated for conservation release, then most of the additional storage capacity can be accounted for without adjusting the projected permanent pool elevation. Conservation release will be accomplished by designing a permanent, ungated orifice in the riser component of the principal spillway system.

Construction to install the necessary rehabilitation measures, including adding a dedicated water supply, will require the reservoir to be drained for a period of up to two construction seasons. During this period, the PSD1 will have to secure an alternative, temporary water supply source or enter into a water purchase agreement with other entities to maintain service through the period of construction.

Clean Water Act

Existing Conditions: A study conducted by an interdisciplinary NRCS team in May 2012 identified 10.92 acres of wetlands and 5,135 linear feet of stream within the UDC1 potential area of effect. The existing reservoir was classified as open water and comprised 23.8 acres.

No Federal Action (Sponsors' Rehabilitation): This alternative assumes that project sponsors (non-federal entities) would assume responsibility for compliance with WV Dam Safety requirements. This alternative also includes the addition of 310 acre-feet of dedicated water supply. The addition of the dedicated water supply actually is a less expensive alternative because the higher reservoir elevation results in a much less extensive amount of excavation for the new ASW.

The addition of rural water supply would result in the permanent reservoir elevation rising 10.8 feet and increasing by 11.4 acres to a total surface area of 35.2 acres. This increase is expected to permanently inundate 2.99 acres of palustrine scrub-shrub wetlands located in the shallow cove areas of the existing reservoir. In addition, 2,470 linear feet of stream channels feeding the reservoir will also be permanently inundated.

As a result of increasing the reservoir storage elevation to accommodate the additional water supply, the crest of the ASW will also be raised to insure the 100-year frequency flood storage capacity. The ASW crest would be located 5.6 feet higher in elevation then the current ASW and the 100-year flood storage pool would have a new surface area of 57.9 acres, 10.0 acres larger than the existing flood storage. The higher flood storage elevation would result in the occasional and temporary inundation of 0.26 acres of riparian palustrine wetlands. A herbaceous emergent wetland (pasture) of 0.36 acres is located near the top of the flood storage pool that will minimally be affected by the modified flood storage elevation. Stream channel areas between the new permanent pool and ASW crest elevations will result in the temporary inundation of 2,665 linear feet.

An area of about 47 acres adjacent and downstream of the dam was included in the area of potential effect to accommodate the new auxiliary spillway and the disposal of excess earthen material excavated from the new spillway. The wetland study determined that 7.31 acres of emergent meadow wetlands are situate within this area. Most of this wetland (7.17 acres) lies in the field being considered for earth disposal. This area will be avoided by wasting excavated earth on the downstream face of the dam. The remaining 0.14 acre of wetland is located in the area proposed for excavating the new auxiliary spillway. This wetland cannot be avoided. About 200 linear feet of Deckers Creek below the PSW outlet may be impacted by extending the pipe conduit downstream. This extension is necessary to accommodate the modifications to the dam and the disposal of excavated material from the new ASW.

Rehabilitation of UDC1 with Federal Assistance for Flood Control: Rehabilitation of the dam to maintain current levels of flood protection would require modifications to the dam and the excavation of a new ASW on the left abutment. The permanent reservoir would remain at the same size and elevation as no additional storage would be added for water supply. Wetlands adjacent to the existing pool as well as wetlands and streams above the permanent pool elevation would remain as per the current conditions. The 0.14 acre wetland at the location of the proposed new ASW would be adversely impacted.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: Impacts to wetlands and streams for this alternative are the same as those described for the No Federal Action (Sponsor's Rehabilitation) alternative.

Floodplain Management

Existing Conditions: UDC1 has been re-classified from a Significant Hazard structure to a High Hazard structure due to development downstream of the site. Development pressure continues as housing and population increases in the watershed.

No Federal Action (Sponsors' Rehabilitation): Sponsors will assume all costs for upgrading the site from a Significant Hazard to a High Hazard structure.

Rehabilitation of UDC1 with Federal Assistance for Flood Control: Sponsors and the NRCS will cost share on upgrading the site from a Significant Hazard to a High Hazard structure.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: Sponsors and the NRCS will cost share on upgrading the site from a Significant Hazard to a High Hazard structure. Sponsors will assume the full cost for adding rural water supply during the rehabilitation of UDC1.

Wetlands

Existing Conditions: The existing UDC1 impoundment has a surface area of about 23.8 acres. Much of this impoundment is shallow in depth. Sediment deposition along with leaves and other organic material have resulted in stands of alders, buttonbush and other vegetation in the arable deposits coves where tributary streams empty into the reservoir. Lilly pads and other emergent vegetation has established in shallow areas of these coves. The National Wetlands Inventory classifies the permanent pool of the reservoir as a Palustrine System with an unconsolidated bottom that has been impounded and that is permanently flooded. This Inventory also depicts the shallow cove areas described above as Freshwater Emergent Wetlands. These cove areas amount to about 5.5 acres.

The Soil Survey Report for Preston County, WV indicates that two soil types within the project's area of potential effect are partially hydric (See soils map, Appendix C). These are the Atkins silt loam (Map symbol "At") and Ernest silt loam, 3 to 8 percent slopes (Map symbol "ErB").

A wetland determination and delineation study was conducted by NRCS in May 2012. This study was conducted on the area between the existing reservoir and the proposed new auxiliary spillway crest at an elevation of 1,750 feet msl. Palustrine scrub-shrub wetland amounting to 2.99 acres was found in the cove areas adjacent to the existing reservoir. Riparian-palustrine emergent herbaceous wetlands amounting to 0.26 acres were located in the Deckers Creek tributary area above the proposed new reservoir elevation of 1,735 feet msl. Lastly, 0.36 acres of Pasture-herbaceous palustrine emergent wetland was located upstream of Zinn Chapel Road.

Adjacent to the existing dam and in the field downstream, an area of 47 acres was surveyed for wetlands. Two hay-emergent meadow marshes, totaling 7.31 acres, were delineated in this area. All of this area, except for 0.14 acres located between the farm buildings and the existing dam, were in the hay field downstream of the dam.

No Federal Action (Sponsors' Rehabilitation): This alternative assumes that project sponsors (non-federal entities) would assume responsibility for compliance with WV Dam Safety requirements. This alternative also includes the addition of 310 acre-feet of dedicated water supply. The addition of the dedicated water supply actually is a less expensive alternative because the higher reservoir elevation results in a much less extensive amount of excavation for the new ASW.

The addition of rural water supply would result in the permanent reservoir elevation rising 10.8 feet and increasing by 11.4 acres to a total surface area of 35.2 acres. This increase is expected to permanently inundate 2.99 acres of palustrine scrub-shrub wetlands located in the shallow cove areas of the existing reservoir. In order to minimize the effects of flooding the 2.99 acres of palustrine scrub-shrub wetlands in these cove areas, it is proposed that soil substrate, including the existing vegetation, be moved upstream to the area of the new permanent reservoir elevation.

Once rehabilitation work is complete and reservoir is refilled, this soil and biomass will be situated where this vegetative community may become re-established. This activity will allow for a more rapid establishment of this wetland community without a lengthy disruption of habitat functionality.

As a result of increasing the reservoir storage elevation to accommodate the additional water supply, the crest of the ASW will also be raised to insure the 100-year frequency flood storage capacity. The ASW crest would be located 5.6 feet higher in elevation than the existing ASW and the 100-year flood storage pool would have a new surface area of 57.9 acres, 10.0 acres larger than the existing flood storage. The higher flood storage elevation would result in the occasional and temporary inundation of 0.26 acres of riparian palustrine wetlands. A herbaceous emergent wetland (pasture) of 0.36 acres is located near the top of the flood storage pool that will minimally be affected by the modified flood storage elevation.

The 47 acres adjacent and downstream of the dam was included in the area of potential effect to accommodate the new auxiliary spillway and the disposal of excess earthen material excavated from the new spillway. The wetland study determined that 7.31 acres of emergent meadow wetlands are situate within this area. Most of this wetland (7.17 acres) lies in the field being considered for earth disposal. This area will be avoided by wasting excavated earth on the downstream face of the dam. The remaining 0.14 acre of wetland is located in the area proposed for excavating the new auxiliary spillway. This wetland cannot be avoided.

Rehabilitation of UDC1 with Federal Assistance for Flood Control: Rehabilitation of the dam to maintain current levels of flood protection would require modifications to the dam and the excavation of a new ASW on the left abutment. The permanent reservoir would remain at the same size and elevation as no additional storage would be added for water supply. Wetlands adjacent to the existing pool as well as wetlands and streams above the permanent pool elevation would remain as per the current conditions. The 0.14 acre wetland at the location of the proposed new ASW would be adversely impacted.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: Impacts to wetlands for this alternative are the same as those described for the No Federal Action (Sponsor's Rehabilitation) alternative.

Threatened and Endangered Species

Existing Conditions: Consultation with the USFWS in Elkins did not identify the presence of any federally-listed endangered or threatened species within the project area. Transient species may use habitats around UDC1 seasonably or during migration.

No Federal Action (Sponsor's Rehabilitation): The USFWS has made a "no effect" determination that the project will not affect federally-listed endangered or threatened species. Therefore no biological assessment or further section 7 consultation under the Endangered Species Act is required with the USFWS (See USFWS correspondence, Appendix E).

Rehabilitation of UDC1 with Federal Assistance for Flood Control: The USFWS has made a "no effect" determination that the project will not affect federally-listed endangered or threatened

species. Therefore no biological assessment or further section 7 consultation under the Endangered Species Act is required with the USFWS.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: The USFWS has made a "no effect" determination that the project will not affect federally-listed endangered or threatened species. Therefore no biological assessment or further section 7 consultation under the Endangered Species Act is required with the USFWS.

Cultural Resources

Existing Conditions: A Phase I cultural resources investigation was conducted within the UDC1 area of potential effect (APE) for the combined rehabilitation alternatives. This APE included approximately 81 acres and excluded the area of the existing dam, ASW and the 24.8 acre permanent pool.

No Federal Action (Sponsor's Rehabilitation): Pedestrian reconnaissance was conducted on the approximately 81 acre project area to determine potential to contain archaeological deposits (Figure 4). Soil Test Pits were excavated at 7-meter to 15 meter intervals at twelve areas. STPs producing artifacts were further examined by radial STPs placed at 5 and 10 meter intervals in each cardinal direction. Recovered artifacts were placed in bags and labeled for analyses at the Ottery Group laboratory.

In total, this Phase 1 cultural resources investigation resulted in two archaeological sites (46PR156 and 46PR157) and three isolated finds (46PR153, 46PR154 and 46PR155) being recorded. Four of these sites did not warrant further investigation and are not considered eligible for listing in the National Register of Historic Places. Site 46PR156 contained artifacts (including lithic tools) in possibly undisturbed contexts (Figure 11). As such, three additional 1 x 1-meter test pits were excavated. These excavations revealed only three additional artifacts and further evaluation of this site was not recommended by the Phase I contractor. WVSHPO concurred with this recommendation by letter dated May 3, 2012 located in Appendix A.

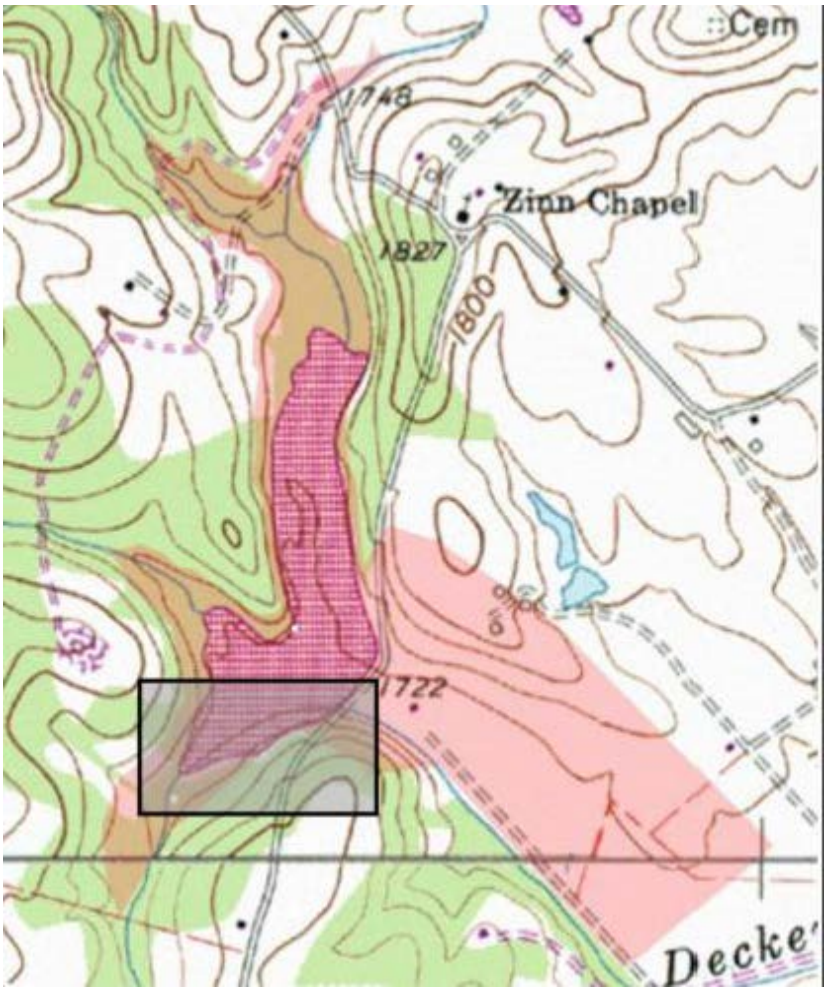


Figure 12 – General location of Site 46PR156.

Rehabilitation of UDC1 with Federal Assistance for Flood Control: This alternative would bring the dam and ASW up to current design and performance standards. The reservoir pool and flood storage pool elevations and volumes would not increase in size. Site 46PR156 lies above the permanent pool and will not be permanently inundated. This site does; however, lie within the floodwater detention pool and will be subject to occasional and temporary flooding.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: Pedestrian reconnaissance was conducted on the approximately 81 acre project area to determine potential to contain archaeological deposits (Figure 4). STPs were excavated at 7-meter to 15 meter intervals at twelve areas. STPs producing artifacts were further examined by radial STPs placed at 5 and 10 meter intervals in each cardinal direction. Recovered artifacts were placed in bags and labeled for analyses at the Ottery Group laboratory.

In total, this Phase 1 cultural resources investigation resulted in two archaeological sites (46PR156 and 46PR157) and three isolated finds (46PR153, 46PR154 and 46PR155) being recorded. Four of these sites did not warrant further investigation and are not considered eligible for listing in the National Register of Historic Places. Site 46PR156 contained artifacts

(including lithic tools) in possibly undisturbed contexts. As such, three additional 1 x 1-meter test pits were excavated. These excavations revealed only three additional artifacts and further evaluation of this site was not recommended by the Phase I contractor. WVSHPO concurred with this recommendation by letter dated May 3, 2012 located in Appendix A.

Invasive Species

Existing Conditions: Non-native invasive species of vegetation are present within the UDC1 project area. An inventory of the species present and relative abundance of these plant species was not compiled. Multiflora rose was abundant around the reservoir in areas that were cleared above the reservoir pool elevation. Several herbaceous species are prevalent on the dam and in the agricultural fields below the dam.

No Federal Action (Sponsors' Rehabilitation): In an effort to minimize the introduction or spread on non-native, invasive plant species associated with this alternative, several measures will be adopted. These include using weed-free certified seed mixes for revegetating disturbed areas following construction, using weed-free mulches and minimizing or eliminating the use of lime and fertilizer soil additives where mowing and other vegetative maintenance will not be performed. Also, equipment and construction materials should be cleaned and power washed to insure that soil and biomass from offsite locations are not introduced to the UDC1 construction area.

Rehabilitation of UDC1 with Federal Assistance for Flood Control: Measures to minimize risk for introducing or spreading non-native invasive plants are the same as for the No Federal Action (Sponsor's Rehabilitation Alternative.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: Measures to minimize risk for introducing or spreading non-native invasive plants are the same as for the No Federal Action (Sponsor's Rehabilitation Alternative).

Riparian Areas

Existing Conditions: An estimated 6,180 linear feet of shoreline surrounds the existing 23.8 acre impoundment at UDC1.

No Federal Action (Sponsor's Rehabilitation): With the addition of water supply storage to increase the surface area of the reservoir to 35.2 acres, it is estimated that the new shoreline will have a length of about 9,000 linear feet.

Rehabilitation of UDC1 with Federal Assistance for Flood Control: Under this alternative, the permanent pool will remain at the current elevation with a surface area of 23.8 acres. Riparian areas will be temporarily impacted by the drainage of the reservoir while rehabilitation work is performed. Upon completion of this work, estimated to take two construction seasons, the reservoir will be refilled.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: With the addition of water supply storage to increase the surface area of the reservoir to 35.2 acres, it is estimated that the new shoreline will have a length of about 9,000 linear feet.

Fish and Wildlife Habitat

Existing Conditions: The existing 23.8 acre permanent reservoir is not a designated public fishing area and the reservoir is not managed as a fishery. Recreational fishing is limited to private access through adjoining landowners. The status of fish populations and species composition has not been evaluated and is unknown.

The reservoir is utilized by migrating waterfowl for feeding and resting areas. Diving ducks, including buffleheads, ring-necked ducks, and scaup have been observed on this reservoir, as well as dabbling ducks including mallards, black ducks, woodducks and Canada geese. It is likely that any species of waterfowl commonly migrating through this area utilize this impoundment during spring and fall migrations. Resident waterfowl nest on the reservoir and include mallards, woodducks, Canada geese and likely others.

While not surveyed, the UDC1 impoundment is likely to support a number of frogs, aquatic turtles, snakes and other herptile species.

The majority of land surrounding the impoundment is forested. Most of the woodlands are comprised of mixed oak-hickory deciduous forest type. Dominate species include white oak, black cherry, hickory and red maple. An area between the permanent pool of the reservoir and the more mature forest appears to have been cleared when the impoundment was constructed and varies in width from 30 to 150 feet. This area is comprised of brush, shrubs and sparse herbaceous vegetation. Cove areas in the reservoir contain shrubs tolerant of wet soils and are dominated by willows, alders and buttonbush.

Upland and riparian areas surrounding the impoundment are utilized by song and insectivorous birds, small mammals, game animals, including squirrels and white-tail deer, furbearers, including beaver, raccoon and muskrats, and game birds including turkeys and ruffed grouse.

The dam and ASW are vegetated with herbaceous species that are mowed to discourage woody species from becoming established. Field areas east of the dam are maintained by the WVU Farm as grasslands for hay production.

No Federal Action (Sponsor's Rehabilitation): Draining of the reservoir for an estimated two construction seasons would be required for the installation of this alternative. Habitats utilized by fish in the reservoir, reptiles and amphibians, waterfowl and semi-aquatic mammals would be eliminated for this period. The reservoir would be refilled to a depth 10.8 feet higher than the existing pool elevation upon completing construction. An additional 11.4 acres of land surrounding the existing reservoir would be permanently inundated. This area is presently subjected to occasional and temporary flooding during periods of floodwater detention. Most of the standing timber in the cove areas of the 11.4 acres would be removed to reduce floating debris at the riser. An additional area 5.6 feet (10.0 acres) between the existing ASW and the new ASW crest will be subject to occasional and temporary flooding when storm water is being detained. Standing timber on this acreage is not recommended for removal.

Because the reservoir is not open for public access, recreational losses will be negligible. The fishery will be lost. Migrating and breeding waterfowl will be temporarily displaced to other water bodies. Adult reptiles and amphibians will have to seek refugia in Deckers Creek and other tributaries feeding the reservoir area, or in adjacent terrestrial habitats, until the reservoir is reestablished. Reproduction for these species will be eliminated or severely suppressed for these two years and some mortality to adults may be realized. Upon refilling the reservoir, the reintroduction of bluegills and largemouth bass is recommended as a food source for fish-eating ducks and mergansers, osprey, aquatic turtles and snakes, and semi-aquatic mammals. Public access to the impoundment will still be restricted.

Open areas to be excavated for the new ASW and where fill will be wasted will be revegetated with herbaceous plants. These areas are currently in herbaceous vegetation.

Rehabilitation of UDC1 with Federal Assistance for Flood Control: Effects associated with the drainage of the reservoir, the excavation of the new ASW and the placement of fill below the dam will be similar to those described for the No Federal Action (Sponsor's Rehabilitation) alternative.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: The effects of this alternative are the same as those identified for the No Federal Action (Sponsor's Rehabilitation) alternative.

Flood Damages

Existing Conditions: UDC1 provides 34 percent of the total flood damage reduction benefits realized by the entire Upper Deckers Creek Watershed project. This amount equates to $98,600 in average annual flood damage reduction benefit. Since the watershed project was installed, there has been additional development in the floodplain and increased traffic on the roads that traverse the floodplain. Flooding is currently reduced by the existence of UDC1.

No Federal Action (Sponsors' Rehabilitation): Sponsors would bear the total cost of rehabilitating the dam to meet current design criteria and performance standards. The flood damage reduction benefits provided by UDC1 would be extended into the future.

Rehabilitation of UDC1 with Federal Assistance for Flood Control: The cost for rehabilitation would be shared between the Sponsors and the NRCS. The flood damage reduction benefits provided by UDC1 would be extended into the future.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: The cost for rehabilitation would be shared between the Sponsors and the NRCS. The flood damage reduction benefits provided by UDC1 would be extended into the future. The cost for the water supply would be borne by the Sponsors. It is more cost-effective to incorporate water supply into the structure during the rehabilitation work.

Public Health and Safety

Existing Conditions: Public safety is enhanced by UDC1's impact on downstream flooding. UDC1 and other flood control impoundments in the watershed reduce the risk to loss of life and property during storms.

No Federal Action (Sponsors' Rehabilitation): Sponsors would bear the total cost of rehabilitation. Under this alternative, the dam would be structurally rehabilitated to comply with current design criteria and performance standards in order to provide continued public safety. The downstream flood levels would be the same as they are presently. The threat to loss of life and property from failure of the dam would be reduced.

Rehabilitation of UDC1 with Federal Assistance for Flood Control: The cost for the dam would be shared between Sponsors and NRCS. The dam would be rehabilitated to comply with current design criteria and performance standards in order to provide continued public safety. The downstream flooding levels would be the same as they are presently. The threat to loss of life and property from failure of the dam would be reduced.

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: The cost for the dam would be shared between Sponsors and NRCS. The dam would be rehabilitated to comply with current design criteria and performance standards in order to provide continued public safety. The downstream flooding levels would be the same as they are presently. The threat to loss of life and property from failure of the dam would be reduced.

Environmental Justice

Existing Conditions: UDC1 is currently out of compliance with NRCS design criteria and performance standards. All downstream beneficiary groups are equally affected by noncompliance of UDC1.

No Federal Action (Sponsors' Rehabilitation): Sponsors' rehabilitation will benefit all populations equally. There is no disproportionate effect to any segment of the benefited population.

Rehabilitation of UDC1 with Federal Assistance for Flood Control: Same as the No Federal Action (Sponsors' Rehabilitation).

Rehabilitation of UDC1 with Federal Assistance for Flood Control and Rural Water Supply: Same as the No Federal Action (Sponsors' Rehabilitation).

Tabulation 9 summarizes the effects of each alternative considered. Refer to the Effects of Alternative Plans section for additional information.

Tabulation 9 – Summary and Comparison of Candidate Plans

Effects	No Action (Sponsors' Rehabilitation)	Structural Rehabilitation for Flood Control Only	Structural Rehabilitation for Flood Control and Rural Water Supply
Sponsor Goals	Continue to provide flood control and source water for PSD1, reduce liability	Continue to provide flood control, reduce liability	Continue to provide flood control and secure rural water supply for PSD1, reduce liability
Structural	Upgrade dam to meet WV State Dam Safety design criteria & performance	Upgrade dam to meet NRCS design criteria & performance for flood control purpose	Upgrade dam to meet NRCS design criteria & performance for flood control and rural water supply purposes
Total Project Investment	$5,242,000	$9,452,600	$8,044,100
National Economic Development Account			
Average Annual Benefits	$127,300	$127,300	$189,300
Average Annual Costs	$246,400	$440,000	$376,900
Net Benefits	($119,100)	($312,700)	(191,200)
Benefit/Cost Ratio	.5 to 1.0	.3 to 1.0	.5 to 1.0
Estimated OM&R	$2,400	$2,400	$2,400
Environmental Effects Account			
Upland Erosion	Temporary increase in soil erosion resulting from construction activities.	Temporary increase in soil erosion resulting from construction activities.	Temporary increase in soil erosion resulting from construction activities.
Sedimentation	No change in sedimentation rate anticipated.	No change in sedimentation rate anticipated.	No change in sedimentation rate anticipated.
Prime and Unique Farmland	0.9 acres of prime farmland and 13.9 acres of state-wide important farmland will be converted to non-agricultural uses.	About 0.9 acres of prime farmland and 9.4 acres of state-wide important farmland will be converted to non-agricultural uses.	0.9 acres of prime farmland and 14.1 acres of state-wide important farmland will be converted to non-agricultural uses.
Surface Water Quality	Minor increases in turbidity (suspended sediment) during construction.	Minor increases in turbidity (suspended sediment) during construction.	Minor increases in turbidity (suspended sediment) during construction.
Surface Water Quantity	Add 310 ac-ft of water supply storage. Secure water supply for PSD1's 1,534 customers. Alternative water supply needed during construction.	Retain existing water supply from remaining sediment pool. Alternative water supply needed during construction.	Add 310 ac-ft of water supply storage. Secure water supply for PSD1's 1,534 customers. Alternative water supply needed during construction.
Clean Water Act	2,470 feet of stream above the dam permanently flooded. Up to 200 feet of stream in conduit to lengthen PSW pipe. 2,665 feet of stream subjected to occasional flooding.	Up to 200 feet of stream channel encased in conduit to lengthen PSW pipe.	2,470 feet of stream above the dam permanently flooded. Up to 200 feet of stream in conduit to lengthen PSW pipe. 2,665 feet of stream subjected to occasional flooding.
Wetlands	0.14 acre wetland impacted by new ASW excavation. 2.99 acres wetland permanently inundated and 0.26 acres occasionally flooded.	0.14 acre wetland impacted by new ASW excavation.	0.14 acre wetland impacted by new ASW excavation. 2.99 acres wetland permanently inundated and 0.26 acres occasionally flooded.
Threatened and Endangered Species	A "No Effect" determination made by USFWS.	A "No Effect" determination made by USFWS.	A "No Effect" determination made by USFWS.
Invasive Species	Invasive plant species present, but not inventoried. Measures are recommended to minimize spread of invasive plants.	Invasive plant species present, but not inventoried. Measures are recommended to minimize spread of invasive plants.	Invasive plant species present, but not inventoried. Measures are recommended to minimize spread of invasive plants.
Riparian Areas	6,180 linear feet of shoreline replaced with 9,000 linear feet of new shoreline. Interruption of riparian habitat while lake is drained during construction.	6,180 linear feet of shoreline interrupted while lake is drained during construction. Riparian areas restored when reservoir refilled.	6,180 linear feet of shoreline replaced with 9,000 linear feet of new shoreline. Interruption of riparian habitat while lake is drained during construction.
Fish and Wildlife Habitat	Fish and wildlife habitat temporarily lost while reservoir is drained. Aquatic habitat will increase from 23.8 acres to 35.2 acres.	Fish and wildlife habitat temporarily lost while reservoir is drained.	Fish and wildlife habitat temporarily lost while reservoir is drained. Aquatic habitat will increase from 23.8 acres to 35.2 acres.
Migratory Birds	Aquatic migratory birds that use the reservoir for feeding and resting areas will be affected by the drainage of the reservoir during construction.	Aquatic migratory birds that use the reservoir for feeding and resting areas will be affected by the drainage of the reservoir during construction.	Aquatic migratory birds that use the reservoir for feeding and resting areas will be affected by the drainage of the reservoir during construction.
Other Social Effects Account			
Flood Damages	Maintain benefits for all beneficiary groups	Maintain benefits for all beneficiary groups	Maintain benefits for all beneficiary groups
Water Supply	Water Supply not secure	Water Supply not secure	Water Supply secure
Civil Rights	Maintain benefits for all beneficiary groups	Maintain benefits for all beneficiary groups	Maintain benefits for all beneficiary groups
Flood Plain Management	Sponsors bear cost to upgrade from Significant Hazard to High Hazard	Sponsors and NRCS share cost to upgrade structure to higher classification	Sponsors and NRCS share cost to upgrade structure to higher classification. Sponsors pay for water supply component.

CUMMULATIVE IMPACTS

Flood protection provided by the UDC1 dam would continue with the rehabilitation of this structure to meet current design criteria and performance standards. The number of buildings, including residences and businesses, occupying the protected floodplain areas may increase over time as presently vacant space may be developed. A rehabilitated dam would also insure the availability of a water supply for the PSD1, at least from the sediment pool as is currently used. Without additional storage capacity in the reservoir, the quantity of rural water available to the PSD1 would continue to gradually diminish as sediment continues to accumulate into the future. Additionally, the expansion of the PSD1 service area will likely to continue placing additional demand upon the already limited rural water supply that is currently available. Under this scenario, it is likely that water shortages would become more frequent and more severe over time.

The addition of a dedicated rural water supply by increasing the permanent reservoir capacity of the reservoir would insure the rural water supply is adequate to meet current demand, as well as projected growth into the near future. A temporary interruption to this supply will result during the period of construction during which the reservoir must be drained. An alternative rural water supply source will be necessary to continue water service during the construction period.

With the added rural water supply capacity proposed for this reservoir and the planned extension of water lines to areas within PSD1 that do not presently have water service, some new development is anticipated. Development typically follows the installation of new water service and new construction can be expected as additional service lines are installed. Population growth in excess of 14 percent within Preston County, since the year 2000, is also indicative of growth potential; however, this rate may be somewhat less considering the current economic conditions.

Public sewer systems are non-existent within the PSD1 service area. Existing residences and businesses rely on in-ground septic systems for most sewage disposal. New growth associated with water service expansion will likely include additional septic disposal systems. Existing and new septic systems may contribute to groundwater degradation and contamination of surface waters where leech fields have failed.

National Economic Development (NED) Plan

If UDC1 were to experience a catastrophic failure, there would be risk to human life. The structure does not meet current performance and safety standards for a High Hazard structure. Therefore, the NED plan is defined as the **federally assisted** alternative with the greatest net benefits. There are two candidate plans:

1. Structural rehabilitation for flood control only and,
2. Structural rehabilitation for flood control and water supply.

The more cost-effective alternative is rehabilitating the dam for flood control and rural water supply. The increased elevation of the pool crest for rural water supply also increases the crest elevation of the auxiliary spillway. A higher auxiliary spillway crest results in less spillway

excavation, and less excess excavation to be removed to an earth and rock disposal area. The overall result of adding the purpose of rural water supply is a net decrease in the project cost compared to rehabilitation for flood control only. The NED plan is the Structural Rehabilitation for Flood Control and Rural Water Supply Alternative.

Adverse Effects Which Cannot be Avoided

The rehabilitation of UDC1 will require that the reservoir be drained in order to replace the principal spillway riser and to flatten the upstream face of the dam. Draining the reservoir will result in the loss of aquatic habitat for at least two construction seasons and will eliminate the fishery that exists in the reservoir pool. Habitat utilized by reptiles, amphibians, semi-aquatic mammals and migratory waterfowl will be either lost or severely diminished during this period. Populations of animals in these groups will be displaced to streams or to marginal remnant aquatic areas that remain after the pool is drained. Mortality to those individuals that are unable to relocate to other areas is anticipated. The drainage of the reservoir will also interrupt the rural water supply source utilized by the PSD1. Alternative water sources or a water purchase agreement will be necessary for PSD1 to maintain water service to its customers.

Upon completion of the rehabilitation work to upgrade the dam and ASW, the reservoir will be refilled to an elevation approximately 10.8 feet higher than the existing reservoir pool. This higher storage volume will inundate about 6,180 linear feet of existing riparian shoreline and replace it with about 9,000 feet of new shoreline. The raised reservoir pool will also permanently inundate 2.99 acres of palustrine scrub-shrub wetlands and approximately 0.26 acres of riparian palustrine herbaceous wetland. The palustrine scrub-shrub wetland impacts will be minimized by moving soil substrate and vegetation upstream to the new reservoir surface elevation. An additional 0.14 acres of emergent meadow wetland will be eliminated as a result of constructing the new ASW on the left abutment.

Approximately 2,470 linear feet of streams will be permanently inundated by the enlarged reservoir pool. These stream segments were within the original flood storage pool area and were subject to occasional and temporary flooding. The elevation of the flood storage pool will also be higher as a result of adding rural water supply storage and will subject 2,665 linear feet of stream channel to occasional, temporary inundation during flood events. Up to 200 linear feet of Deckers Creek downstream of the dam will be eliminated by an extension of the principal spillway conduit and the construction of a new PSW outlet.

With 310 acre-feet of rural water supply storage to be added to the reservoir of UDC1, the pool surface area will inundate 10.0 additional acres of land. These 10.0 acres are currently subjected to occasional, temporary inundation during flood storage events. The flood storage pool, at the new ASW elevation, will result in a new temporary flood pool surface area of 57.9 acres. This area is 11.4 acres larger than the original flood pool surface elevation. Modifications to the dam, including the excavation of a new ASW at the left abutment, will alter about 9.2 acres of land in addition to the footprint of the existing dam and ASW at the right abutment. In total, about 19.3 acres of land will be added to the dam, ASW and reservoir pool area. Of this land, approximately 0.9 acres are classified as prime farmland and 14.1 acres are classified as state-wide important farmland.

RISK AND UNCERTAINTY

Estimating project costs and benefits involves a certain degree of risk and uncertainty. Assumptions made during the planning process are based on the best available technology and information at the time of planning. Extended delays between planning and implementation may increase the degree of risk and uncertainty. Estimated project costs are based on computed work quantities multiplied by the appropriate unit cost for that type of work. Unit costs are based on historical data from similar projects, indexed to current price levels. Costs can be influenced by several economic factors that cannot be predicted with certainty during the planning process. Fuel shortages, unforeseen labor and materials shortages, natural disasters, and international incidents can adversely affect costs.

Economic benefits are based on material values of floodplain property and infrastructure. Such property is expected to become more valuable in the future as personal income increases. It is probable that some monetary and non-monetary benefits have not been fully captured. Finally, there is inherent uncertainty in estimating the social and environmental costs associated with each alternative because values and judgments vary among interested parties.

Geology and Engineering: Risk and Uncertainty in the disciplines of geology and engineering varies with the subject of analysis. Concerning the study of earthen embankment dams, there is inherent uncertainty that soil and rock data from the investigation represents the actual material that will be used for the dam and exposed in the auxiliary spillway. The risk may be modifying a design during construction if actual materials differ significantly.

Surveys and mapping of the dam site has small uncertainty; cultural features that are buried are at risk of not being located. A bathymetric survey of the reservoir has more uncertainty for lack of visibility of the entire surface being measured. A high density of data points mitigates risk when measuring submerged sediment deposits.

RATIONALE FOR PLAN SELECTION

The Recommended Plan is to rehabilitate UDC1 to meet current design criteria and performance standards and to add 310 acre-feet of water supply. The Recommended Plan fulfills the identified purposes and needs for the project, maintains flood reduction benefits, and secures a dedicated rural water supply. Project Sponsors, local residents, and state and local government agencies prefer the Recommended Plan for the following reasons:

- Flood reduction benefits for properties and infrastructure remains with UDC1's design meeting High Hazard standards.
- Protection of transportation corridors is maintained.
- Protection of utilities in the floodplain of Deckers Creek is maintained.
- The liability associated with operating a non-compliant dam is eliminated.
- A dedicated rural water supply is secured for the developing areas in the Deckers Creek valley.
- Wildlife habitat is maintained.

When compared to the No Action Alternative (Sponsors' Rehabilitation), the Recommended Plan (Rehabilitation) best meets the Local Sponsors needs. The Recommended Plan meets the Sponsors' objectives of bringing UDC1 into compliance with current design criteria and dam

performance standards, maintaining flood reduction benefits, securing a rural water supply source, and addressing resource concerns identified by the public.

The Recommended Plan will utilize more federal funds and require less local funds than the No Action alternative. The recommended Plan is less expensive than the single purpose flood control alternative, due to the cost savings associated with using the excess spoil material to raise the top of the dam. Raising the top of the dam accommodates the water supply storage need and also allows for an efficient disposal site for the new auxiliary spillway material.

CONSULTATION AND PUBLIC PARTICIPATION

A scoping meeting was conducted at the PSD1 Office on December 21, 2011. Representatives of federal and state governmental agencies, local sponsoring organizations, potentially affected landowners, and representatives from the Friends of Deckers Creek were invited. The attendance list is included in this section. The purposes of the meeting were two-fold:

1) To explain the known deficiencies of UDC1 and to describe the likely alternatives that would be evaluated during the planning process and,
2) Solicit input from meeting participants to avoid, minimize, or mitigate environmental impacts that may result from the installation of rehabilitation measures.

A Notice of Intent to prepare an Environmental Impact Statement was published in the Federal Register and local newspapers on November 21, 2011. After consultation with the NRCS National Water Management Center, it was determined that the appropriate level of initial analysis would be an Environmental Assessment. Consequently, a Notice of Intent to Withdraw and a Notice of Intent to Prepare an Environmental Assessment was published in the Federal Register and local newspapers on March 6, 2012.

The USFWS was consulted with regard to potential adverse impacts to Threatened and Endangered Species. This agency made a “no effect” determination regarding the potential effects of this project on federally-listed species. The West Virginia Division of Culture and History was also consulted regarding potential impacts to cultural resources. A Phase I Cultural Resources Investigation (Ottery Group 2012) was completed and submitted to the WV Division of Culture and History. No WVSHPO response has been received as of this date.

The US Army Corps of Engineers (USACE), Pittsburgh District was invited to be a participating agency in the preparation of this Environmental Assessment. A Memorandum of Understanding was executed between NRCS and USACE in order to assess project affects to Waters of the United States and to insure that sufficient analyses were conducted to secure the necessary Department of the Army permits prior to initiating construction.

Written and oral comments were collected at the scoping meeting and during the planning process following the scoping meeting. The project was discussed before the Preston County Commission and at each monthly meeting of the Monongahela Conservation District. A number of comments were recommended for consideration during the planning process. These included the following:

- PSD1 requested consideration of their current water use agreement and the need to continue to provide water to customers throughout the project construction phase.
- Friends of Deckers Creek requested consideration of minimum flow requirements to avoid periods of no discharge to Deckers Creek from the reservoir.
- The Preston County Commission requested that rural water be added as a dedicated purpose and that they be included as a legal sponsor of the project.
- A private landowner requested consideration of his water well as it relates to any rehabilitation work.
- An adjoining landowner asked for assurances that access to his property would not be impaired and that access to the natural gas well facilities be addressed.

There are no federally recognized tribal entities in West Virginia for which consultations are required.

Suggestions received from agency consultations and during the scoping meeting were evaluated and, where appropriate, incorporated into the rehabilitation plan. Additional consultations with resource agencies will be conducted as alternatives are evaluated and during the agency and public review process. These consultations are to insure that project affects upon resources of concern are adequately avoided, minimized, or mitigated.

Public Scoping Meeting – List of Attendees December 21, 2011

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The Draft Plan – EA was distributed by mail on June 20, 2012 to governmental agencies, stakeholder groups and individuals (see distribution list) for the purpose of soliciting comments. A legal notice was also placed in the Morgantown, WV newspaper to announce the availability of the draft report. Hard copies of the Draft Plan-EA were made available to those requesting copies to review and the Draft Plan-EA was also posted electronically on the West Virginia NRCS website.

A public meeting was held at the Arthurdale Great Hall in Arthurdale on June 28, 2012 from 4:00 to 7:00 pm. This meeting provided an opportunity for interested individuals and agencies to obtain additional information regarding the Draft Plan-EA for the proposed UDC1 rehabilitation project.

NRCS personnel from different disciplines attended the meeting to discuss matters related to the Draft-EA and to entertain questions. Fifteen individuals attended the meeting including four from NRCS, five representing project sponsors and six members of the public. Written comments were taken at the meeting and by mail and email. Comments were requested at the NRCS State Office in Morgantown, WV by July 20, 2012.

All of the letters, emails and other comments received from agencies, stakeholder groups and individuals as a result of the review of the Draft Plan-EA are included in the administrative record contained in Appendix A. A point by point disposition of the comments for which responses are required follows. Several forms of media and outreach were used to reach all populations interested in the project – newspapers, websites, meetings, etc. This project was planned in accordance with all environmental justice considerations as set forth in Executive Order 12898.

Comments and Responses

Comment letter July 10, 2012 – WV Division of Natural Resources:

Comment: The Wildlife Resources Section (WRS) requests that excavated shrubs are relocated to the sites where scrub-shrub wetlands are to be restored. In addition, The WRS requests that, if after two growing seasons, 2.99 acres of scrub-shrub wetlands are not established, that scrub shrub wetlands be restored by planting shrubs in the newly created cove areas.

Response: NRCS agrees to monitor the survival of relocated shrubs from the existing cove areas supporting scrub-shrub wetlands to the location of the scrub-shrub wetlands to be re-established. NRCS also agrees to supplement plantings of shrub species at those locations in the event that the shrub component of the transplanted material fails to survive after two growing seasons.

Comment: The WRS concurs with the NRCS proposal of avoidance of impacts to the palustrine emergent wetlands (PEM) located within the proposed earth disposal site. The WRS recommends that either the 7.17 acres of PEM wetland be excluded from the project plan, or if there is a possibility this disposal area will be needed, the US Army Corps of

Engineers be consulted for a jurisdictional determination and possibly permitted under§ 404 of the Clean Water Act.

Response: NRCS agrees with the recommendation to avoid impacts to the 7.17 PEM wetland area identified downstream of the dam. The portion of the field supporting this wetland will be eliminated from the project plan. In the event that all of this wetland area cannot be avoided, following the completion of the project's design phase, the appropriate authorizations under§404 and 401 of the Clean Water Act will be obtained prior to initiating construction.

Comment letter July 19, 2012 – WV Division of Culture and History:

Comment: In our opinion, there are no cultural resources listed in or eligible for listing in the National Register of Historic Places within the APE for UDC1 Rehabilitation Project.

Response: Comment noted.

Comment Sheet from June 28, 2012 Public Meeting- Franklin T. Smith:

Comment: Concerns with the affects of the rehabilitation project upon private septic system, water line, driveway and bridges. How high will the new water elevations be and how much property will be affected?

Response: Permanent pool elevation with the addition of the rural raw water supply is estimated to be at an elevation of 1735.3 msl, about 10.8 feet higher than the existing permanent pool elevation. This elevation is a planning estimate and may change once the final project design is complete. During the final design, a detailed survey will be completed to determine where the permanent pool and auxiliary spillway crest elevation lies relative to roads, driveways, bridges, utilities and other features. It is presently estimated that approximately 20 acres, more or less, of additional landrights will be needed upstream of the dam.

Oral questions presented at the June 28, 2012 public meeting:

Why not clean out sediment and not have to raise the pool [as much]?

Response: Sediment accumulation in the UDC1 pool is estimated to be at a rate of 1.2 acre-feet per year. At this rate, about 52 acre-feet of sediment has accumulated since the dam was completed in 1969. Additional storage of 310 acre-feet in the reservoir for water supply plus approximately 35 acre-feet of water storage for the conservation release requires room for 345 acre-feet in addition to the existing reservoir pool. Sediment removal of the 52 acre-feet would still require approximately 300 acre-feet of additional water storage. Sediment removal would result in lowering the permanent pool elevation by only one foot or less and would not likely change the elevation of the top of the dam. The cost of removing the sediment and locating a suitable disposal site would exceed any cost reduction realized by lowering the permanent pool elevation and reducing the top of the dam.

Concerned with public access- Is there any way to keep people away from the lake?

Response: Upper Deckers Creek Site 1 was not built to include incidental recreation and therefore there are no provisions for public access. All land surrounding the dam and reservoir are owned by the WVU Farm or private landowners. Persons going to the reservoir would have to cross one or more of these properties and would need permission from the respective landowners. At this time, there are no known restrictions for recreational use of the reservoir providing appropriate permissions are acquired to cross adjoining lands.

Mr. Smith requested that his driveway be relocated in a comparable condition as it presently exists, with adequate gravel, sturdy bridges, etc.

Response: Comment and concerns acknowledged.

Mr. Smith expressed concern as to the affects of the higher reservoir elevation may have upon his septic tank and leach field.

Response: Once the final design is complete and elevations are known, surveys will be made to determine the affects upon Mr. Smith's septic tank and leach field. If these appurtenances are required to be moved, relocation costs will be provided to cover that expense.

RECOMMENDED PLAN

Summary and Purpose

The Recommended Plan is to rehabilitate the dam and add rural water supply as a new purpose. This action will modify UDC1 to provide the level of flood protection commensurate with its hazard class, secure a rural water supply for PSD1, and eliminate the liability of operating a dam in non-compliance with current design criteria. The Recommended Plan of action for the dam is outlined below:

1. Replace the existing riser and outlet with a new riser and outlet structures, extend existing principal spillway pipe and install a liner in the existing principal spillway conduit.
2. Construct new internal embankment drainage system.
3. Excavate a new auxiliary spillway in the left abutment and backfill the existing auxiliary spillway.
4. Modify the dam embankment top width and height for multi-purpose use.
5. Construct earth and rock berms to increase stability of the embankment slopes.
6. Mitigate for unavoidable affects to resources of concern that cannot be avoided.

After the implementation of these planned works of improvement, UDC1 will meet all current West Virginia and NRCS dam design criteria and performance standards. Detailed structural data for the proposed rehabilitated dam can be found in Table 3.

Tabulation 10 – Comparison of Structural Alternatives

ITEM	UNIT	EXISTING DAM	REHABILITATED DAM
Elevation, Top of Dam	Feet, MSL	1758.2	1765.5
Elevation, Auxiliary Spillway Crest	Feet, MSL	1744.9	1750.0
Elevation, Principal Spillway Crest	Feet, MSL	1725.1	1734.5
Auxiliary Spillway Type	-	Vegetated Earth	Vegetated Earth
Auxiliary Spillway Bottom Width	Feet	40.0	135
Auxiliary Spillway Exit Slope	%	2.5	2.0
Maximum Height of Dam	Feet	45.7	53.0
Volume of Dam Embankment Fill	Cubic Yards	98,029	155,100
Dam Capacity			
Sediment Submerged	Acre-Feet	96	66
Sediment Aerated	Acre-Feet	17	16
Rural Water Supply	Acre-Feet	0	310
Conservation Release	Acre-Feet	0	35
Floodwater Retarding Pool	Acre-Feet	1,515	1,815
Total Capacity (up to Top of Dam)	Acre-Feet	1,628	2,242
Surface Area			
Sediment Pool	Acres	23.0	20.2
Conservation Release	Acres	-	35.2
Rural Water Supply	Acres	-	35.4
Floodwater Retarding Pool	Acres	77.0	92.4

Easements and Land Rights

The Sponsors are responsible for obtaining any needed land rights, title and easements associated with the rehabilitation project.

For the Recommended Plan, it is projected that 8.6 acres of permanent easement at the dam site and 20.3 acres of flood easement will be necessary in addition to the existing easements. These easements accommodate changes for the dam, increased pool surface area, and the top of dam elevation. In addition, about 5 acres of temporary construction easement is needed for the disposal of excess excavated material from the new auxiliary spillway. Also at the dam site, two gas lines will require relocation to avoid the planned work. About 2,125 feet of existing gas line needs to be removed and 2,015 feet of new gas line will need to be installed.

Approximately 510 linear feet of Zinn Chapel Road (County Route 27/1) lies below the projected new top-of-dam elevation of 1766 feet msl. A portion of this road may need to be elevated to minimize the frequency for which this road might be temporarily inundated during flood events. Also, approximately 2,000 feet of a private road that serves as access to a residence and gas well facilities also lies below the top-of-dam elevation. Portions of this road will need to be raised to at least the auxiliary spillway crest elevation (1750 feet msl) to prevent blocked access during 100-year or less frequency flooding. See Table 2 for real estate costs.

Mitigation

The lake of UDC1 is planned to be drained to construct improvements to the principal spillway riser, an earth-rock berm and reduced slope for the upstream face of the dam. The demolished riser may be placed in the pool area for fish habitat. Earth, including vegetation and wetland seed source from wetlands identified in the cove areas (See wetlands map, Appendix C), is proposed to be moved upstream in the coves and deposited at the approximate new permanent pool elevation. Relocating this material will expedite the establishment of wetland vegetation in the newly created shallow water areas of the reservoir. This material will be moved near the end of the project just prior to refilling the reservoir. Transplanted material will be monitored. If 2.99 acres of scrub-shrub wetland vegetation not established after two years, desirable shrubs will be planted.

Approximately 2,470 linear feet of stream upstream of the dam will be permanently inundated and converted to lake environment as a result of adding 310 acre-feet of water supply to the UDC1 impoundment. Also, up to 200 feet of Deckers Creek below the dam is expected to be eliminated from extending the principal spillway conduit downstream and constructing a new outlet basin. In order to compensate for these unavoidable stream impacts, riparian improvements are being investigated for installation along Deckers Creek downstream of the dam. Riparian improvements may include vegetative enhancements, streambank stabilization and/or livestock exclusion fencing.

Permits and Compliance

The Sponsors are responsible obtaining and complying with permits required by Federal, State, and/or local regulatory agencies. A Department of the Army section 404 permit, a West Virginia section 401 water quality certification, an NPDES stormwater permit, from WVDEP (including an approved erosion and sediment control plan), and a WV Public Land Corporation Stream Access permit are anticipated to be needed.

Costs

Costs are indicated in Table 1; Table 2 shows the costs by category. Total annual costs are shown in Table 4 along with the estimated costs for operation and maintenance. Table 5 displays the average annual flood damage reduction benefits by flood damage categories, and Table 6 displays a comparison of annual costs and benefits. A 2012 price base was used and amortized at 4 percent interest for the 50 year period of analysis.

The planning costs for the proposed rehabilitation measures are estimated costs only. The fact that these costs are included in this plan does not infer that they are final costs. Detailed structural designs and construction cost estimates will be prepared prior to contracting for the work to be performed. The final cost will be the low price received by competitive bidding plus or minus the amounts of contract modifications.

Installation and Financing

The project is planned for installation in two construction seasons. During construction, equipment will not be allowed to operate when conditions are such that soil erosion and water, air, and noise pollution cannot be satisfactorily controlled.

If cultural resources are discovered during installation, work will cease and procedures discussed in General Manual 190-601.29, National Cultural Resources Procedures Handbook, will be implemented.

The NRCS will provide technical and financial assistance to the Sponsors with the design and implementation of the UDC1 rehabilitation project. NRCS will be responsible for the following:

1. Execute a project agreement with the Sponsors before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.
2. Execute a Memorandum of Understanding with the Sponsors to provide a framework for which cost-share funds are accredited.
3. Provide financial assistance equal to 65% of total eligible project costs, not to exceed 100% of actual construction costs.
4. Provide consultative engineering support and technical assistance during the construction of the project.
5. Certify completion of all installed measures.

The Sponsors will be responsible for the following:

1. Secure all needed environmental permits and landrights for installation of the rehabilitation measures.
2. Prepare an updated Emergency Action Plan for the dam prior to the initiation of construction.
3. Execute an updated Operation and Maintenance Agreement with NRCS for the dam.
4. Execute a Memorandum of Understanding with NRCS to provide a framework within which cost-share funds are accredited.
5. Execute a project agreement with NRCS before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.
6. Provide nonfederal funds for cost-sharing of the project at a rate equal to, or greater than, 35% of the total eligible project costs.
7. Provide nonfederal funds for the cost of adding a dedicated rural water supply to UDC1.
8. Participate in and comply with applicable Federal floodplain management and flood insurance programs.
9. Enforce all associated project easements and right-of-ways.

Operation, Maintenance, and Replacement

Measures installed as part of this plan, and previously installed measures, will be operated and maintained by the Sponsors with technical assistance from federal, state, and local agencies in accordance with their delegated authority. A new Operation and Maintenance (O&M) Agreement will be developed for UDC1 utilizing the NRCS National Operation and Maintenance Manual. The O&M agreement will be executed prior to signing the project agreement for the construction of the project. The term of the new O&M agreement will be for the evaluated life of the rehabilitated structure, 50 years[1]. The agreement will specify responsibilities of the Sponsors and include detailed provisions for retention, use, and disposal of

property acquired or improved with PL-106-472 cost sharing. Provisions will be made for free access of district, state, and federal representatives to inspect all structural measures and their appurtenances at any time.

[1] The key determinant of the evaluated useful life was annual sediment delivery to the sediment-pool and flood-pool areas behind the dam. Sediment delivery projections were based on experience to date. In order to assure a 50 year useful life, and potentially extend the useful life significantly longer, the sponsors may choose to take additional erosion and sediment control measures above the impoundment in the upper watershed to slow sediment delivery to UDC1.

Supplemental Watershed Plan No. 2 - EA

Table 1 - Estimated Installation Cost

Upper Deckers Creek Site 1 Subwatershed, West Virginia

Dollars [1]

Installation Cost Items	Estimated Costs		
Structural Measures to rehabilitate UDC1	PL-106-472 Funds[2]	Other Funds	Total
TOTAL	$ 5,342,300	$ 2,701,800	$ 8,044,100

April 2012

[1] Price base 2012

[2] Paid by the USDA/NRCS - the federal agency responsible for assisting in installation of improvements

Supplemental Watershed Plan No. 2 - EA
Table 2 - Estimated Cost Distribution - Structural Measures
Upper Deckers Creek Site 1 Subwatershed, West Virginia
(Dollars) [1/]

Federal Funds						
Item	**Construction**	**Engineering**	**Real Property Rights**	**Relocation Payments**	**Project Admin.**	**Total Federal**
Structural Measures to rehabilitate UDC1						
Total	$ 4,269,200	$ 913,100	$ -	$ -	$ 160,000	$ 5,342,300

Nonfederal Funds								
Construction	**Engineering**	**Real Property Rights**	**Agricultural Water Management**	**Relocation Payments**	**Required Permits**	**Project Admin.**	**Total Nonfederal**	**Total Installation**
$ 1,930,800	$ -	$ 368,000	$ 399,500	$ -	$ 3,500	$ -	$ 2,701,800	$ 8,044,100

April 2012

[1/] Price Base 2012
[2/] Cost Share is 65% federal funds for measures related to flood control purpose; 35% nonfederal funds for measures related to flood control purpose and 100% nonfederal funds for measures related to water supply purpose

Supplemental Watershed Plan No. 2 – EA
Table 3 – Structural Data
Upper Deckers Creek Site 1 Subwatershed, West Virginia

Item	Unit	Preferred Alternative Federal Rehab – Multi-Purpose Excavated ASW
Hazard Class	-	High Hazard
Seismic Zone	-	1
Total Drainage Area	Sq. Mi.	4.65
Time of Concentration	Hours	0.33, 0.85, 0.56[1]
Runoff Curve Number	-	76.0, 72.6, 72.6[1]
Elevation, Top of Dam	Feet, MSL	1765.5
Elevation, Auxiliary Spillway Crest	Feet, MSL	1750.0
Elevation, Principal Spillway Crest	Feet, MSL	1734.5
Auxiliary Spillway Type	-	Vegetated Earth
Auxiliary Spillway Bottom Width	Feet	135
Auxiliary Spillway Exit Slope	%	2.0
Maximum Height of Dam	Feet	53.0
Volume of Dam Embankment Fill	Cu.Yd.	155,100
Total Capacity	Ac.-Ft.	2,242
Sediment Submerged	Ac.-Ft.	66
Sediment Aerated	Ac.-Ft.	16
Rural Water Supply	Ac.-Ft.	310
Conservation Release	Ac.-Ft.	35
Floodwater Retarding Pool	Ac.-Ft.	1,815
Pool Surface Areas		
Sediment Pool	Acres	20.2
Rural Water Supply Pool	Acres	34.5
Floodwater Retarding Pool	Acres	92.4
Conservation Release Pool	Acres	35.2
Principal Spillway Design		
Rainfall Volume (1 day)	Inches	6.1
Runoff Volume (1day)	Inches	2.79
Rainfall Volume (10 day)	Inches	8.55
Runoff Volume (10 day)	Inches	2.71
Capacity at ASW Crest	CFS	144
Conduit Size	Inches	28[2]
Conduit Type	-	Reinforced Concrete with HDPE Lining
Auxiliary Spillway Frequency of Operation	Annual % Probability	1%
Auxiliary Spillway Hydrograph		
Rainfall Volume	Inches	10.1
Runoff Volume	Inches	6.2
Storm Duration	Hours	6
Velocity of Flow (V_e)	Feet/Sec.	9.2
Maximum Surface Elevation	Feet, MSL	
Freeboard Hydrograph		
Rainfall Volume	Inches	27.5
Runoff Volume	Inches	22.8
Storm Duration	Hours	6
Maximum Surface Elevation	Feet, MSL	1765.4
Capacity Equivalents		
Sediment	Inches	0.33
Rural Water Supply	Inches	1.25
Conservation Release	Inches	0.14
Floodwater Retarding	Inches	7.45
[1] data for sub-watersheds 1, 2, and 3, respectively [2] assumed inside diameter of HDPE plastic lining of conduit		June 2012

Supplemental Watershed Plan No. 2 - EA
Table 4 - Average Annual National Economic Development (NED) Costs
Upper Deckers Creek Site 1 Subwatershed, West Virginia
(Dollars) [1/]

Rehabilitation of UDC1	**Amortization of Installation Costs**	**Annual Operation and Maintenance Costs**	**Total Average Annual Costs**
TOTAL	$ 374,500	$ 2,400	$ 376,900

[1/] Price Base 2012, costs are amortized for 50 years at 4.0% discount rate. April 2012

The evaluated life is 50 years.

Supplemental Watershed Plan No. 2 – EA
Table 5 – Estimated Average Annual Flood Damage Reduction Benefits
Upper Deckers Creek Site 1 Subwatershed, West Virginia 1/
(Dollars) 1/

Item	Estimated average annual damage		
	Without project	With project	Damage reduction benefit
Floodwater			
Crop and pasture	$39,500	$ --	$39,500
Residences	$34,200	$700	$33,500
Businesses	$2,600	$400	$2,200
Transportation	$14,800	$1,700	$13,100
Subtotal	$91,100	$2,800	$88,400
Indirect	$10,700	$500	$10,200
Total	$101,900	$3,300	$98,600

1/ Price base 2012. Updated by CPI from 1957 to 2012, then prorated by sq mile drainage area controlled

Supplemental Watershed Plan No. 2 - EA
Table 6 - Comparison of Costs and Benefits
Upper Deckers Creek Site 1 Subwatershed, West Virginia
(Dollars) [1/]

Average Annual Benefits							
Evaluation Unit	Flood Damage Reduction Benefits	Secondary	Redevelopment	Agricultural Water Management	Total	Average Annual Cost	Benefit Cost Ratio
UDC1	98,600	16,000	12,700	62,000	189,300	376,900	0.5
Total	98,600	16,000	12,700	62,000	189,300	376,900	0.5

April 2012

[1/] Price base 2012

REFERENCES

Cardwell, Dudley H., Erwin, Robert B., and Woodward, Herbert P., 1968, Geologic Map of West Virginia, West Virginia Geological and Economic Survey.

Census Bureau, 2010 Census, U.S. Department of Commerce, http://factfinder.census.gov.

Hennen, Ray V. and Reger, David B., 1914, Preston County, West Virginia Geological Survey.

Individual Seam Shapefiles, Disks 1 and 2, 2009, West Virginia Coal Bed Mapping Project, West Virginia Geological and Economic Survey.

NRCS National Engineering Manual.

NRCS National Planning Procedures Handbook.

NRCS Technical Release 60 – Earth Dam and Reservoirs.

NRCS Technical Release 61 – WSP2 - Water Surface Profiles

NRCS Technical Release 66 – Simplified Dam-Breach Routing Procedure.

NRCS National Watershed Manual.

U.S. Water Resources Council. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. Washington, DC., March 10, 1983.

Water Resources Site Analysis Computer Program (SITES).

Ottery Group. 2012. Phase I Cultural Resources Investigation of the Upper Deckers Creek Watershed Rehabilitation Dam Project, Preston County, West Virginia

Gannett Fleming "Formulation of Rehabilitation Alternatives for Upper Decker's Creek, Site 1" September, 2011

Gannett Fleming "Safe Yield Study for Upper Decker's Creek, Site 1" September, 2011

Shrader, Casey; Ridley, Tim; Beard, Jared; and McCord, Noah. 2012 Determination and Delineation of Wetlands Along Upper Decker Creek Site #1 in Preston County, West Virginia. Unpublished.

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NAME	PRESENT TITLE/ OTHER EXPERIENCE (Years in Job)	EDUCATION Degree(s) Continuing Education Subjects	OTHER (licenses, etc.)
Jeffrey McClure	NRCS Geologist (4) WV DEP Geologist (11) Private Geologist (8.5)	BA Geology BA Biology BS Geology	CPG in KY, VA, DE, and PA
Jon Coleman	USACE Regulatory Specialist ( )		
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Michelle Tennant	Program Assistant (2)	BS Childhood Development	Document Editor
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Ronald Wigal	Soil Conservationist (17) Environmental Specialist (5)	BS Wildlife Management MS Wildlife Management	
Timothy Hastings	Program Assistant (1)	BS Management	Document Editor
Timothy Ridley	Hydraulic Engineer (24) Consulting Engineer (8)	BS Civil Engineering	Registered Professional Engineer Registered Professional Surveyor
The draft watershed plan and environmental assessment was reviewed and concurred by State staff specialists having responsibility for engineering, soils, agronomy, range conservation, biology, cultural resources, forestry, and geology. This review was followed by review of the document by the NWMC.			

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APPENDICES

Appendix A – Comments and Responses

Appendix B – Project Map

Appendix C – Support Map

Appendix D – Record of Investigation and Analysis

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Appendix A – Comments and Responses

WEST VIRGINIA
Division of Culture and History

The Culture Center
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EEO/AA Employer

May 3, 2012

Mr. Thomas Bodor
Principal Investigator
The Ottery Group
1810 August Drive
Silver Spring, MD 20902

RE: Upper Deckers Creek Watershed Rehabilitation Dam Project
Phase I Cultural Resource Report
FR# 12-606-PR

Dear Mr. Bodor:

We have reviewed the report titled *Phase I Cultural Resources Investigation of Upper Deckers Creek Watershed Rehabilitation Dam Project, Preston County, West Virginia*, which was submitted for the above referenced project to determine its effects to cultural resources. As required by Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties," we submit our comments.

Archaeological Resources:
According to the report, survey consisted of pedestrian reconnaissance of the entire Area of Potential Effect (APE) and systematic shovel probe excavation within 12 discrete areas in the APE. This work resulted in the identification of two archaeological sites, 46PR156 and 46PR157, and three isolated finds, 46PR153, 46PR154 and 46PR155). Three 1x1 meter test units were also excavated within 46PR156. Field investigations determined that the sites and isolated finds consist of ephemeral lithic scatters from which no diagnostic artifacts were recovered. In addition, no evidence was encountered suggesting the presence of stratified deposits or cultural features. As a result, we concur that no further work is necessary for these resources. In our opinion there are no archaeological resources within the area proposed for dam rehabilitation that are eligible for or listed in the National Register of Historic Places.

Architectural Resources:
We cannot complete our review with the information provided. Submitted information indicates that this project will result in the rehabilitation of the Upper Deckers Creek Dam #1 in Preston County. Please forward photographs of the dam and complete a Historic Property Inventory (HPI) form for the dam, including a determination of eligibility. In addition, please indicate what, if any, impact the proposed project will have with the identified architectural resources. We will provide additional comments upon receipt of the requested information.

We appreciate the opportunity to be of service. *If you have questions regarding our comments or the permit conditions, please contact Lora A. Lamarre-DeMott, Senior Archaeologist or Shirley Stewart Burns, Structural Historian, at (304) 558-0240.*

Sincerely,

Susan M. Pierce
Deputy State Historic Preservation Officer

SMP/LAL/SSB

Bill
File

WEST VIRGINIA
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EEO/AA Employer

June 22, 2012

Mr. Kevin Wickey
NRCS USDA
1550 Earl Core Dr., Suite 200
Morgantown, WV 26505

RE: Upper Deckers Creek Watershed Rehabilitation Dam Project
Phase I Cultural Resource Report
FR# 12-606-PR-1

Dear Mr. Bodor:

We have reviewed the above referenced project to determine its effects to cultural resources. As required by Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties," we submit our comments.

Architectural Resources:
Thank you for forwarding the requested Historic Property Inventory (HPI) form for the dam. It is the consultant's opinion that the 1969 dam is not eligible for inclusion in the National Register of Historic Places. After review of the submitted information, including photographs, we concur with this assessment. In addition, submitted information indicates that the buildings identified in the earlier report will not be demolished or impacted by this project. It is our opinion that the proposed project will have no impact to architectural resources eligible for or included in the National Register. However, should your project change or become altered in any way that would impact the buildings, additional consultation would be necessary at that time.

We appreciate the opportunity to be of service. *If you have questions regarding our comments or the permit conditions, please contact Shirley Stewart Burns, Structural Historian, at (304) 558-0240.*

Sincerely,

Jennifer Brennan for

Susan M. Pierce
Deputy State Historic Preservation Officer

SMP/SSB

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JUN 27 2012
USDA, NRCS
Morgantown, WV

PROPOSED UPPER DECKERS CREEK SITE 1
WATERSHED REHABILITATION PROJECT

DRAFT SUPPLEMENTAL PLAN AND DRAFT SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT
COMMENTS

Name: Franklin T Smith
Address: 1106 Ann Chapel Rd
Reedsville WV 26547
Phone (optional): 304 864 6605
Email (optional):

COMMENT(S):

Septic
water Line
Drive way + Bridges
How high
How much property

Signature: Franklin T Smith

Date: 6-28-12

Email: ron.wigal@wv.usda.gov

Mailing address: USDA – NRCS
1550 Earl Core Road, Suite 200
Morgantown, WV 26505
Attn: UDC1 Scoping Comments

Comments must be received by COB Friday July 20, 2012.

File
Bill O.
Action

DIVISION OF NATURAL RESOURCES
Wildlife Resources Section
324 Fourth Avenue
South Charleston, West Virginia 25303-1228
Telephone (304) 558-2771
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TDD 1-800-354-6087

Earl Ray Tomblin
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Frank Jeziorp
Director

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JUL 16 2012
USDA NRCS
Morgantown WV

July 10, 2012

Mr. Kevin Wickey, State Conservationist
USDA, Natural Resources Conservation Service
1550 Earl Core Road, Suite 200
Morgantown, WV 26505

RE: Comment on Supplemental Watershed Plan Number 2 & Environmental Assessment for Rehabilitation of Site 1, Upper Deckers Creek Watershed, Preston and Monongalia Counties, West Virginia

Dear Mr. Wickey:

The Wildlife Resources Section (WRS) of the West Virginia Division of Natural Resources has completed its review of the referenced Watershed Plan and Environmental Assessment (EA). WRS comments are provided pursuant to provisions of the Fish and Wildlife Coordination Act (16 U.S.C. 661-667e), duties and responsibilities mandated in the West Virginia Code § 20-1-16 (2011), and a Memorandum of Understanding between the Department of Environmental Protection and Division of Natural Resources, dated November 24, 1992.

The proposed project includes the construction of a new excavated auxiliary spillway on the dam's left abutment, lining and extending the existing principal spillway pipe, construction of a new principal spillway inlet and outlet structure, construction of a new internal embankment drainage system, modification of the embankment top width and height for multi-purpose use, and added measures to increase stability of the embankment slopes. The Natural Resources Conservation Service's (NRCS) recommended alternative is to rehabilitate Upper Deckers Creek No. 1 and to add rural water supply for a local Public Service District as a purpose. The addition of PSD 1's water supply would result in the permanent reservoir elevation rising 9.4 feet and increasing the total surface area by 10 acres totaling 34.8 acres.

On pages 9-10 of the EA, the potential environmental effects of the proposed project are reported as the conversion of 8.6 acres of prime farmland and 10.7 acres of statewide important farmland to non-agricultural uses. Aquatic losses include the permanent inundation of 2,470 linear feet of streams, elimination of up to 200 feet of stream at the principal spillway and outlet basin, inundation of 2.99 acres of palustrine scrub-shrub (PSS) wetlands and elimination of 0.14 acres of emergent meadow wetland. The project will result in the replacement of 6,180 linear

feet of shoreline with about 9,000 feet of shoreline, temporary elimination of aquatic habitat for up to two construction seasons while reservoir is drained, and the flooding of 10 acres of land resulting from an enlarged reservoir.

The proposed mitigation for impacts includes the following: The placement of the demolished riser in the pool area for fish habitat. The excavated vegetation with wetland seed sources are proposed to be moved upstream into the new coves and deposited at the approximate new permanent pool elevation. Approximately 2,470 linear feet of stream upstream of the dam will be permanently inundated and converted to lacustrine habitat. Also, up to 200 feet of Deckers Creek below the dam is expected to be eliminated from extending the principal spillway conduit downstream and constructing a new outlet basin. In order to compensate for these unavoidable stream impacts, riparian improvements are being investigated for installation along Deckers Creek downstream of the dam. Riparian improvements may include vegetative enhancements, streambank stabilization and/or livestock exclusion fencing.

The NRCS believes that relocating excavated vegetative material will expedite the establishment of wetland vegetation in the newly created shallow water areas of the reservoir. The WRS is only aware of excavated seed source utilization for palustrine emergent wetland restoration. The WRS requests that excavated shrubs be relocated to the sites where scrub-shrub wetlands are to be restored. In addition, the WRS requests that, if after two growing seasons, 2.99 acres of scrub-shrub wetlands are not established, that scrub-shrub wetlands be restored by planting shrubs in the newly created cove areas.

The WRS concurs with the NRCS's proposal of avoidance of impacts to the PEM vegetated area located within the proposed earth disposal site (page 53 of the EA), but requests that if the 7.17 acres are to be filled, then a survey of West Virginia plant and animal "species of concern" be completed before any disturbance of the area. This habitat type is important nesting habitat for marsh wrens, and is important larval habitat for butterflies such as Baltimore Checkerspot, the Regal Fritillary, and Diana Fritillary; all species of conservation concern in West Virginia. The list for plants and animals of concern can be obtained from the WRS database at the Elkins Operation Center or online at the WVDNR website. The WRS recommends that either the 7.17 acres of PEM wetland be excluded from the project plan, or if there is a possibility the disposal area will be needed, the US Army Corps of Engineers be consulted for a jurisdictional determination and possibly permitted under § 404 of the Clean Water Act.

The WRS appreciates the opportunity to review and comment on the referenced EA. If you have any questions or comments please feel free to contact Kerry Bledsoe at 304-825-6787 or by e-mail at Kerry.D.Bledsoe@wv.gov.

Sincerely,

Curtis I. Taylor, Chief
Wildlife Resources Section

Bill
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JUL 25 2012

July 19, 2012

Mr. Kevin Wickey
State Conservationist
US Department of Agriculture
Natural Resources Conservation Service
1550 Earl Core Road, Suite 200
Morgantown, WV 26505

RE: Upper Deckers Creek Site 1 Dam Rehabilitation Project
FR#: 12-606-PR-2

Dear Mr. Wickey:

We have reviewed the Draft Environmental Analysis (DEA) that was submitted for the above referenced project. As required by Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties," we submit our comments.

In our opinion, the draft document accurately summarizes the proposed project, its Area of Potential Effect (APE), its potential to impact historic resources and our previous comments. We remain in concurrence with our previous determination. In our opinion, the are no cultural resources listed in or eligible for listing in the National Register of Historic Places within the APE for the Upper Deckers Creek Site 1 Dam Rehabilitation Project.

We appreciate the opportunity to be of service. *If you need clarification on our comments or the Section 106 process, please do not hesitate to contact Lora A Lamarre-DeMott, Senior Archaeologist, or Shirley Stewart Burns, Architectural Historian, at (304) 558-0240.*

Sincerely,

Susan M Pierce

Susan M. Pierce
Deputy State Historic Preservation Officer

SMP/LLD

Appendix B – Project Map

UDC1 – Appendix B – Location Map.pdf

Appendix C – Support Maps

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UDC1 – Appendix C – 8 Wetland Delineation.pdf

UDC1 – Appendix C – 9 Probable Limits and Soils.pdf

Appendix D – Record of Investigation and Analysis

Economics

Flood damage reduction benefits, secondary and redevelopment benefits from the March 1963 were indexed to current values. Land use in the watershed has not changed significantly since the original project was planned so values were indexed to reflect current values. All benefit categories were updated using appropriate price indexes as described in the NRCS Economics Guide.

Census information and field observations were used to describe the project setting and economic and social conditions. Where available, such information was described for UDC1, but in most cases data was only available for Preston County.

Census information, input from local sponsors and other sources were used to identify any potential environmental justice issues. No issues were identified through any of these means. All benefits and costs were based on 2012 prices. Costs and benefits were amortized at 4.0% for 50 years.

Engineering

Planning engineering efforts initiated with researching the following historical records for UDC1:

- Original Work Plan – Design Comparison (12/1967)
- As-Built Drawings (1969)
- Design Report Sections (Geology, Soil Mechanics, 1966) (Hydraulic, Structural Computations, Dam Layout Computations, 1967)
- Inspection Records (2007, 2008)
- March 2006 Rehab Assessment
- Field Records (Field Notebooks, Job Diaries, 1968-1969)
- Upper Deckers Creek UDC1 Inundation Map
- Principal Spillway Pipe Inspection Video (July 2010)

A detailed topographic survey of the dam and its spillways, and a bathymetric survey of the reservoir were conducted. The contours above the pool and upstream of the dam were derived from the original design survey. The original design survey and the bathymetric survey were compared for pool sedimentation rate estimates.

The geotechnical investigation program provided typed boring logs, core box photos, geophysical survey results, piezometer data, piezometer construction logs, and bedrock pressure testing data for the engineering analyses. Laboratory soil and rock testing was conducted for data to evaluate auxiliary spillway integrity. Other geotechnical analyses conducted were

- Embankment and Drain Fill Compatibility
- Dispersive Soil
- Rock Slake Durability
- Liquefaction Susceptibility

A Safe Yield Study was conducted to assess the feasibility of adding rural water supply. Water consumption records from PSD1 were analyzed to project future demands for the study. West Virginia Department of Health regulations were researched to assure the study's compliance with state regulation of public water supply.

A limited-detail seismic analysis of the riser was performed using the Seismic Analysis of Risers (SARISERS) program.

Hydrology and Hydraulics

Hydrologic modeling was conducted using the NRCS SITES Version 2005.1.4 computer program. Hydrologic parameters and characteristics of the watershed were determined in accordance with procedures contained in NRCS NEH Part 630, TR-55 and TR-60. Delineation of the drainage area was determined based on the most recent USGS elevation data available using ArcMAP GIS software.

Watershed and sub-watershed delineation was performed using a GIS-based approach that utilizes a DEM. The DEM was developed based on mass points and break lines spaced regularly at 3-meter intervals.

Precipitation data for the hydrologic analyses were acquired from TP-40, TP-49, HMR 51, and NOAA Atlas 14. NOAA Atlas 14, TP-40 and TP-49 were used to obtain the 2- through 100-year precipitation values for the project location, while the probable maximum precipitation (PMP) was obtained from HMR 51. Where values were obtained both from NOAA and from TP-40, the values obtained from the more-recent NOAA Atlas 14 were adopted for this study.

RCN computations in the GIS environment require digital soil and land cover data in conjunction with a digital watershed delineation. Digital soils information was obtained from the NRCS Soil Survey Geographic (SSURGO) database. Digital Land Cover data was obtained from the NLCD, which is a consistent land cover data layer for the United States. The NLCD is categorized based upon the National Land Cover/Land Use classification system. In combination, these digital coverages allow GIS to compute area weighted runoff curve numbers applicable for each delineated watershed.

The inundation zone analysis was accomplished using NRCS Technical Release No. 60 for peak discharge criteria and HEC-RAS for water surface elevation data. The cross section data were taken from a FEMA model developed by AECOM dated December 2009. Additional sectional geometry was developed using a three-meter (3-meter) DEM and orthophotography developed by the SAMB.

Environmental Evaluations –

Soils information used to determine prime and unique farmland mapping units and hydric soils as wetland indicators were obtained from http://websoilsurvey.nrcs.usda.gov. Soils mapping of the UDC1 rehabilitation project area of potential effect and adjacent areas were generated from this website. Soils descriptions for mapping units within this area were generated as a component of the soils reports created through this website.

Surface water quality data were obtained from the PSD1. Routine water quality analyses of the source water are conducted daily, as well as samples of treated water collected at various points along PSD1's distribution system.

Conservation release requirements were discussed with WVDEP. Data for the Deckers Creek watershed at the UDC1 dam location, including the calculated 7Q10 value, was provided by WVDEP from that agency's Stream Flow Report dated February 22, 2012. Stage-storage curves developed in conjunction with the Safe Yield Study for water supply were used to estimate reservoir elevations and volumes necessary to meet sediment storage, rural water supply storage and conservation release storage components of the permanent reservoir.

Wetland determination and delineation for all areas within the project area of potential effect between the existing reservoir pool elevation and the projected new auxiliary spillway crest were performed by an interdisciplinary team of NRCS staff. Wetland delineation was performed in accordance with the 1987 Corps of Engineers Wetland Delineation Manual and appropriate regional supplement. Wetland areas were delineated, described (with supporting data sheets), and surveyed for mapping and remarking purposes. The wetland report and mapping also identified stream segments upstream of the dam that are expected to be permanently inundated by the addition of the dedicated rural water supply or subjected to temporary inundation during flood events in the flood water detention pool area.

Consultation with the USFWS, West Virginia Field Office, was completed early in the planning process. A description of potential project alternatives as well as a map depicting the UDC1 location and area of potential effect was submitted with the request for an opinion as to the potential effects of rehabilitating dam on federally listed threatened and endangered species.

A Phase I cultural resources investigation was contracted by NRCS for investigating the existence of archaeological and architectural resources within the project area of potential effect. The results of this investigation were used to render an opinion regarding the historical scientific value of locations that were within the project area. The opinions of the contractor were incorporated into recommendations that NRCS submitted the WVSHPO. Concurrence has been received from WVSHPO regarding archaeological effects identified in the Phase I report. A response pertaining to project affects upon architectural resources has not yet been received.

Appendix E – Other Supporting Information

MEMORANDUM OF UNDERSTANDING
Between the
NATURAL RESOURCES CONSERVATION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE
And the
PRESTON COUNTY COMMISSION
MONONGAHELA CONSERVATION DISTRICT, and

STATE CONSERVATION COMMITTEE

Sponsors for the
Upper Deckers Creek Site 1 Dam Rehabilitation Project

THIS MEMORANDUM OF UNDERSTANDING is between the United States Department of Agriculture, Natural Resources Conservation Service, hereinafter referred to as NRCS, and the Monongahela Conservation District, the State Conservation Committee, and the Preston County Commission, Sponsoring Local Organizations for this project, hereinafter referred to as Sponsors.

AUTHORITIES, STATUTES, LAWS

The authority of NRCS to enter into this memorandum of understanding is Section 14 of The Watershed Protection and Flood Prevention Act, 16 U.S.C. 1012, as added by Section 313 of Public Law 106-472. This section authorizes NRCS to provide technical and financial assistance to local project Sponsors for rehabilitation of aging dams constructed under the Watershed Protection and Flood Prevention Act (Public Law 83-566), the Flood Control Act of 1944 (Public Law 78-534), and the Pilot Watershed Program and the Resource Conservation and Development (RC&D) Program.

STATEMENT OF PURPOSE

Previously the NRCS provided technical and/or financial assistance to the Sponsors for works of improvement known as Site 1 in the Upper Deckers Creek Watershed Project. This project was originally authorized and installed under the PL 83-566 Program. NRCS has determined that this dam is eligible for rehabilitation under the authorities cited above.

According to the project plan and operation and maintenance agreement for this project, the Sponsors are responsible for the operation and maintenance of this dam to assure it will function as designed and constructed. The Sponsors have an interest in extending the service life of the dam and meeting applicable safety and performance standards. The Sponsors recognize that the process of rehabilitating a dam takes significant advance preparation, and would like to initiate work on specific areas of planning and design of a rehabilitation project.

Although NRCS has authority to assist the Sponsors with rehabilitation of the dam identified above, NRCS resources cannot be committed to this project at this time. However, NRCS

concurs with the Sponsors initiating work on specific areas of planning and design of the rehabilitation project.

Federal funds for a particular rehabilitation project will be equal to 65 percent of the total costs of the rehabilitation project, but will not exceed 100 percent of the actual construction costs incurred in the rehabilitation. Also, the Sponsors will be responsible for acquisition of all landrights and permits. The value of non-federal in-kind contributions can be credited to the Sponsor's 35 percent share of the total cost of the rehabilitation project.

GOAL

The primary goal of this memorandum of understanding is to establish a framework under which the Sponsors may proceed with work on specific aspects of the proposed rehabilitation project.

This memorandum of understanding establishes a basis for cooperation between the parties to define acceptable in-kind contributions for this project. Therefore, the parties pledge to work together with the mutual goal of rehabilitation of this project within the current limits of their respective authorities and available funding.

SCOPE OF MEMORANDUM OF UNDERSTANDING

The Sponsors may provide all or a portion of the Sponsor's 35 percent share of the total cost of the rehabilitation project by providing an in-kind contribution of services and land rights acquisition. NRCS and Sponsors agree that the following services and the maximum in-kind credit values may be considered for credit to the Sponsor's share of the total rehabilitation cost of this project:

- Landrights acquisition: Only those Landrights above and beyond those originally obtained for the existing structures.
- Other to be determined at a later date, at which time this MOU will be supplemented.

The Sponsor shall provide NRCS with documentation of the actual costs incurred for the services and land rights acquisition for determination of final credit values.

LIMITATIONS

- In-kind credit will be provided for administrative functions, service contracts, engineering investigations, environmental analysis, and other activities that are necessary to complete the planning and implementation phases of rehabilitation for Site 1. The values associated with such activities will be established throughout the life of the project.
- The technical quality of the services provided must be concurred in by NRCS prior to in-kind credit being given.

- Only services and landrights acquisition provided by the Sponsor after November 9, 2000 (date of enactment of PL-106-472) will be credited.

- The value of in-kind credit values will be determined as set forth in the NRCS National Contract Grants and Agreements Manual, Sections 510.64 through 510.67.

- The in-kind credit values will not exceed 35 percent of the total costs of the rehabilitation project described above. The Sponsors will receive no cash reimbursement or credit for in-kind contributions that exceed this amount.

- No credit for in-kind contributions will be given for Sponsors' actions normally needed for carrying out their previously assigned responsibilities for this project.

- This memorandum of understanding is not a fund obligating document.

- There is no guarantee that funds will be appropriated by Congress for the dam rehabilitation project described in this memorandum of understanding.

- There is no guarantee that, if funds are appropriated by Congress, the dam rehabilitation project described in this memorandum of understanding will be given any priority for completion by NRCS.

- There is no guarantee that, if the dam rehabilitation project described in this memorandum of understanding is selected as a NRCS priority rehabilitation project, the alternatives currently considered by the Sponsor will be the NRCS recommended or the final alternative selected by the sponsor.

- Determination of the final amounts to be credited shall be at the sole discretion of the NRCS.

- All actions taken and costs incurred by the Sponsor prior to the time of the approval of the rehabilitation plan will be entirely at its own risk. Therefore, there is no guarantee, implied or otherwise, that any services or landrights provided by the sponsor will be credited as an in-kind contribution.

CIVIL RIGHTS

The parties will be in compliance with the nondiscrimination provisions contained in Titles VI and VII of the Civil Rights Act of 1964,as amended, the Civil Rights Restoration Act of 1987 (Public Law 100-259) and other nondiscrimination statutes, namely, Section 504 of the Rehabilitation Act of 1973, Title IX of the Education Amendments of 1972, the Age Discrimination Act of 1975, Americans with Disabilities Act of 1990, and in accordance with regulations of the Secretary of Agriculture (7CFR-15, Subparts A & B) which provide that no person in the United States shall, on the grounds of race, color, national origin, age, sex, religion, marital status, or disability be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving Federal financial assistance from the Department of Agriculture or any agency thereof.

TERMINATION

This memorandum of understanding can be modified or terminated at any time by mutual consent of both parties or can be terminated by either party giving 60 days written notice to the other party.

NATURAL RESOURCES CONSERVATION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

By: _____
Kevin Wickey

Title: State Conservationist

Date: 1/20/2012

Monongahela Conservation District
Preston, Marion, and Monongalia Counties, West Virginia

By: _____

Title: Chairman

Date: 1-5-2012

State Conservation Committee
Kanawha County, West Virginia

By: _____

Title: Chairman

Date: 1/18/12

Preston County Commission
Preston County, West Virginia

By: _____
T. Craig Jennings

Title: President

Date: November 28, 2011

MEMORANDUM OF UNDERSTANDING

BETWEEN THE

US ARMY CORPS OF ENGINEERS

AND THE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

I. PURPOSE

The purpose of this Memorandum of Understanding (MOU) is to establish a framework for the US Army Corps of Engineers (USACE) and the Natural Resources Conservation Service (NRCS) to cooperate in the planning and development of Upper Deckers Creek Watershed Project Site 1 Rehabilitation Project. By NRCS invitation, the USACE has agreed to become a cooperating agency in the development of an Environmental Assessment for Site 1. This MOU will specify the respective roles of each agency during the planning and development of this project.

II. BACKGROUND AND MUTUAL BENEFITS AND INTERESTS

The Upper Deckers Creek Watershed Project was authorized under the authority of the Watershed Protection and Flood Prevention Act (Section 14 of PL-83-566, as amended). Rehabilitation of Deckers Creek Site 1 is authorized by the Small Watershed Rehabilitation Amendments of 2000 (Section 313 of Public Law 106-472). NRCS seeks to establish a cooperating relationship with the USACE in accordance with the Council on Environmental Quality regulations regarding the implementation of the National Environmental Policy Act (NEPA) at 40 CFR Part 1501.6. Such a relationship recognizes the special expertise and jurisdiction of the USACE with respect to small watershed projects.

Such a relationship will be mutually beneficial because both agencies have NEPA compliance responsibilities. Cooperating during the planning and implementation of this project will assist both agencies in fulfilling their respective environmental review requirements and will reduce the duplication and delay between agencies.

III. TERMS AND CONDITIONS

The NRCS will be the lead federal agency for project planning and implementation. NRCS seeks two specific outcomes as a result of this cooperating effort: (1) assistance in the determination of wetlands and the mitigation requirements related to wetland impacts resulting from the project; and, (2) fulfillment of all planning analysis that is necessary for the Sponsors to acquire any Department of the Army permits that may be required to implement the project.

NRCS will initiate meetings, provide right of access to the project area, and engage agency specialists where appropriate. The WV State Conservationist will be the Responsible Federal Official and as such, will issue the Record of Decision or Finding of No Significant Impact, whichever is appropriate. NRCS will bear responsibility for the public participation aspects of NEPA, including public meetings and the distribution of environmental documents for review and comment.

NRCS and Local Sponsors will bear the cost for the planning and implementation of the project. However, no funds will be provided to the USACE to support their cooperation in this project.

The schedule of project milestones is attached to this MOU so that the USACE may assign staff when necessary (see Attachment A). The USACE and the NRCS will maintain open lines of communication throughout the planning and implementation process. The technical contacts listed in this MOU, or their designees, will establish a cooperating relationship that moves the project forward through the planning and implementation process.

IV. PROVISIONS

1. This MOU supersedes any previous MOU between the Parties specific to Upper Deckers Creek Site 1.

2. This MOU takes effect upon the date of last signature by the Parties and remains valid until September 30, 2017.

3. This MOU does not obligate funding. Nothing in this MOU shall obligate either party to transfer any funds. Specific projects or activities that involve the transfer of funds, services, or property among the parties shall require the execution of separate agreements and are contingent upon the availability of appropriated funds.

4. Any costs incurred by either party in implementing this MOU are the sole responsibility of that party.

5. This MOU may be cancelled, renegotiated, amended, or modified by a written amendment through an exchange of correspondence between authorized officials of the signatory Parties.

6. Either Party may terminate this MOU by written notice to the other Party at least 30 calendar days before the effective date of the termination.

7. This MOU is not intended to, and does not create any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity, by any Party against the United States, its agencies, its officers, or any person.

8. As a condition of this MOU, all signatory Parties assure and certify that this MOU, and any agreements written pursuant to this MOU, will comply with the nondiscrimination provision contained in Title VI and VII of the Civil Rights Act of 1964, as amended; the Civil Rights Restoration Act of 1987 (Public Law 100-259); and other nondiscriminatory statutes. They also will be in accordance with regulations of the Secretary of Agriculture (7 CFR 15, Subpart A and B), which provides that no person in the United States shall, on the grounds of race, national origin, age, sex, religion, marital status, or disability be excluded from participating in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving Federal financial assistance from the U. S. Department of Agriculture, or any agency thereof.

9. All activities conducted under this MOU shall be in compliance with the Drug-Free Workplace Act of 1988 (Public Law 100-690, Title V, Subtitle D).

V. TECHNICAL AND ADMINISTRATIVE CONTACTS

USACE Contact:

Name: Karen Kochenbach
Chief Southern Section
Address: U.S. ARMY CORPS OF ENGINEERS, PITTSBURGH DISTRICT
2200 WILLIAM S. MOORHEAD FEDERAL BUILDING
1000 LIBERTY AVENUE
PITTSBURGH, PA 15222-4186
Telephone: 412-395-7361
Email: Karen.A.Kochenbach@usace.army.mil

Name: Jon Coleman
Regulatory Specialist
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1000 LIBERTY AVENUE
PITTSBURGH, PA 15222-4186
Telephone: 412-395-7188
Email: Jon.T.Coleman@usace.army.mil

NRCS Contacts:

Name: Kevin J. Wickey
State Conservationist
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Telephone: (304) 284-7540
Email: kevin.wickey@wv.usda.gov

Name: Bill O'Donnell
Assistant State Conservationist – Programs
Address: 1550 Earl Core Road, Suite 200
Morgantown WV 26505
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Email: bill.odonnell@wv.usda.gov

Name: Amy Stonebraker
Supervisory Contract Specialist
Address: 1550 Earl Core Road, Suite 200
Morgantown WV 26505
Telephone: (304) 284-7557
Email: amy.stonebraker@wv.usda.gov

ACCEPTED BY:

_____, ACTING FOR

Kevin J. Wickey
State Conservationist, Natural Resources Conservation Service
United States Department of Agriculture

3.29.12
DATE

_____

Karen Kochenbach, Chief Southern Section
US Army Corps of Engineers

3/27/12
DATE

Attachment A

Upper Deckers Creek Site 1 Project Schedule

Task	Date
Signature Process Complete for MOU	April 1, 2012
Site Visit and Field Review of Wetlands (one staff day; available dates April 19 or April 20)	April 19-20, 2012
Correspondence from USACE – guidance on wetland delineation	April 30, 2012
USACE – field work for jurisdictional determination of wetlands	May 21, 2012
Correspondence from USACE – jurisdictional determination	May 30, 2012
Notice of Availability of EA – Public Comment Period	August 3, 2012
Publication of EA-ROD/FONSI	September 28, 2012

Projected Water Needs in Public Service District 1

Preston County, West Virginia

Upper Deckers Creek Site 1 – March 2012

Introduction

The purpose of this report is to examine the trends in population and housing that impact the demand for rural residential water in the Preston County Public Service District #1 (PSD#1). In addition, there are other factors that influence the quantity and quality of water available to the residents in this area, such as coal mining. This report will describe these factors and trends. Changes in commercial and industrial water demand were not considered as part of this analysis however, it is acknowledged that there will be increased demands from this sector. Consequently, the project water demand is viewed as the *minimum* projection.

Upper Deckers Site 1 – Original Purpose

Upper Deckers Site 1 was designed and built as a flood control structure. Rural water supply was not included in Site 1 so the site was not designed to store water for that purpose. Although not originally included as a design feature, UDC1 is used by PSD#1 as a primary water supply source. PSD#1 has previously requested that the Monongahela Conservation District seek alternatives for increasing the water supply storage capacity at UDC1. The additional capacity would address water supply demands resulting from rapid development.

Preston County Public Service District #1

PSD#1 serves 1,534 water customers in the vicinity of Arthurdale and Rivesville PSD#1 currently relies on the storage in the sediment pool of UDC1 to meet their water needs. Service areas for PSD1 continue to expand as housing and population grow in this area of Preston County. Additionally, PSD1 is extending lines to residents who have poor water quality or quantity due to mining impacts.

For the purposes of this report, historic water demand and trends in housing and population growth at the county level will be used to project the future demand for water. According to the US Census reports for Year 2000 and Year 2010, Preston County is expanding in both population and housing. Population in Preston County increased by 14% between the Year 2000 and 2010. This outpaced the average statewide growth of 2.5% during the same time period. Housing in Preston County has increased by a similar percentage, 13% from 2000 until 2010, and that is on top of an 11% gain in the previous decade.

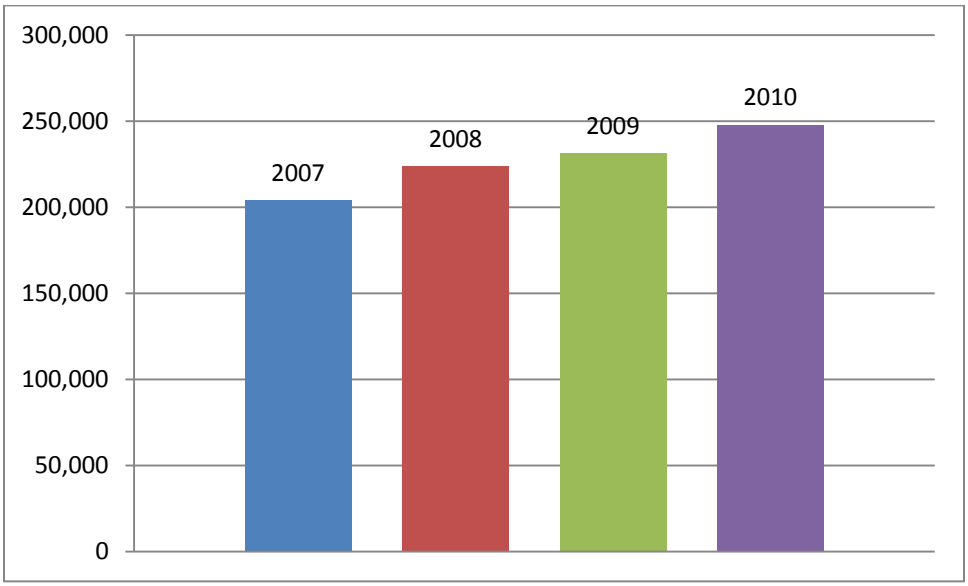
The growing population and housing have increased the demand for sustainable water supplies now and in the future. In addition, private wells and springs have been negatively impacted by mining. Preston County Public Service District 1 (PSD1) has extended their service lines to residents who have degraded wells and springs. Thus, there is a two-fold reason for the increased need for water for PSD1 – population and housing growth and an expanded service area.

Historic Water Demand

Water demand is currently about 250,000 gallons per day. This demand is being met by taking water from the sediment storage pool in Upper Deckers Creek Site 1. The following table shows the trends in average daily demand for PSD#1 from 2007 through 2010. The graphic illustration shows an increasing trend in water demand of about 7 percent per year.

Daily Demand in Gallons Per Day

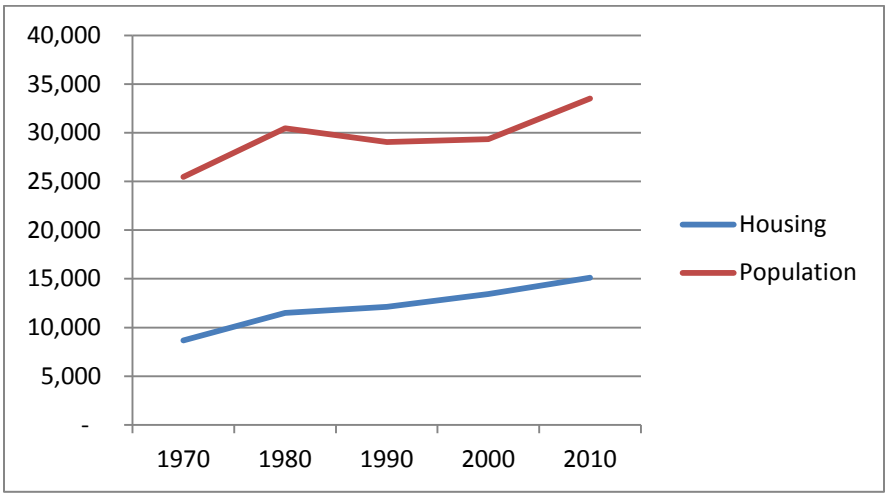
Public Service District #1



Housing and Population Trends

Housing and population in Preston County are increasing at a faster pace than West Virginia as a whole. A relatively strong regional economy exists in nearby Morgantown, providing employment, higher education, retail, and health care opportunities to residents of Preston County and other surrounding rural areas. Approximately 45 percent of those employed in Preston County work outside of Preston County. Consequently, Preston County has experienced housing and population growth because of the strong regional economy. The following chart shows the increase.

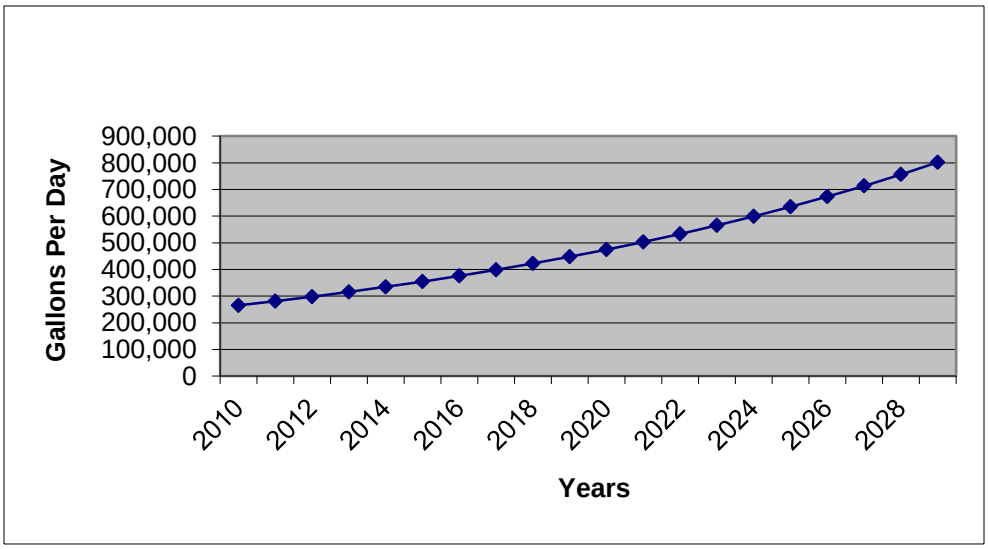
Housing and Population Trends in Preston County 1970-2010



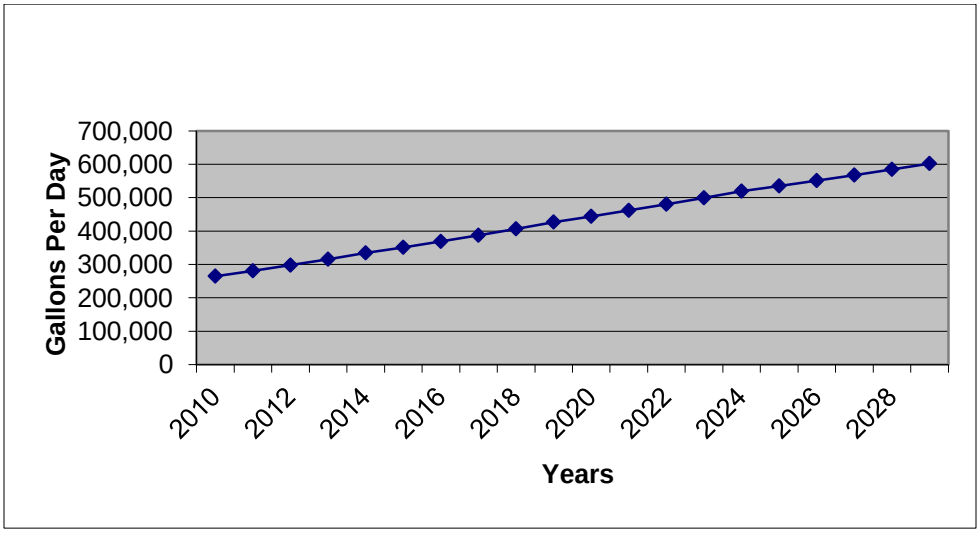
Water Demand Projections

Based on historic trends in housing and population, PSD#1 will be serving more customers for the foreseeable future. Two scenarios were developed to estimate the need for water through the year 2032 – a twenty year projection period. The first scenario assumes a steady increase in demand at 6 percent per year through 2032. This is a more aggressive estimate and it assumes that population and housing will continue to grow at a steady pace. The second scenario assumes a demand increasing at a decreasing rate. This is a more conservative estimate and it assumes that population and housing will continue to grow, but the pace will be slower in the future. The following charts illustrate these scenarios.

Water Demand Increasing at Steady Rate



Water Demand Increasing at Decreasing Rate



As shown in the previous charts, PSD#1 will reach a demand of 500,000 gallons per day by the year 2022 using the aggressive projections. If the conservative projection is applied, PSD#1 will reach a demand of 500,000 gallons per day by the year 2024. Summarily, UDC1 will supply all of the total raw water needs of PSD#1 for the next ten to twelve years. Beyond that timeframe, UDC1 will meet 62% to 83% of total need, depending on which projection scenario is applied. To fill that eventual gap in supply, PSD#1 may need to improve internal efficiencies, implement conservation measures, tap into the sediment pool, or seek an additional raw water source.

Safe Yield Study Results

A safe yield study was conducted as part of this planning effort to determine the yield and dependability of UDC1 as a rural water supply source. The study indicated that if the permanent pool at UDC1 were increased from 1724.46 feet to 1735.0 feet, a quantity of 310 acre-feet of water could be stored. Given these dimensions, 500,000 gallons per day could be supplied from the enlarged site. The safe yield study indicates that UDC1 can produce this quantity of water even in drought conditions. The safe yield study did not consider whether conservation releases would be necessary from UDC1.

Conclusion

As previously stated, Preston County is a growing county and there is a need for a dependable water supply. In order to meet the forecasted demand, source water should be identified that will fully or partially meet the demand through Year 2032. UDC1 is the most feasible site for meeting part of this need, particularly if the pool is enlarged to store a dedicated water supply component. In order for PSD#1 to meet the total projected demand, additional water supply strategies will have to be developed for Years 2022 and beyond.

References

U.S. Census Bureau; Census 2000, Summary File 1 (SF1) and 3 (SF 3); (August 2004).

```
1*******************************************************************************
 SITES XEQ 12/15/2011   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
      VER 2005.1.05              (USER MANUAL - DATED DECEMBER 2005)
      TIME 15:20:52

 ************************* 80-80 LIST OF INPUT DATA **************************

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 SAVMOV    101  1                                                        2
 WSDATA    2C 3 1 AC 72.6      1322.151  0.56
 BASEFLOW            1.5
 PDIRECT                                 10.01     27.30
 GO,DESIGN                     6
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 SAVMOV    101  2                                                        3
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                     1809      0         0         0         0.0247
                     1809.2    2.46      1.6       16.04     0.0247
                     1810      15.63     6.4       32.08     0.0247
                     1810.2    47.48     14.2      43.83     0.0247
                     1811      99.73     23.8      52.69     0.0247
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                     1814.2    1117.56   141.1     119.44    0.0247
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                     1818      4919.49   505.2     314.58    0.0247
                     1818.2    5868.42   569.2     325.28    0.0247
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 BASEFLOW            1.5
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 SAVMOV    101  2                                                        3
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                     1,763.20  387.73    63.4      79.29     0.01843066
                     1,764.00  533.69    80.2      88.15     0.01843066
                     1,764.20  707.71    98.7      97.01     0.01843066
                     1,765.00  911.57    119       105.88    0.01843066
                     1,765.20  1,117.56  141.1     119.44    0.01843066
                     1,766.00  1,149.73  171.2     186.09    0.01843066
                     1,766.20  1,403.98  217.9     252.2     0.01843066
                     1,767.00  1,917.04  270.6     271.81    0.01843066
                     1,767.20  2,548.46  326       282.5     0.01843066
                     1,768.00  3,259.59  383.6     293.19    0.01843066
                     1,768.20  4,049.95  443.3     303.89    0.01843066
                     1,769.00  4,919.49  505.2     314.58    0.01843066
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 SAVMOV    101  1                                                        1
 STRUCTURE UD1       Upper Deckers Creek Site 1
                     1714                                    0
                     1715                                    .08
                     1720                                    15
                     1725                                    105
                     1730                                    237
                     1735                                    400
                     1740                                    590
                     1745                                    814
                     1750                                    1078
                     1755                                    1395
                     1760                                    1775
                     1765                                    2225
                     1770                                    2751
                     1775                                    3360
 ENDTABLE
 WSDATA    2C 1   AC 76        834.34    0.33
 BASEFLOW            1.5
 PDIRECT                                 10.01     27.30
 POOLDATA  ELEV      1724.46   1724.46   1724.46   1712      1719      SC
 PSINLET             0.75      15
 PSDATA    1         290       30                  0.012     1710.5
 ASSPRFL   41
```

```
          23.22     1719.59   42.16     1727.21   50.14     1728.30
          72.97     1732.79   93.02     1737.59   125.50    1741.42
          146.97    1742.74   193.42    1744.30   223.90    1744.35
          243.50    1744.39   285.31    1743.18   326.15    1742.31
          371.73    1740.93   401.16    1740.17   458.80    1738.80
          490.49    1736.85   495.82    1735.97   520.07    1728.56
          542.38    1721.00   569.53    1717.20   584.37    1716.55
 ENDTABLE
 ASSURFACE 41        490.49    0.1
          23.22     584.37    0.035     0.5       1         1
 ENDTABLE
 ASDATA    41                            2.5                           2
 BTMWIDTH  FEET      40
 GRAPHICS  I
 GO,DESIGN HLCP                6                               1724.46
 SAVMOV    2    101  1                   UD1
 ENDJOB

-------------------------------------------------------------
 ** CONTROL FILE SEGMENT LIST **
 SAVMOV    101  1                                                      1
 STRUCTURE UD1       Upper Deckers Creek Site 1
                     1714                                    0
                     1715                                    .08
                     1720                                    15
                     1725                                    105
                     1730                                    237
                     1735                                    400
                     1740                                    590
                     1745                                    814
                     1750                                    1078
                     1755                                    1395
                     1760                                    1775
                     1765                                    2225
                     1770                                    2751
                     1775                                    3360
 ENDTABLE
 WSDATA    2C 1   AC 76        834.34    0.33
 BASEFLOW            1.5
 PDIRECT                                 10.01     27.30
 POOLDATA  ELEV      1724.46   1724.46   1724.46   1712      1719      SC
 PSINLET             0.75      15
 PSDATA    1         290       30                  0.012     1710.5
 ASSPRFL   41
          23.22     1719.59   42.16     1727.21   50.14     1728.30
          72.97     1732.79   93.02     1737.59   125.50    1741.42
          146.97    1742.74   193.42    1744.30   223.90    1744.35
          243.50    1744.39   285.31    1743.18   326.15    1742.31
          371.73    1740.93   401.16    1740.17   458.80    1738.80
          490.49    1736.85   495.82    1735.97   520.07    1728.56
          542.38    1721.00   569.53    1717.20   584.37    1716.55
 ENDTABLE
 ASSURFACE 41        490.49    0.1
          23.22     584.37    0.035     0.5       1         1
 ENDTABLE
 ASDATA    41                            2.5                           2
 BTMWIDTH  FEET      40
 GRAPHICS  I
 GO,DESIGN HLCP                6                               1724.46
 SAVMOV    2    101  1                   UD1

-------------------------------------------------------------

 ***** MESSAGE - DRAINAGE AREA FROM WSDATA CONTROL BEING CONVERTED FROM
                  ACRES TO SQUARE MILES FOR COMPUTATION PURPOSES.

 ***** MESSAGE - AUXILIARY SPILLWAY CREST ELEVATION IS SET TO  1744.39
                FROM THE ASSPRFL RECORDS.


1SITES ---------------------------------------------------------------------------
 XEQ 12/15/2011          Upper Deckers Creek Site 1              WSID= 1
 VER 2005.1.05             Upper Deckers Creek Site 1              SUBW= 1
 TIME 15:20:52           SITE = UD1               PASS=    1     PART=   3


 ****************************    BASIC DATA    *********************************
 HUMID- SUBHUMID CLIMATE AREA                      DESIGN CLASS  C

 STORM DISTRIBUTION USED FOR AUXILIARY SPILLWAY IS;
 NRCS DESIGN STORM RAINFALL DISTRIBUTION  (CHAPTER 21, NEH4 & TR-60).

 PRECIP. - Q-PS,1-DAY    Q-PS,10-DAY       P-SD           P-FB
               0.00          0.00         10.01          27.30

 WSDATA -       CN          DA-SM          TC/L            -/H           QRF
             76.00          1.30          0.33           0.00          0.00

 SITEDATA- PERM POOL     CREST PS        FP SED        VALLEY FL         378?
            1724.46       1724.46       1724.46        1719.00            NO

           BASEFLOW      INITIAL EL     EXTRA VOL      SITE TYPE
               1.50          0.00          0.00         DESIGN

 PSDATA -  NO. COND        COND L         DIA/W            -/H
```

```
              1.00        290.00         30.00           0.00

              PS N            KE         WEIR L         TW EL
             0.012          0.75         15.00        1710.50

           2ND STG         ORF H          ORF L      START AUX.
              0.00          0.00          0.00        1724.46

 ASCRESTS -   AUX.1         AUX.2         AUX.3          AUX.4          AUX.5
           1744.39          0.00          0.00           0.00           0.00

 AUX.DATA -  REF.NO.    RETARD. Ci   TIE STATION    INLET LENGTH
                 41          0.00        243.50              0

 AUX.DATA - INLET N     SIDE SLOPE      EXIT N      EXIT SLOPE     ACTUAL AUX?
              0.035          2.50         0.035          0.029            NO

 BTM WIDTH -    BW1           BW2           BW3            BW4           BW5
   ft         40.00          0.00          0.00           0.00          0.00

 AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1*********************     DETAILED LIST OF BASIC DATA     *********************
 WEIR COEF. FOR ORIFICES.......... 3.10    RATIO OF Ia TO S (CH.10,NEH4). 0.20
 WEIR COEF. FOR DROP INLET........ 3.10    TIME INCS TO PEAK OF UNIT HYD.  10.
 DISCHARGE COEF. FOR ORIFICES..... 0.60    NO. POINTS FOR DESIGN HYD. ... 5000

 HOOD, WEIR INLET COEF. .......... 0.60    DRAWDOWN TIME LIMIT - DAYS.... 10.0
 HOOD, PIPE ENTRANCE COEF. ....... 0.60    DRAWDOWN RATIO STORAGE LIMIT.. 0.15
 HOOD, SLUG FLOW COEF. ........... 0.00    OTHER DRAWDOWN RATIOS APPLY ?.   NO

 PS ACCURACY OF FULL FLOW CALC.,FT 0.01    WSP ALLOWABLE FSS VEL. CHANGE. 0.05
 FILLET SIZE FOR BOX CONDUITS..... 6.00    WSP FSS CALC. PRECISION, FT.. 0.005

 GRAVITATIONAL CONSTANT........... 32.16    AUX. SPILLWAY MIN. CAP. COEF. 237.0
 MIN. NHCP378 PS PIPE AREA SQFT.. 0.545    AUX. SPILLWAY MIN. CAP. EXP.  0.493

 MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00    MIN. AUX. BW IN BW SOLUTION,FT 20.0
 MIN. NHCP378 DEPTH AUX.TO TOP DAM 2.00    PRECISION OF BW SOLUTION......  1.0
 MIN. NHCP378 DEPTH PS - AUX.CREST 1.00    OLD TR60 CRITERIA USED .......   NO
 MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00    OLD NHCP378 CRITERIA USED ....   NO

 EMBANKMENT TEMPLATE:  TOP WIDTH = (calc.),  MAX. CROWN = 0.667 ft,
 SIDE SLOPE   WAVE BERM   MULTIPLE STABILITY BERMS    SEPARATE STABILITY BERMS
    RATIOS      WIDTH      U&D/S WIDTHS   DELTA H     WIDTHS, ft   HEIGHTS, ft
   U/S  D/S       ft           ft          ft        U/S   D/S    U/S   D/S
  2.50 2.50      10.0           0.0        0.00       0.00  0.00   0.00  0.00


 DIMENSIONLESS UNIT HYDROGRAPH

 PEAK FACTOR = 484.0 | TIME INC. =0.020 | NO. INC. TO PEAK =  10.
 VOLUME FACTOR =  48.3429

      0.0000     0.0300     0.1000     0.1900     0.3100
      0.4700     0.6600     0.8200     0.9300     0.9900
      1.0000     0.9900     0.9300     0.8600     0.7800
      0.6800     0.5600     0.4600     0.3900     0.3300
      0.2800     0.2410     0.2070     0.1740     0.1470
      0.1260     0.1070     0.0910     0.0770     0.0660
      0.0550     0.0470     0.0400     0.0340     0.0290
      0.0250     0.0210     0.0180     0.0150     0.0130
      0.0110     0.0090     0.0080     0.0070     0.0060
      0.0050     0.0040     0.0030     0.0020     0.0010
      0.0000


1NRCS DESIGN STORM RAINFALL DISTRIBUTION  (CHAPTER 21, NEH4 & TR-60).

       0.000      0.008      0.016      0.025      0.033
       0.043      0.052      0.063      0.074      0.086
       0.099      0.112      0.126      0.142      0.160
       0.180      0.205      0.255      0.345      0.437
       0.530      0.603      0.633      0.660      0.684
       0.705      0.724      0.742      0.759      0.775
       0.790      0.804      0.818      0.831      0.844
       0.856      0.868      0.879      0.890      0.900
       0.910      0.920      0.930      0.939      0.948
       0.957      0.966      0.975      0.983      0.992
       1.000


1SITES ---------------------------------------------------------------------------
 XEQ 12/15/2011           Upper Deckers Creek Site 1              WSID= 1
 VER 2005.1.05              Upper Deckers Creek Site 1              SUBW= 1
 TIME 15:20:52            SITE = UD1               PASS=    1     PART=   4

MESSAGE ---- Climatic Index changed from 0.0 to 1.0 for this run.

 PERM POOL      1724.46 FT      95.3 ACFT      0.00 AC       0.0 CFS

 CREST PS       1724.46 FT      95.3 ACFT      0.00 AC       0.0 CFS

 SED ACCUM      1724.46 FT      95.3 ACFT      0.00 AC       0.0 CFS
```

```
 BASEFLOW       1724.53 FT      96.6 ACFT      0.00 AC       2.0 CFS

 START ELEV     1724.53 FT      96.6 ACFT      0.00 AC       2.0 CFS


 ******************************************************************************
 RATING TABLE DEVELOPED, SITE = UD1  :
  BY PROGRAM FOR PS AND AUX. SPILLWAYS
  AUX. RATING USED WSPVRT METHOD.


 RATING TABLE NUMBER  1
        ELEV.    Q-TOTAL    Q-PS     Q-AUX.    VOLUME     AREA
        FEET       CFS       CFS       CFS      AC-FT     ACRE
   1  1724.46      0.00      0.00      0.00     95.28      0.00
   2  1724.81      9.61      9.61      0.00    101.57      0.00
   3  1725.16     27.17     27.17      0.00    109.20      0.00
   4  1725.51     49.92     49.92      0.00    118.42      0.00
                                             FULL CONDUIT FLOW, ELEV = 1725.86 FT
   5  1725.86     76.86     76.86      0.00    127.65      0.00
   6  1732.00     90.97     90.97      0.00    302.22      0.00
   7  1738.14    103.15    103.15      0.00    519.45      0.00
   8  1744.29    114.04    114.04      0.00    782.02      0.00
   9  1750.43    123.97    123.97      0.00   1105.20      0.00
  10  1756.57    133.17    133.17      0.00   1514.46      0.00
  11  1762.71    141.77    141.77      0.00   2019.32      0.00
  12  1768.86    149.87    149.87      0.00   2630.81      0.00
  13  1775.00    157.57    157.57      0.00   3360.04      0.00

 UNCONTROLLED AREA HYDROGRAPH -  SDH PEAK         =   4704.66 CFS
                                     TIME TO PEAK =      2.54 HRS,  SITE  UD1
                                     VOLUME       =    487.81 ACFT

 ADDHYD RESULTS STAB. DESIGN HYD. -  PEAK         =  11865.36 CFS
                                     TIME TO PEAK =      2.75 HRS,  SITE  UD1
                                     VOLUME       =   1660.64 ACFT

 UNCONTROLLED AREA HYDROGRAPH -  FBH PEAK         =  15584.62 CFS
                                     TIME TO PEAK =      2.52 HRS,  SITE  UD1
                                     VOLUME       =   1657.89 ACFT

 ADDHYD RESULTS FREEBOARD HYD. -     PEAK         =  43247.77 CFS
                                     TIME TO PEAK =      2.72 HRS,  SITE  UD1
                                     VOLUME       =   5803.43 ACFT


1SITES ---------------------------------------------------------------------------
 XEQ 12/15/2011           Upper Deckers Creek Site 1              WSID= 1
 VER 2005.1.05              Upper Deckers Creek Site 1              SUBW= 1
 TIME 15:20:52            SITE = UD1               PASS=    1     PART=   5


 AUX. CREST     1744.39 FT     786.7 ACFT      0.00 AC     114.2 CFS

      PS STORAGE    691.4 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

 START ELEV     1724.53 FT      96.6 ACFT      0.00 AC       2.0 CFS

 EFFECTIVE HEIGHT(H)= 32.4 FEET,  PRODUCT=   25480. (H * STORAGE AT CREST AUX.).

 INPUT DESIGN CLASS = C

 NRCS-SDH      D=   6.00 HR    P= 10.01 IN     Q=  7.02 IN      DA=   1.30 SM
              TC=   0.33 HR   CN=  76.00     VOL=    487.8 ACFT

      PEAK =     11865.4 CFS, AT    2.8 HRS.
      ACCUMULATED SYSTEM DRAINAGE AREA =   4.65 SQUARE MILES.

 NRCS-FBH      D=   6.00 HR    P= 27.30 IN     Q= 23.84 IN      DA=   1.30 SM
              TC=   0.33 HR   CN=  76.00     VOL=   1657.9 ACFT

      PEAK =     43247.8 CFS, AT    2.7 HRS.
      ACCUMULATED SYSTEM DRAINAGE AREA =   4.65 SQUARE MILES.


 ******************************************************************************
 RATING TABLE DEVELOPED, SITE = UD1  :
  BY PROGRAM FOR PS AND AUX. SPILLWAYS
  AUX. RATING USED WSPVRT METHOD.


 RATING TABLE NUMBER  2
        ELEV.    Q-TOTAL    Q-PS     Q-AUX.    VOLUME     AREA
        FEET       CFS       CFS       CFS      AC-FT     ACRE
   1  1724.46      0.00      0.00      0.00     95.28      0.00
   2  1724.81      9.61      9.61      0.00    101.57      0.00
   3  1725.16     27.17     27.17      0.00    109.20      0.00
   4  1725.51     49.92     49.92      0.00    118.42      0.00
                                             FULL CONDUIT FLOW, ELEV = 1725.86 FT
   5  1725.86     76.86     76.86      0.00    127.65      0.00
   6  1728.17     82.48     82.48      0.00    188.80      0.00
   7  1730.49     87.72     87.72      0.00    253.00      0.00
   8  1732.81     92.66     92.66      0.00    328.52      0.00
   9  1735.12     97.35     97.35      0.00    404.71      0.00
  10  1737.44    101.83    101.83      0.00    492.74      0.00
```

```
 11  1739.76    106.12    106.12      0.00    580.76      0.00
 12  1742.07    110.24    110.24      0.00    682.89      0.00
 13  1744.39    114.21    114.21      0.00    786.67      0.00
 14  1745.92    302.87    116.76    186.10    862.60      0.00
 15  1747.45    720.61    119.26    601.35    943.42      0.00
 16  1750.21   2022.05    123.63   1898.43   1091.06      0.00
 17  1753.57   4475.06    128.76   4346.30   1304.53      0.00
 18  1759.70  12179.29    137.61  12041.68   1751.83      0.00
 19  1767.35  26701.55    147.92  26553.62   2471.96      0.00
 20  1775.00  47851.89    157.56  47694.32   3360.00      0.00
 ****************************************************************************

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH  FROM     TO   SLOPE  RETARDANCE  VEGETAL  MAINT. ROOTING  REACH
       STA     STA            CURVE      COVER    CODE   DEPTH  LOCATION
       (ft)    (ft)   (%)     INDEX@     FACTOR          (ft)     *
-----  ----    ----  ------ ----------  -------  -----  ------- --------
  1     23.     42.  -40.2     0.035       **       **     **    INLET
  2     42.     50.  -13.7     0.035       **       **     **    INLET
  3     50.     73.  -19.7     0.035       **       **     **    INLET
  4     73.     93.  -23.9     0.035       **       **     **    INLET
  5     93.    126.  -11.8     0.035       **       **     **    INLET
  6    126.    147.   -6.1     0.035       **       **     **    INLET
  7    147.    193.   -3.4     0.035       **       **     **    INLET
  8    193.    224.   -0.2     0.035       **       **     **    INLET
  9    224.    244.   -0.2     0.035       **       **     **    INLET
 10    244.    285.    2.9     0.035     0.50       1     1.0    EXIT !
 11    285.    326.    2.1     0.035     0.50       1     1.0    EXIT
 12    326.    372.    3.0     0.035     0.50       1     1.0    EXIT
 13    372.    401.    2.6     0.035     0.50       1     1.0    EXIT
 14    401.    459.    2.4     0.035     0.50       1     1.0    EXIT
 15    459.    490.    6.2     0.035     0.50       1     1.0    EXIT
 16    490.    496.   16.5     0.035     0.50       1     1.0    exit
 17    496.    520.   30.6     0.035     0.50       1     1.0    exit
 18    520.    542.   33.9     0.035     0.50       1     1.0    exit
 19    542.    557.   14.0     0.035     0.50       1     1.0    exit

 @ The program interprets retardance curve index entries of less than 1 as
   Manning's n values.
 * Upper case indicates a reach of constructed spillway channel.
** The program does not use vegetal cover factor, maintenance code, and
     rooting depth for inlet and crest reaches in computations.
 ! Reach  10 used in computing exit channel velocities.
 ****************************************************************************

ROUTED       BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS          FT        FT        ACFT      AC         FT       ACFT
NRCS-SDH          40.0   1751.16    1151.8       0.0      6.77     365.1

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =      125.     2595.     2720.

                         CRITICAL  CRITICAL   CRITICAL  25% OF Q
                           DEPTH   VELOCITY   SLOPE-Sc     Sc
          AUXILIARY         FT      FT/SEC     FT/FT     FT/FT
          SPILLWAY ---     4.59     10.99     0.012     0.015

          AUXILIARY SPILLWAY DURATION FLOW =       11.9 HOURS

          EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY=  14.9 FT/SEC
                                           EXIT SLOPE  = 0.029 FT/FT
                                           FLOW DEPTH  =   3.6 FT
         ******************************************************************

         EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
         (Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
           Aux. Spillway Discharge =    2595. cfs;   Bottom Width =    40. ft

                                                                 TOTAL  EFFECTIVE
           REACH   FROM    TO    SLOPE  MANNING`S  VELOCITY  STRESS  STRESS
            NO.    STA     STA     %        n        ft/s    lb/ft^2 lb/ft^2
            10     244.    285.   2.89   0.035      14.86      6.45   0.802
            11     285.    326.   2.13   0.035      13.40      5.18   0.644
            12     326.    372.   3.03   0.035      15.09      6.66   0.828
            13     372.    401.   2.58   0.035      14.30      5.95   0.739
            14     401.    459.   2.38   0.035      13.90      5.60   0.696
            15     459.    490.   6.15   0.035      19.12     11.05   1.373   max.
         ******************************************************************

          PLOT NRCS-SDH                  1 IN =   2000. CFS                                        EXIT SLOPE = 0.029
                                                 0.     2000.     4000.     6000.     8000.    10000.    12000.    14000.
 Time    Qin  Qout   Elev    Vol   Area  ExtVel  I         I         I         I         I         I         I         I
  0.97     3     2 1724.5    96.6   0.0   0.00   .
  1.03     8     2 1724.5    96.6   0.0   0.00   .
  1.08    19     2 1724.5    96.6   0.0   0.00   .
  1.14    34     2 1724.5    96.7   0.0   0.00   .
  1.19    59     3 1724.6    96.9   0.0   0.00   .
  1.24    82     3 1724.6    97.2   0.0   0.00   .
  1.30   110     4 1724.6    97.7   0.0   0.00   .I
  1.35   141     4 1724.6    98.2   0.0   0.00   .I
  1.41   181     6 1724.7    98.9   0.0   0.00   .I
  1.46   228     7 1724.7    99.8   0.0   0.00   .I
  1.51   283     9 1724.8   100.9   0.0   0.00   .I
  1.57   347    11 1724.8   102.2   0.0   0.00   . I
```

1.62	420	15	1724.9	103.9	0.0	0.00	. I
1.68	502	20	1725.0	105.9	0.0	0.00	. I
1.73	594	25	1725.1	108.2	0.0	0.00	. I
1.78	698	32	1725.2	111.0	0.0	0.00	. I
1.84	816	40	1725.3	114.2	0.0	0.00	. I
1.89	949	49	1725.5	117.9	0.0	0.00	. I
1.95	1106	61	1725.7	122.3	0.0	0.00	. I
2.00	1311	76	1725.8	127.4	0.0	0.00	. I
2.05	1608	77	1726.1	133.5	0.0	0.00	. I
2.11	2045	78	1726.4	141.3	0.0	0.00	. I
2.16	2670	79	1726.8	151.5	0.0	0.00	. I
2.22	3507	80	1727.3	164.9	0.0	0.00	. I
2.27	4488	82	1727.9	182.4	0.0	0.00	. I
2.32	5564	84	1728.8	204.5	0.0	0.00	. I
2.38	6718	86	1729.8	231.5	0.0	0.00	. I
2.43	7904	88	1730.8	263.7	0.0	0.00	. I
2.49	9098	91	1732.0	301.3	0.0	0.00	. I
2.54	10183	94	1733.3	343.9	0.0	0.00	. I
2.59	11061	97	1734.7	390.9	0.0	0.00	. I
2.65	11635	99	1736.1	441.1	0.0	0.00	. I
2.70	11865	102	1737.4	493.1	0.0	0.00	.P X
2.76	11852	104	1738.8	545.5	0.0	0.00	.P I
2.81	11640	107	1740.2	597.5	0.0	0.00	.P I
2.86	11272	109	1741.3	648.1	0.0	0.00	.P I
2.92	10780	111	1742.4	696.9	0.0	0.00	.P I
2.97	10122	113	1743.4	743.0	0.0	0.00	.P I
3.03	9435	114	1744.4	786.1	0.0	0.00	.P I
3.08	8716	212	1745.2	825.9	0.0	4.53	.A I
3.13	8042	302	1745.9	862.2	0.0	5.81	. A I
3.19	7421	470	1746.5	894.9	0.0	7.39	. A I
3.24	6880	622	1747.1	924.4	0.0	8.43	. A I
3.30	6411	787	1747.6	950.9	0.0	9.33	. A I
3.35	6005	996	1748.0	974.7	0.0	10.27	. A I
3.40	5649	1182	1748.4	995.8	0.0	10.99	. A I
3.46	5341	1349	1748.8	1014.7	0.0	11.56	. A I
3.51	5069	1498	1749.1	1031.6	0.0	12.02	. A I
3.57	4832	1631	1749.4	1046.7	0.0	12.40	. A I
3.62	4620	1750	1749.7	1060.2	0.0	12.73	. A I
3.67	4432	1857	1749.9	1072.4	0.0	13.00	. A I
3.73	4261	1953	1750.1	1083.3	0.0	13.24	. A I
3.78	4109	2045	1750.2	1093.0	0.0	13.45	. A I
3.84	3971	2144	1750.4	1101.7	0.0	13.68	. A I
3.89	3844	2232	1750.5	1109.4	0.0	13.88	. A I
3.94	3728	2310	1750.6	1116.1	0.0	14.04	. A I
4.00	3621	2378	1750.7	1122.1	0.0	14.19	. A I
4.05	3523	2438	1750.8	1127.3	0.0	14.31	. A I
4.11	3433	2490	1750.8	1131.8	0.0	14.41	. A I
4.16	3350	2535	1750.9	1135.7	0.0	14.50	. A I
4.21	3273	2574	1751.0	1139.1	0.0	14.58	. A I
4.27	3201	2607	1751.0	1142.0	0.0	14.64	. A I
4.32	3134	2635	1751.0	1144.4	0.0	14.70	. A I
4.38	3071	2658	1751.1	1146.4	0.0	14.74	. A I
4.43	3010	2678	1751.1	1148.1	0.0	14.78	. A I
4.48	2953	2693	1751.1	1149.4	0.0	14.81	. A I
4.54	2897	2704	1751.1	1150.4	0.0	14.83	. A
4.59	2843	2713	1751.2	1151.2	0.0	14.84	. A
4.65	2791	2718	1751.2	1151.6	0.0	14.85	. A
4.70	2740	2720	1751.2	1151.8	0.0	14.86	. X
4.75	2691	2720	1751.2	1151.8	0.0	14.86	. IA
4.81	2644	2717	1751.2	1151.6	0.0	14.85	. IA
4.86	2598	2713	1751.2	1151.1	0.0	14.84	. IA
4.92	2555	2706	1751.1	1150.6	0.0	14.83	. IA
4.97	2513	2697	1751.1	1149.8	0.0	14.82	. A
5.02	2474	2687	1751.1	1148.9	0.0	14.80	. IA
5.08	2437	2675	1751.1	1147.9	0.0	14.77	. IA
5.13	2402	2663	1751.1	1146.8	0.0	14.75	. IA
5.19	2369	2649	1751.1	1145.6	0.0	14.72	. IA
5.24	2338	2634	1751.0	1144.3	0.0	14.70	. IA
5.29	2309	2618	1751.0	1143.0	0.0	14.67	. IA
5.35	2282	2602	1751.0	1141.5	0.0	14.63	. I A
5.40	2256	2586	1751.0	1140.1	0.0	14.60	. I A
5.46	2231	2568	1751.0	1138.6	0.0	14.57	. I A
5.51	2207	2551	1750.9	1137.1	0.0	14.54	. I A
5.56	2184	2533	1750.9	1135.5	0.0	14.50	. I A
5.62	2162	2515	1750.9	1134.0	0.0	14.46	. I A
5.67	2140	2497	1750.9	1132.4	0.0	14.43	. IA
5.73	2119	2479	1750.8	1130.8	0.0	14.39	. IA
5.78	2099	2460	1750.8	1129.2	0.0	14.35	. I A
5.83	2080	2442	1750.8	1127.6	0.0	14.32	. I A
5.89	2062	2423	1750.8	1126.0	0.0	14.28	. I A
5.94	2045	2405	1750.7	1124.3	0.0	14.24	. I A
6.00	2029	2386	1750.7	1122.7	0.0	14.20	. I A
6.05	2007	2368	1750.7	1121.1	0.0	14.17	. I A
6.10	1956	2348	1750.7	1119.5	0.0	14.13	. I A
6.16	1859	2326	1750.6	1117.5	0.0	14.08	. I A
6.21	1728	2300	1750.6	1115.2	0.0	14.02	. I A
6.27	1585	2268	1750.5	1112.4	0.0	13.95	. I A
6.32	1437	2230	1750.5	1109.1	0.0	13.87	. I A
6.37	1285	2186	1750.4	1105.4	0.0	13.78	. I A
6.43	1126	2137	1750.4	1101.1	0.0	13.67	. I A
6.48	964	2083	1750.3	1096.3	0.0	13.54	. I A
6.54	810	2023	1750.2	1091.1	0.0	13.40	. I A
6.59	668	1973	1750.1	1085.5	0.0	13.29	. I A
6.64	544	1920	1750.0	1079.5	0.0	13.16	. I A
6.70	439	1865	1749.9	1073.3	0.0	13.02	. I A

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  6.75   355  1809 1749.8  1066.8   0.0  12.88   . I      A
  6.81   288  1751 1749.7  1060.3   0.0  12.73   .I       A
  6.86   234  1694 1749.5  1053.8   0.0  12.57   .I      A
  6.91   190  1637 1749.4  1047.3   0.0  12.42   .I      A
  6.97   156  1580 1749.3  1040.9   0.0  12.26   .I      A
  7.02   127  1525 1749.2  1034.6   0.0  12.10   .I      A
  7.08   105  1470 1749.1  1028.5   0.0  11.94   .I     A
  7.13    86  1417 1748.9  1022.4   0.0  11.77   .      A
  7.18    71  1366 1748.8  1016.6   0.0  11.61   .      A
  7.24    58  1315 1748.7  1010.9   0.0  11.45   .      A
  7.29    48  1267 1748.6  1005.4   0.0  11.28   .     A
  7.35    39  1219 1748.5  1000.0   0.0  11.12   .     A
  7.40    32  1174 1748.4   994.8   0.0  10.96   .     A
  7.45    27  1130 1748.3   989.8   0.0  10.80   .     A
  7.51    22  1087 1748.2   985.0   0.0  10.64   .    A
  7.56    18  1046 1748.1   980.3   0.0  10.48   .    A
 Time    Qin  Qout   Elev    Vol   Area  ExtVel  I         I         I         I         I         I         I         I
                                                  0.     2000.     4000.     6000.     8000.    10000.    12000.    14000.
        END NRCS-SDH   PLOT

ROUTED       BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS          FT        FT        ACFT      AC         FT       ACFT
NRCS-FBH          40.0   1766.09    2340.0       0.0     21.70    1553.3

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =      146.    23894.    24040.

                       CRITICAL  CRITICAL   CRITICAL  25% OF Q
                         DEPTH   VELOCITY   SLOPE-Sc     Sc
          AUXILIARY        FT      FT/SEC     FT/FT     FT/FT
          SPILLWAY ---    16.06     18.56     0.009     0.010

          AUXILIARY SPILLWAY DURATION FLOW =       13.7 HOURS
                             ATTACK, OE/B =      124.1 ACFT/FT

          EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY=  28.8 FT/SEC
                                           EXIT SLOPE  = 0.029 FT/FT
                                           FLOW DEPTH  =  11.9 FT

          PLOT NRCS-FBH                  1 IN =  10000. CFS                                        EXIT SLOPE = 0.029
                                                 0.    10000.    20000.    30000.    40000.    50000.    60000.    70000.
 Time    Qin  Qout   Elev    Vol   Area  ExtVel  I         I         I         I         I         I         I         I
  0.51    27     2 1724.5    96.6   0.0   0.00   .
  0.56    73     2 1724.5    96.6   0.0   0.00   .
  0.62   131     2 1724.5    96.9   0.0   0.00   .
  0.67   212     3 1724.6    97.3   0.0   0.00   .
  0.72   318     4 1724.6    98.0   0.0   0.00   .
  0.78   449     6 1724.7    99.2   0.0   0.00   .
  0.83   605     9 1724.8   100.9   0.0   0.00   .I
  0.89   788    13 1724.9   103.2   0.0   0.00   .I
  0.94   997    20 1725.0   106.2   0.0   0.00   .I
  0.99  1229    29 1725.2   110.1   0.0   0.00   .I
  1.05  1482    41 1725.4   114.9   0.0   0.00   .I
  1.10  1752    57 1725.6   120.7   0.0   0.00   . I
  1.16  2035    77 1725.9   127.6   0.0   0.00   . I
  1.21  2330    78 1726.2   135.8   0.0   0.00   . I
  1.26  2634    78 1726.5   145.1   0.0   0.00   .  I
  1.32  2945    79 1726.9   155.9   0.0   0.00   .  I
  1.37  3261    81 1727.4   168.0   0.0   0.00   .  I
  1.43  3581    82 1727.9   181.5   0.0   0.00   .   I
  1.48  3905    83 1728.5   196.4   0.0   0.00   .   I
  1.53  4236    84 1729.1   212.7   0.0   0.00   .   I
  1.59  4578    86 1729.8   230.5   0.0   0.00   .    I
  1.64  4936    87 1730.4   249.7   0.0   0.00   .    I
  1.70  5316    89 1731.0   270.6   0.0   0.00   .    I
  1.75  5726    90 1731.7   293.1   0.0   0.00   .     I
  1.80  6174    92 1732.5   317.3   0.0   0.00   .     I
  1.86  6676    94 1733.3   343.4   0.0   0.00   .      I
  1.91  7238    95 1734.1   371.7   0.0   0.00   .      I
  1.97  7933    97 1735.1   402.3   0.0   0.00   .       I
  2.02  8894    99 1735.9   435.7   0.0   0.00   .        I
  2.07 10317   101 1736.9   472.8   0.0   0.00   .         I
  2.13 12371   103 1738.0   515.2   0.0   0.00   .           I
  2.18 15200   105 1739.4   565.4   0.0   0.00   .              I
  2.24 18714   108 1740.8   626.4   0.0   0.00   .                  I
  2.29 22592   111 1742.5   701.6   0.0   0.00   .                     I
  2.34 26643   131 1744.5   793.3   0.0   2.25*  .                        I
  2.40 30756   505 1746.7   901.7   0.0   7.65   .A                           I
  2.45 34693  1444 1749.0  1025.4   0.0  11.86   .A                              I
  2.51 38247  2836 1751.3  1161.9   0.0  15.07   .  A                               I
  2.56 41034  4539 1753.6  1308.2   0.0  17.60   .    A                                I
  2.61 42776  7137 1755.8  1459.1   0.0  20.28   .      A                                I
  2.67 43248  9711 1757.8  1608.5   0.0  22.25   .         A                             X
  2.72 42561 12176 1759.7  1751.6   0.0  23.78   .           A                           I
  2.78 41073 14821 1761.2  1882.8   0.0  25.17   .              A                       I
  2.83 39131 17146 1762.5  1998.1   0.0  26.23   .                A                     I
  2.88 36731 19123 1763.6  2096.2   0.0  27.05   .                  A                 I
  2.94 34163 20743 1764.5  2176.5   0.0  27.67   .                    A            I
  2.99 31472 22009 1765.1  2239.3   0.0  28.14   .                     A       I
  3.05 28878 22940 1765.6  2285.4   0.0  28.46   .                      A     I
  3.10 26446 23563 1765.9  2316.3   0.0  28.67   .                       A I
  3.15 24269 23916 1766.0  2333.8   0.0  28.79   .                       A
  3.21 22361 24040 1766.1  2340.0   0.0  28.83   .                     I X
  3.26 20715 23978 1766.1  2336.9   0.0  28.81   .                   I  A
  3.32 19277 23768 1766.0  2326.5   0.0  28.74   .                  I    A
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3.37 18028 23443 1765.8  2310.4   0.0  28.63   .                 I    A
3.42 16949 23030 1765.6  2289.9   0.0  28.49   .                I     A
3.48 16012 22553 1765.4  2266.2   0.0  28.33   .               I      A
3.53 15188 22030 1765.1  2240.3   0.0  28.14   .              I      A
3.59 14463 21476 1764.9  2212.9   0.0  27.94   .             I      A
3.64 13815 20904 1764.5  2184.4   0.0  27.73   .             I      A
3.69 13236 20321 1764.2  2155.6   0.0  27.52   .            I      A
3.75 12713 19736 1763.9  2126.5   0.0  27.29   .            I      A
3.80 12241 19153 1763.6  2097.7   0.0  27.06   .           I      A
3.86 11810 18579 1763.3  2069.2   0.0  26.83   .           I      A
3.91 11418 18014 1763.0  2041.2   0.0  26.60   .          I      A
3.96 11061 17463 1762.7  2013.8   0.0  26.37   .          I     A
4.02 10735 16927 1762.4  1987.3   0.0  26.14   .          I     A
4.07 10436 16408 1762.1  1961.5   0.0  25.91   .         I     A
4.13 10161 15906 1761.8  1936.6   0.0  25.68   .         I     A
4.18  9908 15423 1761.5  1912.7   0.0  25.45   .         I    A
4.23  9674 14959 1761.3  1889.7   0.0  25.23   .         I    A
4.29  9455 14514 1761.0  1867.6   0.0  25.02   .        I     A
4.34  9250 14088 1760.8  1846.5   0.0  24.80   .        I    A
4.40  9056 13680 1760.6  1826.2   0.0  24.59   .        I    A
4.45  8870 13290 1760.4  1806.9   0.0  24.39   .        I   A
4.50  8690 12917 1760.1  1788.4   0.0  24.19   .        I   A
4.56  8517 12561 1759.9  1770.8   0.0  23.99   .        I   A
4.61  8350 12220 1759.7  1753.9   0.0  23.80   .       I   A
4.67  8188 11934 1759.5  1737.6   0.0  23.64   .       I   A
4.72  8032 11663 1759.3  1721.8   0.0  23.48   .       I   A
4.77  7882 11400 1759.1  1706.6   0.0  23.33   .       I  A
4.83  7738 11145 1758.9  1691.8   0.0  23.17   .       I  A
4.88  7600 10898 1758.7  1677.4   0.0  23.02   .       I  A
4.94  7469 10659 1758.5  1663.6   0.0  22.87   .      I   A
4.99  7345 10428 1758.4  1650.1   0.0  22.72   .      I  A
5.04  7228 10204 1758.2  1637.2   0.0  22.58   .      I  A
5.10  7118  9988 1758.0  1624.6   0.0  22.44   .      I  A
5.15  7015  9780 1757.9  1612.5   0.0  22.30   .      I  A
5.21  6919  9579 1757.7  1600.9   0.0  22.16   .      I  A
5.26  6828  9386 1757.6  1589.6   0.0  22.02   .      I A
5.31  6743  9200 1757.4  1578.8   0.0  21.89   .      I A
5.37  6661  9021 1757.3  1568.5   0.0  21.77   .      I A
5.42  6584  8849 1757.2  1558.5   0.0  21.64   .      I A
5.48  6510  8685 1757.0  1548.9   0.0  21.52   .      I A
5.53  6438  8526 1756.9  1539.7   0.0  21.40   .     I  A
5.58  6369  8374 1756.8  1530.9   0.0  21.29   .     I A
5.64  6302  8229 1756.7  1522.4   0.0  21.17   .     I A
5.69  6236  8088 1756.6  1514.3   0.0  21.06   .     I A
5.75  6173  7954 1756.5  1506.5   0.0  20.96   .     I A
5.80  6112  7824 1756.4  1499.0   0.0  20.85   .     I A
5.85  6055  7700 1756.3  1491.7   0.0  20.75   .     I A
5.91  6001  7580 1756.2  1484.8   0.0  20.65   .     I A
5.96  5950  7465 1756.1  1478.1   0.0  20.56   .     IA
6.02  5899  7355 1756.0  1471.7   0.0  20.46   .     IA
6.07  5804  7249 1755.9  1465.6   0.0  20.37   .     IA
6.12  5589  7146 1755.8  1459.6   0.0  20.29   .     IA
6.18  5238  7038 1755.8  1453.3   0.0  20.19   .    I A
6.23  4799  6918 1755.7  1446.4   0.0  20.09   .    I A
6.29  4321  6777 1755.6  1438.2   0.0  19.96   .   I  A
6.34  3825  6613 1755.4  1428.7   0.0  19.81   .   I  A
6.39  3324  6425 1755.3  1417.8   0.0  19.63   .  I  A
6.45  2836  6214 1755.1  1405.5   0.0  19.43   .  I  A
6.50  2377  5982 1755.0  1392.0   0.0  19.20   . I   A
6.56  1961  5732 1754.7  1377.5   0.0  18.95   . I   A
6.61  1600  5469 1754.5  1362.2   0.0  18.67   . I  A
6.66  1299  5196 1754.2  1346.4   0.0  18.37   .I   A
6.72  1057  4918 1754.0  1330.3   0.0  18.06   .I   A
6.77   862  4641 1753.7  1314.2   0.0  17.72   .I   A
6.83   699  4403 1753.5  1298.3   0.0  17.43   .I  A
6.88   571  4222 1753.2  1282.5   0.0  17.19   .I  A
6.93   466  4043 1753.0  1266.9   0.0  16.95   .   A
6.99   384  3867 1752.7  1251.6   0.0  16.71   .   A
7.04   316  3695 1752.5  1236.6   0.0  16.46   .   A
7.10   261  3527 1752.3  1222.1   0.0  16.21   .   A
7.15   214  3365 1752.0  1208.0   0.0  15.96   .  A
7.20   177  3209 1751.8  1194.3   0.0  15.71   .  A
7.26   146  3058 1751.6  1181.2   0.0  15.46   .  A
7.31   121  2913 1751.4  1168.6   0.0  15.21   .  A
7.37   100  2774 1751.2  1156.5   0.0  14.96   .  A
7.42    82  2641 1751.1  1144.9   0.0  14.71   .  A
7.47    68  2514 1750.9  1133.8   0.0  14.46   .  A
7.53    56  2392 1750.7  1123.2   0.0  14.22   . A
7.58    46  2275 1750.6  1113.1   0.0  13.97   . A
7.64    38  2164 1750.4  1103.4   0.0  13.73   . A
7.69    31  2058 1750.3  1094.2   0.0  13.49   . A
7.74    25  1972 1750.1  1085.3   0.0  13.28   . A
7.80    20  1897 1750.0  1076.8   0.0  13.10   . A
7.85    17  1824 1749.8  1068.6   0.0  12.92   . A
7.91    14  1755 1749.7  1060.7   0.0  12.74   . A
7.96    12  1688 1749.5  1053.1   0.0  12.56   . A
8.01    10  1623 1749.4  1045.8   0.0  12.38   . A
8.07     8  1561 1749.3  1038.7   0.0  12.20   . A
8.12     6  1501 1749.1  1031.9   0.0  12.03   . A
8.18     5  1443 1749.0  1025.4   0.0  11.85   .A
8.23     4  1388 1748.9  1019.1   0.0  11.68   .A
8.28     3  1334 1748.8  1013.1   0.0  11.51   .A
8.34     2  1283 1748.7  1007.2   0.0  11.34   .A
8.39     2  1234 1748.6  1001.6   0.0  11.17   .A
8.45     1  1186 1748.5   996.2   0.0  11.00   .A
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   8.50     1  1141 1748.4   991.0   0.0  10.84   .A
   8.55     0  1097 1748.3   986.1   0.0  10.67   .A
   8.61     1  1054 1748.2   981.3   0.0  10.51   .A
   8.66     0  1014 1748.1   976.7   0.0  10.35   .A
   8.72     1   974 1748.0   972.2   0.0  10.18   .A
   8.77     0   937 1747.9   968.0   0.0  10.02   .A
   8.82     1   901 1747.8   963.9   0.0   9.87   .A
   8.88     0   866 1747.8   959.9   0.0   9.71   .A
   8.93     1   833 1747.7   956.1   0.0   9.55   .A
   8.99     0   801 1747.6   952.5   0.0   9.40   .A
   9.04     1   770 1747.6   949.0   0.0   9.24   .A
   9.09     0   740 1747.5   945.6   0.0   9.09   .A
   9.15     1   715 1747.4   942.4   0.0   8.96   .A
   9.20     0   699 1747.4   939.2   0.0   8.87   .A
   9.26     1   683 1747.3   936.1   0.0   8.78   .A
  Time    Qin  Qout   Elev    Vol   Area  ExtVel  I         I         I         I         I         I         I         I
                                                  0.    10000.    20000.    30000.    40000.    50000.    60000.    70000.
        END NRCS-FBH   PLOT

 Inflow Hyd 1 SDH-Peak =       2720.21 CFS  at    4.70 hrs.,  Location Point

 Inflow Hyd 1 FBH-Peak =      24040.32 CFS  at    3.16 hrs.,  Location Point
HYDOUT   1     UD1

1SITES....JOB NO.  1 COMPLETE.
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 1             Upper Deckers Creek Site 1

       2 SUBWATERSHED(S) ANALYZED.

       1 STRUCTURE(S) ANALYZED.

       2 HYDROGRAPHS ROUTED AT LOWEST SITE.

       0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

 ******************************************************************************



 SITES.....COMPUTATIONS COMPLETE


1                              SUMMARY TABLE  1          SITES VERSION 2005.1.05
                              ----------------                DATED 01/01/2005


 WATERSHED ID                       RUN DATE                           RUN TIME
 ------------                       --------                           --------
 1                                 12/15/2011                          15:20:52

 >>>   SITE   SUBWS   SUBWS DA   CURVE    TC   TOTAL DA   TYPE    STRUC    <<<
        ID      ID     (SQ MI)    NO.    (HRS)  (SQ MI)  DESIGN   CLASS
       -----   ----   --------   -----   ----   -------   -----   -----
       UD1      1         1.30     76.   0.33      4.65    TR60     C

 PASS  DIA./  AUX.CREST  BTM.  MAX.    MAX.    EMB.  INTEGR.*  EXIT*    TYPE
  NO.  WIDTH    ELEV    WIDTH   HP     ELEV    VOL.   DIST.     VEL.     HYD
     (IN/FT)   (FT)     (FT)  (FT)    (FT)    (CY)   (FT)   (FT/SEC)
 ----  -----  -------  ------  ----  -------  -------  -----  ------  ---------
    1   30.0   1744.4    40.0  21.7   1766.1       0.     0.    28.8  NRCS-FBH


 *  INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED
    HYDROGRAPH SHOWN UNDER TYPE HYD.



 SITES.......SUMMARY TABLE 1 COMPLETED.


                     NRCS  SITES    VERSION 2005.1.05 ,01/01/2005
                              1        FILES

INPUT  = W:\426\Active Jobs\51995 - WV NRCS\05 Working\Upper Deckers Creek Site 1\Item 4 H&H Prop\SITES\SITES MODELS REVISED
DATED 10.28.11\SITES MODELS\UDC1Existing\UD1_Estimating_TOD_Crest_6Hr_PMP_NRCS_STD_Distribn.D2C
OUTPUT = W:\426\Active Jobs\51995 - WV NRCS\05 Working\Upper Deckers Creek Site 1\Item 4 H&H Prop\SITES\SITES MODELS REVISED
DATED 10.28.11\SITES MODELS\UDC1Existing\UD1_Estimating_TOD_Crest_6Hr_PMP_NRCS_STD_Distribn.OUT
         DATED 12/15/2011 15:20:52

                           GRAPHICS FILES GENERATED

OPTION "L"  = W:\426\Active Jobs\51995 - WV NRCS\05 Working\Upper Deckers Creek Site 1\Item 4 H&H Prop\SITES\SITES MODELS REVISED
DATED 10.28.11\SITES MODELS\UDC1Existing\UD1_Estimating_TOD_Crest_6Hr_PMP_NRCS_STD_Distribn.DRG DATED 12/15/2011 15:20:52

OPTION "P"  = W:\426\Active Jobs\51995 - WV NRCS\05 Working\Upper Deckers Creek Site 1\Item 4 H&H Prop\SITES\SITES MODELS REVISED
DATED 10.28.11\SITES MODELS\UDC1Existing\UD1_Estimating_TOD_Crest_6Hr_PMP_NRCS_STD_Distribn.DHY DATED 12/15/2011 15:20:52

OPTION "E"  = W:\426\Active Jobs\51995 - WV NRCS\05 Working\Upper Deckers Creek Site 1\Item 4 H&H Prop\SITES\SITES MODELS REVISED
DATED 10.28.11\SITES MODELS\UDC1Existing\UD1_Estimating_TOD_Crest_6Hr_PMP_NRCS_STD_Distribn.DEM DATED 12/15/2011 15:20:52
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HEC-RAS River: Deckers Creek Reach: Reach-1 Profile: Max WS

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	48699	Max WS	PMF Breach	35079.85	1721.46	1762.02		1762.07	0.000013	1.78	23938.25	752.30	0.05
Reach-1	48699	Max WS	Sunny Day	200.00	1721.46	1744.30		1744.30	0.000000	0.02	11278.90	623.72	0.00
Reach-1	48698	Max WS	PMF Breach	35079.32	1721.46	1762.02	1728.38	1762.07	0.000013	1.78	23938.25	752.30	0.05
Reach-1	48698	Max WS	Sunny Day	200.00	1721.46	1744.30		1744.30	0.000000	0.02	11278.90	623.72	0.00
Reach-1	48526			Inl Struct									
Reach-1	48300	Max WS	PMF Breach	47897.18	1705.56	1728.85	1728.87	1734.45	0.018653	29.08	2693.64	371.83	1.08
Reach-1	48300	Max WS	Sunny Day	11529.61	1705.56	1723.53		1724.66	0.005493	13.19	1536.83	316.34	0.56
Reach-1	48115	Max WS	PMF Breach	48006.89	1704.77	1726.82		1728.60	0.009619	18.73	4958.57	515.01	0.71
Reach-1	48115	Max WS	Sunny Day	10837.37	1704.77	1723.56		1723.78	0.001678	7.01	3333.33	481.78	0.29
Reach-1	47831	Max WS	PMF Breach	47876.70	1703.84	1725.51		1726.40	0.005078	14.23	7343.84	788.69	0.55
Reach-1	47831	Max WS	Sunny Day	9065.55	1703.84	1723.40		1723.45	0.000394	3.70	5712.22	757.69	0.15
Reach-1	47305	Max WS	PMF Breach	47210.54	1703.82	1723.49		1724.21	0.002885	9.42	7446.68	797.07	0.38
Reach-1	47305	Max WS	Sunny Day	14067.85	1703.82	1719.60		1719.79	0.001351	5.53	4422.71	756.13	0.25
Reach-1	46762	Max WS	PMF Breach	46106.34	1701.07	1722.32		1722.77	0.002203	9.46	9137.46	948.55	0.37
Reach-1	46762	Max WS	Sunny Day	15361.78	1701.07	1716.49		1716.83	0.003062	8.93	3967.64	827.56	0.41
Reach-1	46373	Max WS	PMF Breach	45688.09	1700.00	1721.88		1722.11	0.001047	6.85	12658.51	1348.89	0.26
Reach-1	46373	Max WS	Sunny Day	14200.94	1700.00	1715.68		1715.84	0.001475	6.44	5093.00	1094.77	0.29
Reach-1	46339			Culvert									
Reach-1	46302	Max WS	PMF Breach	45688.09	1699.87	1721.88		1722.06	0.000864	6.20	13758.56	1432.19	0.24
Reach-1	46302	Max WS	Sunny Day	14200.94	1699.87	1715.68		1715.81	0.001139	5.66	5700.50	1168.01	0.26
Reach-1	45870	Max WS	PMF Breach	45285.56	1699.41	1721.29		1721.57	0.001458	7.76	10890.74	1181.03	0.30
Reach-1	45870	Max WS	Sunny Day	13580.53	1699.41	1714.88		1715.09	0.002105	7.36	4192.72	915.85	0.33
Reach-1	45507	Max WS	PMF Breach	44911.19	1699.50	1720.73		1721.04	0.001469	7.57	10381.34	1089.97	0.29
Reach-1	45507	Max WS	Sunny Day	13122.10	1699.50	1714.20		1714.38	0.001873	6.64	4140.48	841.11	0.31
Reach-1	45092	Max WS	PMF Breach	44566.34	1699.00	1720.37		1720.55	0.000891	6.49	14144.66	1578.58	0.25
Reach-1	45092	Max WS	Sunny Day	11110.89	1699.00	1713.56		1713.67	0.000984	5.23	5046.82	1135.54	0.25
Reach-1	45071			Culvert									
Reach-1	45041	Max WS	PMF Breach	44566.34	1698.87	1720.35		1720.51	0.000859	6.23	14850.60	1687.81	0.24
Reach-1	45041	Max WS	Sunny Day	8640.79	1698.87	1712.59		1712.69	0.001119	5.23	4024.60	1042.01	0.25

HEC-RAS River: Deckers Creek Reach: Reach-1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	44463	Max WS	PMF Breach	44529.70	1698.51	1719.89		1720.06	0.000696	5.71	13737.20	1196.03	0.22
Reach-1	44463	Max WS	Sunny Day	7603.63	1698.51	1712.24		1712.28	0.000380	3.11	5264.08	1003.78	0.15
Reach-1	43942	Max WS	PMF Breach	44324.19	1698.90	1719.29		1719.58	0.001177	7.29	10622.26	922.17	0.29
Reach-1	43942	Max WS	Sunny Day	6886.27	1698.90	1712.03		1712.07	0.000383	3.06	4452.21	766.72	0.15
Reach-1	43500	Max WS	PMF Breach	43442.01	1698.54	1717.05		1718.13	0.005829	14.98	5584.54	552.94	0.62
Reach-1	43500	Max WS	Sunny Day	6046.93	1698.54	1711.80		1711.88	0.000711	4.15	2963.63	456.56	0.21
Reach-1	43140	Max WS	PMF Breach	41696.61	1698.10	1715.63	1711.36	1716.24	0.004121	11.86	7228.20	873.24	0.51
Reach-1	43140	Max WS	Sunny Day	8150.48	1698.10	1710.68	1709.15	1710.80	0.001378	5.45	3391.98	691.83	0.28
Reach-1	43103			Bridge									
Reach-1	43078	Max WS	PMF Breach	41696.61	1696.85	1715.26		1715.86	0.004144	12.70	7281.79	921.99	0.53
Reach-1	43078	Max WS	Sunny Day	8080.50	1696.85	1708.11		1708.83	0.008342	12.88	1811.87	639.30	0.69
Reach-1	42513	Max WS	PMF Breach	40265.16	1696.42	1714.39		1714.45	0.000345	3.34	20624.31	1878.43	0.14
Reach-1	42513	Max WS	Sunny Day	4372.04	1696.42	1705.89		1705.92	0.000561	2.74	3462.33	1628.56	0.16
Reach-1	41994	Max WS	PMF Breach	40224.89	1696.00	1714.18		1714.26	0.000429	3.79	18260.10	1686.79	0.16
Reach-1	41994	Max WS	Sunny Day	4261.94	1696.00	1705.70		1705.72	0.000249	1.87	4544.56	1277.26	0.11
Reach-1	41471	Max WS	PMF Breach	39779.99	1695.50	1713.80		1713.93	0.000849	5.60	14078.35	1474.01	0.23
Reach-1	41471	Max WS	Sunny Day	4166.55	1695.50	1705.49		1705.52	0.000530	2.90	3202.34	1010.40	0.17
Reach-1	41030	Max WS	PMF Breach	39377.67	1694.45	1713.36	1707.35	1713.52	0.001062	6.59	13074.95	1497.02	0.27
Reach-1	41030	Max WS	Sunny Day	4070.57	1694.45	1705.10	1703.01	1705.19	0.001068	4.46	2145.15	882.10	0.24
Reach-1	41001			Bridge									
Reach-1	40972	Max WS	PMF Breach	39377.67	1694.20	1713.19		1713.37	0.001337	7.21	12001.24	1400.90	0.29
Reach-1	40972	Max WS	Sunny Day	3981.95	1694.20	1704.41		1704.65	0.003580	7.71	1398.20	753.91	0.43
Reach-1	40541	Max WS	PMF Breach	38959.10	1693.79	1712.73		1712.88	0.000945	6.06	12952.46	1329.31	0.25
Reach-1	40541	Max WS	Sunny Day	3916.48	1693.79	1703.59		1703.64	0.000863	3.67	2339.56	866.76	0.21
Reach-1	39904	Max WS	PMF Breach	38533.70	1694.16	1712.06		1712.23	0.001130	6.25	12272.08	1366.46	0.26
Reach-1	39904	Max WS	Sunny Day	3802.99	1694.16	1703.03		1703.08	0.000959	3.56	2445.05	724.28	0.21
Reach-1	39428	Max WS	PMF Breach	37839.05	1693.54	1710.96		1711.36	0.002623	9.55	7878.96	871.60	0.41
Reach-1	39428	Max WS	Sunny Day	3775.96	1693.54	1702.57		1702.63	0.000965	3.70	2144.37	520.79	0.22

HEC-RAS River: Deckers Creek Reach: Reach-1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	39144	Max WS	PMF Breach	37055.79	1692.58	1710.09	1704.70	1710.59	0.002930	10.12	7056.86	766.79	0.43
Reach-1	39144	Max WS	Sunny Day	3732.52	1692.58	1702.24	1701.01	1702.33	0.001247	4.36	1916.23	557.58	0.25
Reach-1	39123			Bridge									
Reach-1	39101	Max WS	PMF Breach	36152.06	1691.33	1709.72		1710.28	0.003288	11.18	6663.86	756.93	0.47
Reach-1	39101	Max WS	Sunny Day	3653.62	1691.33	1701.41		1701.65	0.002696	6.62	1378.78	485.66	0.38
Reach-1	38822	Max WS	PMF Breach	35651.09	1690.92	1709.37		1709.57	0.001273	6.87	10373.83	1098.06	0.29
Reach-1	38822	Max WS	Sunny Day	3550.17	1690.92	1700.91		1701.01	0.001656	5.09	1963.53	865.29	0.29
Reach-1	38500	Max WS	PMF Breach	35148.25	1690.63	1708.98		1709.23	0.000933	5.85	9129.81	959.59	0.24
Reach-1	38500	Max WS	Sunny Day	3434.25	1690.63	1700.54		1700.60	0.000879	3.72	1979.72	727.54	0.21
Reach-1	37982	Max WS	PMF Breach	34626.05	1690.51	1708.67		1708.78	0.000861	5.64	16031.84	1715.32	0.24
Reach-1	37982	Max WS	Sunny Day	3206.37	1690.51	1700.17		1700.21	0.000672	3.24	2903.08	1336.61	0.19
Reach-1	37525	Max WS	PMF Breach	34148.59	1689.41	1708.26		1708.33	0.001016	6.15	18904.97	2185.31	0.25
Reach-1	37525	Max WS	Sunny Day	2901.43	1689.41	1699.64		1699.72	0.001606	5.11	2908.07	1396.32	0.28
Reach-1	37000	Max WS	PMF Breach	33471.29	1688.93	1707.75		1707.86	0.000859	5.76	14221.34	1695.37	0.24
Reach-1	37000	Max WS	Sunny Day	2693.93	1688.93	1699.13		1699.16	0.000562	3.08	2838.11	987.70	0.17
Reach-1	36556	Max WS	PMF Breach	32528.36	1688.78	1707.04		1707.24	0.002110	9.23	12853.61	1671.83	0.39
Reach-1	36556	Max WS	Sunny Day	2630.47	1688.78	1698.86		1698.91	0.000660	3.43	3133.99	860.24	0.19
Reach-1	35962	Max WS	PMF Breach	31037.59	1690.21	1705.87		1706.12	0.001792	7.94	9474.79	1200.38	0.36
Reach-1	35962	Max WS	Sunny Day	2594.16	1690.21	1698.33		1698.41	0.001109	4.00	2052.12	775.09	0.25
Reach-1	35511	Max WS	PMF Breach	30724.51	1689.94	1705.06		1705.26	0.001950	7.50	9444.32	1428.46	0.35
Reach-1	35511	Max WS	Sunny Day	2019.79	1689.94	1697.40		1697.49	0.001863	4.45	1348.84	681.11	0.30
Reach-1	34985	Max WS	PMF Breach	30492.91	1688.89	1704.29		1704.45	0.001142	6.13	9938.51	1171.48	0.28
Reach-1	34985	Max WS	Sunny Day	1634.09	1688.89	1697.00		1697.01	0.000174	1.55	2632.26	849.52	0.10
Reach-1	34551	Max WS	PMF Breach	20367.36	1688.18	1704.12		1704.17	0.000337	3.30	11876.41	1450.71	0.15
Reach-1	34551	Max WS	Sunny Day	1600.15	1688.18	1696.92		1696.94	0.000192	1.64	2521.69	1076.00	0.10
Reach-1	34078	Max WS	PMF Breach	19731.27	1687.66	1703.98		1704.03	0.000270	3.12	12315.09	1614.87	0.14
Reach-1	34078	Max WS	Sunny Day	1589.34	1687.66	1696.87		1696.88	0.000064	1.02	3165.62	893.52	0.06
Reach-1	33600	Max WS	PMF Breach	19446.36	1686.75	1703.83		1703.89	0.000335	3.51	10426.85	1686.18	0.15
Reach-1	33600	Max WS	Sunny Day	1582.21	1686.75	1696.83		1696.84	0.000089	1.27	2775.71	867.09	0.07

HEC-RAS River: Deckers Creek Reach: Reach-1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	33172	Max WS	PMF Breach	19200.06	1686.67	1703.77	1695.71	1703.80	0.000091	1.86	16755.88	2339.94	0.08
Reach-1	33172	Max WS	Sunny Day	1579.43	1686.67	1696.81	1692.99	1696.81	0.000032	0.78	4620.98	1615.55	0.04
Reach-1	33108			Bridge									
Reach-1	33032	Max WS	PMF Breach	19200.06	1686.42	1703.72		1703.75	0.000134	2.25	13269.40	2092.59	0.10
Reach-1	33032	Max WS	Sunny Day	1410.87	1686.42	1694.81		1694.85	0.000472	2.55	1261.77	886.58	0.16
Reach-1	32492	Max WS	PMF Breach	18989.93	1684.06	1703.63		1703.67	0.000196	2.61	11842.33	1575.08	0.11
Reach-1	32492	Max WS	Sunny Day	1387.33	1684.06	1694.58		1694.61	0.000379	2.37	1058.00	384.29	0.13
Reach-1	32090	Max WS	PMF Breach	18976.38	1682.60	1703.58		1703.61	0.000105	2.05	13726.60	1402.71	0.08
Reach-1	32090	Max WS	Sunny Day	1380.90	1682.60	1694.51		1694.52	0.000076	1.16	2305.45	821.99	0.06
Reach-1	32027			Culvert									
Reach-1	31966	Max WS	PMF Breach	18976.38	1682.51	1703.55		1703.58	0.000107	2.05	13626.27	1420.79	0.08
Reach-1	31966	Max WS	Sunny Day	1360.02	1682.51	1694.49		1694.50	0.000081	1.19	2340.76	898.92	0.06
Reach-1	31491	Max WS	PMF Breach	18952.00	1683.79	1703.51		1703.53	0.000102	2.06	15877.30	1549.85	0.08
Reach-1	31491	Max WS	Sunny Day	1324.54	1683.79	1694.46		1694.47	0.000053	0.97	3505.54	1251.52	0.05
Reach-1	31011	Max WS	PMF Breach	18844.62	1683.82	1703.46		1703.49	0.000102	1.98	15447.88	1466.89	0.08
Reach-1	31011	Max WS	Sunny Day	1318.65	1683.82	1694.44		1694.45	0.000039	0.80	3485.23	999.50	0.04
Reach-1	30408	Max WS	PMF Breach	18839.77	1684.54	1703.35		1703.39	0.000224	2.89	11628.34	1329.29	0.12
Reach-1	30408	Max WS	Sunny Day	1299.64	1684.54	1694.41		1694.41	0.000081	1.11	2209.38	567.37	0.06
Reach-1	29854	Max WS	PMF Breach	18831.34	1685.15	1703.07		1703.19	0.000558	4.37	7038.96	830.17	0.18
Reach-1	29854	Max WS	Sunny Day	1295.22	1685.15	1694.30		1694.32	0.000265	1.91	1259.53	336.16	0.11
Reach-1	29508	Max WS	PMF Breach	18823.55	1685.90	1702.52	1700.37	1702.84	0.001881	8.35	5273.73	1149.23	0.37
Reach-1	29508	Max WS	Sunny Day	1293.53	1685.90	1693.90	1689.94	1694.11	0.001410	4.35	387.40	70.23	0.28
Reach-1	29454			Bridge									
Reach-1	29399	Max WS	PMF Breach	6480.67	1685.65	1701.08		1701.08	0.000041	1.19	9945.03	1238.25	0.05
Reach-1	29399	Max WS	Sunny Day	1270.22	1685.65	1692.64		1692.92	0.002027	4.92	353.16	533.08	0.33
Reach-1	29011	Max WS	PMF Breach	6253.27	1683.92	1701.07		1701.07	0.000020	0.84	12281.95	1798.84	0.04
Reach-1	29011	Max WS	Sunny Day	1264.28	1683.92	1692.34		1692.35	0.000134	1.31	1988.43	740.78	0.08
Reach-1	28715	Max WS	PMF Breach	6250.78	1682.92	1701.07	1692.18	1701.07	0.000012	0.66	15293.81	1831.47	0.03
Reach-1	28715	Max WS	Sunny Day	1263.78	1682.92	1692.18	1689.14	1692.26	0.000637	2.83	606.00	919.16	0.18

HEC-RAS River: Deckers Creek Reach: Reach-1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	28666			Bridge									
Reach-1	28596	Max WS	PMF Breach	6147.51	1682.67	1701.05		1701.06	0.000011	0.65	15857.23	1860.76	0.03
Reach-1	28596	Max WS	Sunny Day	816.60	1682.67	1690.36		1690.42	0.000566	2.54	514.07	918.05	0.17
Reach-1	28000	Max WS	PMF Breach	6142.46	1681.87	1701.05		1701.05	0.000006	0.50	19199.46	2062.34	0.02
Reach-1	28000	Max WS	Sunny Day	737.13	1681.87	1690.22		1690.22	0.000044	0.76	2153.64	1146.86	0.05
Reach-1	27501	Max WS	PMF Breach	6137.64	1681.41	1701.05		1701.05	0.000003	0.36	24654.13	2362.99	0.01
Reach-1	27501	Max WS	Sunny Day	729.62	1681.41	1690.21		1690.21	0.000014	0.44	3543.70	1497.61	0.03
Reach-1	27000	Max WS	PMF Breach	6131.93	1682.33	1701.05		1701.05	0.000003	0.33	24589.97	2413.69	0.01
Reach-1	27000	Max WS	Sunny Day	728.66	1682.33	1690.21		1690.21	0.000007	0.28	4450.85	1436.43	0.02
Reach-1	26475	Max WS	PMF Breach	6123.72	1681.30	1701.05		1701.05	0.000003	0.34	22473.59	2021.36	0.01
Reach-1	26475	Max WS	Sunny Day	727.76	1681.30	1690.20		1690.20	0.000006	0.27	4054.12	1049.00	0.02
Reach-1	26010	Max WS	PMF Breach	6117.16	1681.87	1701.05		1701.05	0.000008	0.60	13362.86	1138.66	0.02
Reach-1	26010	Max WS	Sunny Day	726.56	1681.87	1690.20		1690.20	0.000020	0.52	2215.11	601.41	0.03
Reach-1	25567	Max WS	PMF Breach	6111.23	1682.17	1701.04	1689.07	1701.04	0.000019	0.92	9440.32	1204.93	0.04
Reach-1	25567	Max WS	Sunny Day	723.38	1682.17	1690.18	1685.39	1690.18	0.000056	0.85	1332.20	390.08	0.06
Reach-1	25524			Bridge									
Reach-1	25479	Max WS	PMF Breach	6111.23	1681.92	1701.03		1701.04	0.000017	0.86	9890.80	1129.43	0.04
Reach-1	25479	Max WS	Sunny Day	723.38	1681.92	1690.12		1690.12	0.000052	0.80	1508.46	543.31	0.05
Reach-1	25110	Max WS	PMF Breach	6073.40	1681.77	1701.02		1701.03	0.000033	1.20	9507.33	1004.68	0.05
Reach-1	25110	Max WS	Sunny Day	722.32	1681.77	1690.10		1690.10	0.000067	0.94	1868.75	533.80	0.06
Reach-1	24742	Max WS	PMF Breach	6071.80	1681.98	1701.01		1701.02	0.000043	1.34	9714.48	749.25	0.06
Reach-1	24742	Max WS	Sunny Day	721.36	1681.98	1690.08		1690.08	0.000051	0.79	2201.80	560.76	0.05
Reach-1	24249	Max WS	PMF Breach	6068.88	1681.14	1700.98		1700.99	0.000061	1.67	9244.51	692.49	0.07
Reach-1	24249	Max WS	Sunny Day	720.35	1681.14	1690.06		1690.06	0.000038	0.75	2579.21	504.77	0.05
Reach-1	23819	Max WS	PMF Breach	6044.99	1680.93	1700.96		1700.97	0.000052	1.47	9843.81	735.99	0.06
Reach-1	23819	Max WS	Sunny Day	720.06	1680.93	1690.03		1690.04	0.000064	0.92	2196.76	595.75	0.06
Reach-1	23314	Max WS	PMF Breach	6043.38	1680.50	1700.88	1691.77	1700.92	0.000202	2.92	5921.37	683.90	0.12
Reach-1	23314	Max WS	Sunny Day	718.57	1680.50	1689.84	1685.01	1689.93	0.000591	2.88	452.34	181.72	0.17

HEC-RAS River: Deckers Creek Reach: Reach-1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	23275			Bridge									
Reach-1	23248	Max WS	PMF Breach	6043.38	1680.25	1700.87		1700.89	0.000132	2.37	6824.74	670.65	0.09
Reach-1	23248	Max WS	Sunny Day	717.07	1680.25	1689.63		1689.76	0.000793	3.30	357.48	335.01	0.20
Reach-1	22792	Max WS	PMF Breach	6027.88	1680.13	1700.70		1700.82	0.000430	4.37	3944.86	431.10	0.17
Reach-1	22792	Max WS	Sunny Day	715.60	1680.13	1689.34		1689.44	0.000597	2.86	435.15	107.69	0.18
Reach-1	22288	Max WS	PMF Breach	6003.19	1680.00	1700.45	1691.44	1700.60	0.000524	4.84	3587.85	459.52	0.19
Reach-1	22288	Max WS	Sunny Day	713.18	1680.00	1689.03	1684.21	1689.13	0.000618	2.90	416.98	114.95	0.18
Reach-1	22260			Bridge									
Reach-1	22230	Max WS	PMF Breach	6003.19	1679.75	1700.43		1700.52	0.000347	3.97	4137.88	504.18	0.16
Reach-1	22230	Max WS	Sunny Day	711.99	1679.75	1688.91		1688.99	0.000456	2.52	479.14	157.27	0.16
Reach-1	21975	Max WS	PMF Breach	5948.71	1679.62	1699.93		1700.61	0.001492	8.10	1440.18	171.77	0.33
Reach-1	21975	Max WS	Sunny Day	711.01	1679.62	1688.74		1688.86	0.000655	2.98	361.65	70.51	0.19
Reach-1	21751	Max WS	PMF Breach	5927.54	1679.94	1699.79		1700.22	0.000986	6.61	1573.85	182.13	0.27
Reach-1	21751	Max WS	Sunny Day	709.39	1679.94	1688.62		1688.72	0.000577	2.77	376.43	83.32	0.18
Reach-1	21508	Max WS	PMF Breach	5927.09	1678.89	1699.75		1699.92	0.000556	5.05	3757.67	690.93	0.20
Reach-1	21508	Max WS	Sunny Day	709.36	1678.89	1688.52		1688.59	0.000432	2.54	590.70	130.35	0.15
Reach-1	21021	Max WS	PMF Breach	5889.13	1679.35	1699.50		1699.64	0.000527	4.79	3537.72	368.05	0.19
Reach-1	21021	Max WS	Sunny Day	707.39	1679.35	1688.26		1688.35	0.000603	2.86	505.45	127.72	0.18
Reach-1	20445	Max WS	PMF Breach	5826.87	1678.27	1698.98		1699.28	0.000998	6.49	2188.15	215.14	0.26
Reach-1	20445	Max WS	Sunny Day	704.08	1678.27	1687.82		1687.96	0.000828	3.40	358.26	83.72	0.20
Reach-1	20000	Max WS	PMF Breach	5791.69	1678.04	1698.70		1698.83	0.000627	4.75	2826.83	252.67	0.19
Reach-1	20000	Max WS	Sunny Day	701.57	1678.04	1687.56		1687.62	0.000568	2.56	584.03	149.96	0.16
Reach-1	19522	Max WS	PMF Breach	5749.27	1678.05	1698.33		1698.56	0.000728	5.62	2617.29	250.81	0.23
Reach-1	19522	Max WS	Sunny Day	699.46	1678.05	1687.28		1687.36	0.000533	2.73	501.18	129.65	0.17
Reach-1	19119	Max WS	PMF Breach	5732.42	1676.00	1698.22	1687.98	1698.27	0.000254	3.17	4928.92	429.61	0.12
Reach-1	19119	Max WS	Sunny Day	698.66	1676.00	1687.11	1679.80	1687.17	0.000369	2.33	575.39	246.76	0.13
Reach-1	19088			Bridge									
Reach-1	19059	Max WS	PMF Breach	5716.24	1675.75	1698.11		1698.19	0.000299	3.66	4417.67	420.43	0.14
Reach-1	19059	Max WS	Sunny Day	696.45	1675.75	1686.92		1686.99	0.000314	2.23	468.48	143.75	0.13

HEC-RAS River: Deckers Creek Reach: Reach-1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	18470	Max WS	PMF Breach	5700.08	1676.94	1697.88		1697.99	0.000449	4.26	4032.55	467.72	0.17
Reach-1	18470	Max WS	Sunny Day	694.44	1676.94	1686.70		1686.77	0.000446	2.42	601.55	161.47	0.15
Reach-1	17994	Max WS	PMF Breach	5685.27	1674.95	1697.70		1697.78	0.000367	3.87	4154.41	395.00	0.15
Reach-1	17994	Max WS	Sunny Day	694.11	1674.95	1686.57		1686.60	0.000192	1.72	974.50	182.88	0.09
Reach-1	17528	Max WS	PMF Breach	5664.71	1675.80	1697.45		1697.59	0.000561	4.61	3265.36	373.75	0.18
Reach-1	17528	Max WS	Sunny Day	693.30	1675.80	1686.42		1686.48	0.000382	2.25	671.55	157.58	0.13
Reach-1	17164	Max WS	PMF Breach	5638.67	1675.00	1697.10	1688.36	1697.35	0.001165	6.15	2843.55	469.75	0.24
Reach-1	17164	Max WS	Sunny Day	692.44	1675.00	1686.18	1679.83	1686.29	0.000775	3.05	364.82	60.24	0.17
Reach-1	17132			Bridge									
Reach-1	17099	Max WS	PMF Breach	5645.11	1674.75	1697.17		1697.22	0.000296	3.16	5018.43	602.28	0.12
Reach-1	17099	Max WS	Sunny Day	690.98	1674.75	1685.93		1686.00	0.000482	2.41	506.83	229.73	0.14
Reach-1	16500	Max WS	PMF Breach	5633.20	1675.04	1696.90		1697.03	0.000498	4.48	3912.47	547.81	0.18
Reach-1	16500	Max WS	Sunny Day	690.30	1675.04	1685.70		1685.77	0.000396	2.33	551.37	133.11	0.14
Reach-1	15997	Max WS	PMF Breach	5627.75	1674.00	1696.67	1685.81	1696.81	0.000369	4.14	3621.90	367.95	0.16
Reach-1	15997	Max WS	Sunny Day	690.04	1674.00	1685.56	1677.90	1685.60	0.000193	1.81	655.64	168.44	0.10
Reach-1	15962			Bridge									
Reach-1	15933	Max WS	PMF Breach	5623.27	1673.75	1696.66		1696.75	0.000272	3.49	4034.65	405.17	0.14
Reach-1	15933	Max WS	Sunny Day	690.04	1673.75	1685.53		1685.55	0.000100	1.27	1113.56	195.87	0.07
Reach-1	15550	Max WS	PMF Breach	5618.68	1676.38	1696.54		1696.62	0.000407	3.77	4188.32	439.95	0.15
Reach-1	15550	Max WS	Sunny Day	689.55	1676.38	1685.36		1685.43	0.000641	2.55	558.61	168.35	0.17
Reach-1	15244	Max WS	PMF Breach	5610.78	1676.08	1696.30		1696.46	0.000908	5.51	3011.91	353.01	0.22
Reach-1	15244	Max WS	Sunny Day	689.27	1676.08	1685.15		1685.22	0.000767	2.86	525.76	109.35	0.18
Reach-1	14801	Max WS	PMF Breach	5606.86	1677.10	1696.06	1686.58	1696.13	0.000376	3.91	4617.35	523.76	0.16
Reach-1	14801	Max WS	Sunny Day	688.87	1677.10	1684.78	1680.64	1684.88	0.000801	3.03	445.95	115.54	0.20
Reach-1	14768			Bridge									
Reach-1	14732	Max WS	PMF Breach	5600.04	1676.85	1695.83		1695.89	0.000278	3.38	4898.02	489.90	0.14
Reach-1	14732	Max WS	Sunny Day	688.75	1676.85	1684.68		1684.76	0.000541	2.50	457.52	254.16	0.17
Reach-1	14250	Max WS	PMF Breach	5596.66	1674.78	1695.51		1695.72	0.000788	5.48	2838.16	297.31	0.22

HEC-RAS River: Deckers Creek Reach: Reach-1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	14250	Max WS	Sunny Day	688.36	1674.78	1684.44		1684.51	0.000488	2.48	562.50	123.54	0.15
Reach-1	13695	Max WS	PMF Breach	5590.28	1674.87	1695.00		1695.30	0.000881	6.02	2288.89	309.88	0.24
Reach-1	13695	Max WS	Sunny Day	688.28	1674.87	1684.16		1684.24	0.000513	2.61	490.50	110.95	0.16
Reach-1	13250	Max WS	PMF Breach	5569.92	1675.07	1693.79		1694.92	0.002669	9.87	1070.27	104.77	0.42
Reach-1	13250	Max WS	Sunny Day	688.15	1675.07	1683.74		1683.92	0.001054	3.51	266.11	52.40	0.23
Reach-1	12750	Max WS	PMF Breach	5563.17	1674.91	1693.32		1693.60	0.001222	6.23	1599.68	182.37	0.26
Reach-1	12750	Max WS	Sunny Day	687.99	1674.91	1683.07		1683.25	0.001667	4.05	244.34	60.88	0.26
Reach-1	12252	Max WS	PMF Breach	5553.07	1675.00	1692.87		1693.07	0.000857	5.24	1937.88	232.56	0.22
Reach-1	12252	Max WS	Sunny Day	687.73	1675.00	1682.14		1682.35	0.002016	4.13	228.93	65.26	0.29
Reach-1	11727	Max WS	PMF Breach	5549.41	1672.75	1692.66	1684.98	1692.73	0.000299	3.44	3493.63	456.54	0.14
Reach-1	11727	Max WS	Sunny Day	687.17	1672.75	1681.47	1677.22	1681.59	0.000839	3.17	305.16	68.41	0.20
Reach-1	11697			Bridge									
Reach-1	11673	Max WS	PMF Breach	5549.41	1672.50	1692.62		1692.68	0.000368	3.29	3123.66	361.87	0.13
Reach-1	11673	Max WS	Sunny Day	686.98	1672.50	1681.30		1681.41	0.001181	3.32	286.20	78.10	0.20
Reach-1	11273	Max WS	PMF Breach	5544.09	1672.42	1692.33		1692.53	0.000674	5.14	2174.71	227.11	0.21
Reach-1	11273	Max WS	Sunny Day	686.46	1672.42	1680.90		1681.01	0.000816	3.07	330.31	99.84	0.20
Reach-1	10750	Max WS	PMF Breach	5539.50	1671.68	1692.00		1692.17	0.000685	5.13	2673.02	231.23	0.21
Reach-1	10750	Max WS	Sunny Day	686.36	1671.68	1680.51		1680.60	0.000734	2.90	500.11	121.49	0.18
Reach-1	10435	Max WS	PMF Breach	5541.29	1671.59	1691.79		1691.94	0.000696	4.79	2744.39	241.87	0.19
Reach-1	10435	Max WS	Sunny Day	686.25	1671.59	1680.25		1680.35	0.000941	2.97	462.70	135.54	0.19
Reach-1	9972	Max WS	PMF Breach	5537.47	1671.23	1691.42		1691.65	0.000754	5.57	2798.69	368.42	0.22
Reach-1	9972	Max WS	Sunny Day	685.99	1671.23	1679.83		1679.95	0.000801	3.07	404.09	107.77	0.20
Reach-1	9506	Max WS	PMF Breach	5537.18	1670.51	1690.92		1691.26	0.001150	6.74	2055.96	176.96	0.27
Reach-1	9506	Max WS	Sunny Day	685.87	1670.51	1679.43		1679.56	0.000942	3.35	398.59	109.42	0.21
Reach-1	9049	Max WS	PMF Breach	5532.25	1670.95	1689.43		1690.45	0.003925	10.72	1162.93	118.07	0.45
Reach-1	9049	Max WS	Sunny Day	685.78	1670.95	1678.39		1678.70	0.003149	5.02	220.90	56.80	0.34
Reach-1	8685	Max WS	PMF Breach	5529.35	1670.01	1688.28		1689.16	0.002692	9.46	1210.46	125.08	0.40
Reach-1	8685	Max WS	Sunny Day	685.68	1670.01	1677.35		1677.66	0.002550	4.71	203.52	55.00	0.33
Reach-1	8250	Max WS	PMF Breach	5526.03	1668.21	1687.52		1688.12	0.001456	7.46	1627.22	310.31	0.31

HEC-RAS River: Deckers Creek Reach: Reach-1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	8250	Max WS	Sunny Day	685.49	1668.21	1676.75		1676.88	0.000800	3.02	317.96	67.06	0.20
Reach-1	7756	Max WS	PMF Breach	5524.68	1668.07	1687.10		1687.41	0.000853	5.68	2195.48	275.02	0.24
Reach-1	7756	Max WS	Sunny Day	685.46	1668.07	1676.37		1676.49	0.000749	2.83	315.84	86.35	0.19
Reach-1	7246	Max WS	PMF Breach	5523.72	1668.35	1685.37		1686.86	0.004205	11.49	1061.65	168.43	0.51
Reach-1	7246	Max WS	Sunny Day	685.43	1668.35	1675.51		1675.78	0.002269	4.47	222.68	56.51	0.32
Reach-1	6829	Max WS	PMF Breach	5522.73	1667.75	1684.39		1685.15	0.002207	8.41	1397.30	307.04	0.38
Reach-1	6829	Max WS	Sunny Day	685.41	1667.75	1674.68		1674.91	0.001829	3.97	205.42	50.64	0.29
Reach-1	6462	Max WS	PMF Breach	5522.14	1666.00	1683.94	1678.36	1684.27	0.001573	6.62	2132.49	347.28	0.28
Reach-1	6462	Max WS	Sunny Day	685.39	1666.00	1674.03	1669.81	1674.26	0.001802	3.98	240.99	65.15	0.26
Reach-1	6428			Bridge									
Reach-1	6407	Max WS	PMF Breach	5521.88	1665.75	1682.72		1683.46	0.003151	9.01	1549.82	317.08	0.41
Reach-1	6407	Max WS	Sunny Day	685.39	1665.75	1673.68		1673.99	0.002746	4.60	191.25	53.63	0.33
Reach-1	6097	Max WS	PMF Breach	5521.56	1665.42	1681.07		1682.51	0.005184	11.26	1054.27	189.52	0.53
Reach-1	6097	Max WS	Sunny Day	685.39	1665.42	1672.70		1673.06	0.003307	4.84	155.09	42.07	0.36
Reach-1	5765	Max WS	PMF Breach	5521.34	1665.58	1679.28		1680.60	0.005117	10.38	905.95	139.44	0.54
Reach-1	5765	Max WS	Sunny Day	685.38	1665.58	1671.04		1671.57	0.008483	5.85	117.19	35.21	0.56
Reach-1	5332	Max WS	PMF Breach	5521.03	1661.20	1676.47		1678.22	0.007153	12.27	802.33	103.47	0.59
Reach-1	5332	Max WS	Sunny Day	685.36	1661.20	1668.16		1668.59	0.004838	5.32	144.29	48.02	0.41
Reach-1	4863	Max WS	PMF Breach	5521.02	1659.77	1668.74	1671.02	1676.20	0.058387	23.28	339.84	81.68	1.55
Reach-1	4863	Max WS	Sunny Day	685.36	1659.77	1663.40	1663.93	1665.57	0.055602	11.81	58.03	22.35	1.29
Reach-1	4588	Max WS	PMF Breach	5520.97	1645.07	1653.09	1655.03	1659.74	0.048841	22.49	354.27	66.67	1.48
Reach-1	4588	Max WS	Sunny Day	685.36	1645.07	1648.11	1648.62	1649.96	0.057033	10.96	66.97	45.05	1.31
Reach-1	4334	Max WS	PMF Breach	5520.98	1631.58	1639.07	1641.28	1646.38	0.076705	26.34	406.32	99.29	1.79
Reach-1	4334	Max WS	Sunny Day	685.36	1631.58	1634.70	1635.83	1637.89	0.091118	14.33	48.16	21.95	1.64
Reach-1	4155	Max WS	PMF Breach	5520.98	1616.58	1625.17	1626.78	1631.16	0.041760	21.55	387.73	72.43	1.38
Reach-1	4155	Max WS	Sunny Day	685.33	1616.58	1620.02	1620.33	1621.64	0.043071	10.22	69.15	37.87	1.16
Reach-1	3940	Max WS	PMF Breach	5520.96	1607.27	1614.04	1617.32	1625.67	0.125648	30.94	295.12	76.83	2.25
Reach-1	3940	Max WS	Sunny Day	685.32	1607.27	1610.02	1611.31	1613.83	0.134508	15.67	44.58	28.11	1.95
Reach-1	3767	Max WS	PMF Breach	5520.94	1584.98	1592.80	1595.71	1602.22	0.087077	27.91	318.76	68.30	1.85

HEC-RAS River: Deckers Creek Reach: Reach-1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	3767	Max WS	Sunny Day	685.35	1584.98	1587.94	1588.92	1591.13	0.099119	14.39	50.89	35.39	1.67
Reach-1	3623	Max WS	PMF Breach	5520.95	1572.27	1581.37	1582.67	1585.69	0.040231	20.79	556.46	136.16	1.29
Reach-1	3623	Max WS	Sunny Day	685.35	1572.27	1576.09	1576.61	1578.00	0.050082	11.47	76.49	46.62	1.21
Reach-1	3338	Max WS	PMF Breach	5520.91	1558.74	1568.68	1571.12	1575.65	0.046121	24.42	412.65	97.70	1.44
Reach-1	3338	Max WS	Sunny Day	685.35	1558.74	1562.82	1563.31	1565.03	0.046293	11.96	59.94	25.58	1.21
Reach-1	3106	Max WS	PMF Breach	5520.87	1549.01	1558.60	1558.98	1561.40	0.021435	15.75	687.06	164.86	0.98
Reach-1	3106	Max WS	Sunny Day	685.36	1549.01	1552.93	1552.94	1554.14	0.029826	8.90	84.96	41.88	0.96
Reach-1	2726	Max WS	PMF Breach	5520.85	1537.85	1547.56	1548.69	1552.33	0.034711	20.80	487.23	90.10	1.23
Reach-1	2726	Max WS	Sunny Day	685.35	1537.85	1541.72	1541.92	1543.26	0.034766	10.26	81.37	37.86	1.03
Reach-1	2478	Max WS	PMF Breach	5520.71	1529.95	1539.11	1540.34	1543.72	0.035523	20.77	522.75	108.76	1.26
Reach-1	2478	Max WS	Sunny Day	685.33	1529.95	1533.58	1533.92	1535.15	0.037250	10.44	86.82	53.48	1.08
Reach-1	2250	Max WS	PMF Breach	5520.77	1520.94	1530.89	1532.04	1535.14	0.036610	21.32	567.13	115.95	1.25
Reach-1	2250	Max WS	Sunny Day	685.34	1520.94	1525.46	1525.96	1527.34	0.035122	11.24	77.66	51.29	1.05
Reach-1	2002	Max WS	PMF Breach	5520.72	1512.71	1522.50	1522.99	1525.77	0.026598	18.29	624.07	125.84	1.08
Reach-1	2002	Max WS	Sunny Day	685.33	1512.71	1516.75	1517.07	1518.23	0.032523	10.09	91.86	61.18	1.01
Reach-1	1753	Max WS	PMF Breach	5520.72	1505.27	1514.04	1516.44	1519.95	0.041798	22.37	441.86	114.08	1.37
Reach-1	1753	Max WS	Sunny Day	685.34	1505.27	1508.62	1509.03	1510.37	0.039867	10.69	72.82	45.92	1.12
Reach-1	1500	Max WS	PMF Breach	5520.71	1496.05	1505.13	1505.18	1508.41	0.020024	15.87	526.29	94.78	0.98
Reach-1	1500	Max WS	Sunny Day	685.35	1496.05	1499.56	1499.28	1500.40	0.020222	7.41	100.63	56.50	0.81
Reach-1	1088	Max WS	PMF Breach	5520.61	1487.97	1496.82	1497.36	1499.91	0.018575	14.94	573.02	161.30	0.93
Reach-1	1088	Max WS	Sunny Day	685.33	1487.97	1491.12		1491.90	0.020256	7.14	98.76	45.56	0.80
Reach-1	599	Max WS	PMF Breach	5520.59	1477.26	1486.45	1487.84	1491.56	0.036444	20.54	455.12	331.44	1.26
Reach-1	599	Max WS	Sunny Day	685.33	1477.26	1481.28	1481.07	1482.52	0.025092	8.94	77.60	27.81	0.89
Reach-1	500	Max WS	PMF Breach	5525.49	1470.00	1476.48		1477.16	0.009378	6.93	1038.85	330.49	0.55
Reach-1	500	Max WS	Sunny Day	685.33	1470.00	1472.63		1472.85	0.013104	3.69	185.64	124.64	0.53
Reach-1	493	Max WS	PMF Breach	5520.26	1453.29	1464.34		1465.38	0.008077	8.51	864.19	229.08	0.54
Reach-1	493	Max WS	Sunny Day	685.30	1453.29	1458.36		1458.62	0.006129	4.13	166.02	52.17	0.41
Reach-1	485	Max WS	PMF Breach	5512.63	1446.00	1457.05		1457.17	0.000929	3.46	2658.66	387.91	0.19
Reach-1	485	Max WS	Sunny Day	684.93	1446.00	1450.67		1450.71	0.000950	1.75	475.69	178.77	0.17

HEC-RAS River: Deckers Creek Reach: Reach-1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	477	Max WS	PMF Breach	5508.95	1442.70	1454.73		1455.07	0.002865	5.67	1728.77	350.16	0.33
Reach-1	477	Max WS	Sunny Day	684.54	1442.70	1447.98		1448.23	0.005689	4.00	171.34	111.30	0.39
Reach-1	469	Max WS	PMF Breach	5507.98	1434.30	1447.66		1448.96	0.009522	9.12	605.64	83.66	0.58
Reach-1	469	Max WS	Sunny Day	684.49	1434.30	1439.91		1440.27	0.007589	4.79	142.76	41.29	0.45
Reach-1	461	Max WS	PMF Breach	5507.66	1425.00	1435.92		1436.52	0.003847	6.27	945.29	131.58	0.38
Reach-1	461	Max WS	Sunny Day	684.46	1425.00	1429.36		1429.51	0.004586	3.19	214.32	80.86	0.35
Reach-1	453	Max WS	PMF Breach	5507.20	1418.00	1428.92		1429.97	0.007478	8.27	682.87	100.13	0.52
Reach-1	453	Max WS	Sunny Day	684.42	1418.00	1422.40		1422.69	0.007941	4.30	159.11	57.66	0.46
Reach-1	448	Max WS	PMF Breach	5507.07	1411.00	1421.59		1423.19	0.011906	10.23	576.44	94.11	0.66
Reach-1	448	Max WS	Sunny Day	684.39	1411.00	1415.49		1415.88	0.010929	5.04	135.80	48.99	0.53
Reach-1	443	Max WS	PMF Breach	5506.91	1401.00	1410.39		1411.78	0.010628	9.60	629.99	107.35	0.62
Reach-1	443	Max WS	Sunny Day	684.39	1401.00	1405.00		1405.31	0.011018	4.48	152.80	66.94	0.52
Reach-1	438	Max WS	PMF Breach	5506.78	1392.23	1401.96		1403.04	0.008820	8.97	826.68	154.01	0.57
Reach-1	438	Max WS	Sunny Day	684.37	1392.23	1396.59		1396.88	0.009540	4.33	161.90	79.58	0.49
Reach-1	433	Max WS	PMF Breach	5506.55	1385.00	1392.77		1393.41	0.006867	7.22	1075.09	211.65	0.49
Reach-1	433	Max WS	Sunny Day	684.34	1385.00	1387.95		1388.16	0.008633	3.77	210.62	128.43	0.46
Reach-1	424	Max WS	PMF Breach	5505.59	1370.02	1382.34		1383.28	0.005118	8.21	873.97	130.07	0.45
Reach-1	424	Max WS	Sunny Day	684.35	1370.02	1375.28		1375.50	0.004807	3.71	186.69	62.81	0.36
Reach-1	419	Max WS	PMF Breach	5505.53	1365.75	1376.05		1377.40	0.010359	9.44	644.48	125.91	0.61
Reach-1	419	Max WS	Sunny Day	684.31	1365.75	1370.13		1370.47	0.009666	4.68	146.09	53.88	0.50
Reach-1	414	Max WS	PMF Breach	5505.33	1358.00	1366.84		1367.84	0.008156	8.08	706.61	119.73	0.54
Reach-1	414	Max WS	Sunny Day	684.30	1358.00	1361.36		1361.60	0.008169	3.94	173.84	74.02	0.45
Reach-1	408	Max WS	PMF Breach	5505.13	1348.00	1358.41		1359.18	0.006136	7.10	812.73	132.91	0.47
Reach-1	408	Max WS	Sunny Day	684.28	1348.00	1352.55		1352.75	0.005995	3.60	190.12	73.18	0.39
Reach-1	402	Max WS	PMF Breach	5504.82	1342.00	1351.48		1352.22	0.005726	7.23	935.12	165.39	0.46
Reach-1	402	Max WS	Sunny Day	684.26	1342.00	1345.87		1346.07	0.006955	3.58	191.38	85.72	0.42
Reach-1	395	Max WS	PMF Breach	5504.54	1332.00	1341.57		1343.00	0.016164	9.66	587.82	122.44	0.73
Reach-1	395	Max WS	Sunny Day	684.22	1332.00	1335.96		1336.45	0.016617	5.58	122.59	52.33	0.64
Reach-1	388	Max WS	PMF Breach	5504.37	1313.18	1321.70		1323.35	0.017217	10.31	534.11	92.81	0.76
Reach-1	388	Max WS	Sunny Day	684.23	1313.18	1316.29		1316.77	0.018624	5.53	123.71	58.49	0.67

HEC-RAS River: Deckers Creek Reach: Reach-1 Profile: Max WS (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	382	Max WS	PMF Breach	5504.27	1295.07	1303.32	1303.20	1305.79	0.029602	12.61	436.39	83.67	0.97
Reach-1	382	Max WS	Sunny Day	684.21	1295.07	1298.27		1299.04	0.033074	7.04	97.12	49.10	0.88
Reach-1	374	Max WS	PMF Breach	5504.12	1250.54	1259.19	1260.71	1264.43	0.067051	18.37	299.54	58.99	1.44
Reach-1	374	Max WS	Sunny Day	684.19	1250.54	1254.06	1254.45	1255.72	0.067418	10.34	66.17	31.56	1.26
Reach-1	366	Max WS	PMF Breach	5504.15	1155.72	1161.76	1162.83	1165.71	0.069040	15.95	345.11	88.47	1.42
Reach-1	366	Max WS	Sunny Day	684.21	1155.72	1158.40	1158.67	1159.51	0.084180	8.43	81.14	63.41	1.31
Reach-1	357	Max WS	PMF Breach	5503.91	1041.00	1047.72	1047.65	1049.90	0.031431	11.85	464.63	103.29	0.98
Reach-1	357	Max WS	Sunny Day	684.17	1041.00	1043.50		1044.14	0.033863	6.43	106.35	63.01	0.87
Reach-1	350	Max WS	PMF Breach	5503.94	1000.00	1007.66		1009.73	0.024957	11.52	477.58	92.66	0.89
Reach-1	350	Max WS	Sunny Day	684.20	1000.00	1002.77		1003.33	0.023473	6.00	114.02	56.88	0.75
Reach-1	344	Max WS	PMF Breach	5503.80	973.10	980.21		981.38	0.016520	8.71	633.06	149.95	0.72
Reach-1	344	Max WS	Sunny Day	684.18	973.10	975.97		976.30	0.018563	4.57	149.84	94.86	0.64
Reach-1	338	Max WS	PMF Breach	5503.72	954.00	962.54	961.95	964.28	0.018404	10.87	611.63	163.26	0.78
Reach-1	338	Max WS	Sunny Day	684.18	954.00	957.36	956.75	957.89	0.018807	5.84	117.18	51.30	0.68