United States Department of Agriculture

Natural Resources Conservation Service

SUPPLEMENTAL WATERSHED PLAN NO. I and Environmental Assessment for the Rehabilitation of Floodwater Retarding Structure No. 2 of the Upper Cibolo Creek Watershed Kendall County, Texas

Prepared By:
U.S. Department of Agriculture - Natural Resources Conservation Service

In Cooperation With:
Kendall County Soil and Water Conservation District # 216
Kendall County Commissioners Court
City of Boerne

February 2023

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Authority

The original watershed work plan was prepared, and works of improvement have been installed, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended. The rehabilitation of Floodwater Retarding Structure (FRS) No. 2 is authorized under Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. Sections 1001 to 1008, 1010, and 1012).

Abstract

Upper Cibolo Creek FRS No. 2 was constructed as a low hazard potential dam. Residential development has occurred downstream of the dam in Kendall County and within the City of Boerne, TX and the population of the City of Boerne has increased by over 500% since the time that the dam was constructed. As a result of the increased population, traffic has also increased on roads downstream of FRS No. 2. These factors have caused concerns regarding the hydraulic capacity of the FRS and human health and safety. As a result, the FRS has been reclassified as a high hazard potential dam. The FRS does not comply with current high hazard potential dam safety and performance criteria and has been prioritized for rehabilitation. Historical floods in the past 41 years since FRS No. 2 was constructed have caused the auxiliary spillway to function on at least two occasions. The proposed rehabilitation of FRS No. 2 will allow the FRS to comply with current performance and safety standards and to continue to provide flood control benefits. The preferred alternative for FRS No. 2 will include widening the existing 200-foot-wide earthen auxiliary spillway (AS) to 350 feet and adding a splitter dike, lowering the existing AS crest by 0.7 foot and adding a concrete cutoff wall at the control section, adding rock riprap at the downstream end of the auxiliary spillway, replacing the existing principal spillway (PS) inlet tower and lowering the PS crest 4.7 feet to the elevation of the existing low level ports, replacing the existing PS conduit with 36-inch-diameter pipe and constructing a new impact basin, raising the top of the dam (TOD) by 2.3 feet with earth fill, and replacing the rock blanket on the upstream embankment slope. The total project installation cost is estimated to be $7,692,000 of which $5,525,000 will be paid from the Small Watershed Rehabilitation funds and $2,167,000 will be paid from local funds.

Comments and Inquiries

The U.S. Department of Agriculture (USDA) and then Natural Resources Conservation Service (NRCS) has completed this Final Plan-Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA) and USDA-NRCS guidelines and standards. Reviewers should provide comments to NRCS during the allotted Final Plan-EA review period. Submit comments and inquiries to: Mark Northcut, Natural Resources Planning Manager, USDA/NRCS, 101 South Main, Temple, Texas 76501 (254-742-9824).

Non-Discrimination Statement

In accordance with Federal civil rights law and USDA civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident. Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English. To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at How to File a Program Discrimination Complaint and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov. USDA is an equal opportunity provider, employer, and lender.

UPPER CIBOLO CREEK WATERSHED
SUPPLEMENTAL WATERSHED AGREEMENT NO. I

between the

Kendall County Soil and Water Conservation District # 216 (SWCD)
Sponsoring Local Organization

Kendall County Commissioners Court (County)
Sponsoring Local Organization

City of Boerne (City)
Sponsoring Local Organization

(Referred to herein as Sponsors)

and the

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
Formerly the Soil Conservation Service (SCS)

(Referred to herein as NRCS)

Whereas, the original Watershed Work Plan Agreement for Upper Cibolo Creek Watershed, State of Texas, executed by the Sponsors named therein, the Boerne Water Supply Corporation, and the NRCS, became effective on the 1st day of April 1969; and

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

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 Floodwater Retarding Structure (FRS) No. 2 in the Upper Cibolo Creek Watershed, State of Texas, 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, there has been developed through the cooperative efforts of the Sponsors and NRCS a Supplemental Watershed Work Plan No. I and Environmental Assessment for works of improvement for the rehabilitation of FRS No. 2 of the Upper Cibolo Creek Watershed, State of Texas, hereinafter referred to as the Plan-EA or plan, which plan is annexed to and made a part of this agreement;

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 that 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 (103 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 item 5 hereof.

   The sponsors agrees 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 agrees to comply with all of the policies and procedures of the Uniform Relocation Assistance and Real Property Acquisition Policies Act (42 U.S.C. Section 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 sponsors are 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. **Cost-Share for Watershed Work Plan.** The following table shows cost-share percentages and amounts for Watershed Work Plan implementation.

Cost-Share Table for Rehabilitation Projects			
Works of Improvement	**NRCS**	**Sponsors**	**Total**
Cost-Shareable Items	Cost[1/]	Cost[1/]	Cost[1/]
Rehabilitation of FRS No. 2 (Construction Costs)	$3,840,000	$2,023,000	$5,863,000
Replacement in-kind	$0	$0	$0
Required Decent, Safe, Sanitary	$0	$0	$0
Sponsor Planning Costs	NA	$0	$0
Sponsor Engineering Costs	NA	$0	$0
Sponsor Project Administration	NA	$15,000	$15,000
Land Rights Acquisition Cost	NA	$30,000	$30,000
Subtotal: Cost-Sharable Costs	$3,840,000	$2,068,000	$5,908,000
Cost-Share Percentages[2/]	65%	35%	100%
Non-Cost-Sharable Items [3/]			
NRCS Engineering & Project Administration[4/]	$1,685,000	NA	$1,685,000
Natural Resource Rights	NA	$0	
Federal, State, and Local Permits	NA	$99,000	$99,000

Relocation, Beyond Required Decent, Safe, and Sanitary			
Subtotal: Non-Cost-Share Costs	$1,685,000	$99,000	$1,784,000
Total	$5,525,000	$2,167,000	$7,692,000

1/ All costs rounded to nearest $1,000.
2/ 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 of downstream properties).
3/ If actual non-cost-sharable item expenditures vary from these figures, the responsible party will bear the change.
4/ The sponsors and NRCS will each bear the costs of project administration that each incurs. Sponsor costs for project administration include relocation assistance advisory service.

6. **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.

7. **Floodplain Management.** Before construction of any project for flood prevention, the sponsors must agree to participate in and comply with applicable Federal floodplain management and flood insurance programs. The sponsors are required to have development controls in place below low and significant hazard potential dams prior to NRCS or the sponsor entering into a construction contract.

8. **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 must be borne by the sponsors and these costs are not eligible as part of the sponsor's cost-share.

9. **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.

10. **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.

11. **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.

12. **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 must 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 must be in accordance 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.

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

14. **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 (100 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.

15. **Emergency Action Plan.** Prior to construction, the sponsors must 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 must meet the minimum content specified in 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 must be reviewed and updated by the sponsors annually.

16. **Nondiscrimination Provisions**. In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

    Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

    To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at How to File a Program Discrimination Complaint and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

    USDA is an equal opportunity provider, employer, and lender.

By signing this agreement the recipient assures the Department of Agriculture that the program or activities provided for under this agreement will be conducted in compliance with all applicable Federal civil rights laws, rules, regulations, and policies.

17. **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 plea 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 indirect 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' payroll; or employees of subrecipients 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 must—

(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 of such conviction. Employers of convicted employees must provide 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 must 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 who 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 a 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 will keep the original of all disclosure reports in the official files of the agency.

18. **Certification Regarding Lobbying** (7 CFR Part 3018) (for projects > $100,000)

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 a 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 employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the

undersigned must complete and submit Standard Form LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.

(3) The sponsors must require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients must 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—Primary 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 governmental 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 is unable to certify to any of the statements in this certification, such prospective participant must attach an explanation to this agreement.

20. **Clean Air and Water Certification.**

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 (X) 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 for use 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 organizations 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 NRCS 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 contained in a permit issued to a discharger by the Environmental Protection Agency 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, plant, 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, plant, installation, or structure, the entire location will 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 sponsors 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 a 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, 3017, 3018, 3019, 3021 and 3052.

22. **Examination of Records.** The sponsors must 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 retain 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. **Signatures.** The signing of this Public Law 83-566 Watershed Agreement by an authorized representative of the Sponsors indicates that the Sponsor(s) has reviewed this Agreement and the Upper Cibolo Creek Watershed Supplemental Watershed Work Plan No. I -Environmental Assessment and concur with the intent and contents of each.

The Sponsors and NRCS further agree to all other terms, conditions, and stipulations of said watershed agreement not modified herein.

Kendall County Soil and Water Conservation District #216
Local Organization

By ____
Don Miller

Title Chairman ______________________________________

Date ____

The signing of this agreement was authorized by a resolution of the governing body of the Kendall County Soil and Water Conservation District adopted at a meeting held on __________________ ______________________________.

____
Eddie Seidensticker, Secretary, Kendall County Soil and Water Conservation District #216

<u>Kendall County Commissioners Court</u>
Local Organization

By ____
Darrel Lux

Title Kendall County Judge ________________________

Date ____

The signing of this agreement was authorized by a resolution of the governing body of the Kendall County Commissioners Court adopted at a meeting held on __________________________ __________________.

____
Darlene Herrin, County Clerk, Kendall County

<u>City of Boerne</u>
Local Organization

By ____
Tim Handren

Title Mayor ________________________________

Date ____

The signing of this agreement was authorized by a resolution of the governing body of the City of Boerne adopted at a meeting held on ____.

____
Lori Carroll, Secretary, City of Boerne

<u>Natural Resources Conservation Service</u>
United States Department of Agriculture

Approved By ____
Kristy Oates, State Conservationist

Date ____

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SUMMARY – OFFICE OF MANAGEMENT AND BUDGET (OMB) FACT SHEET

SUPPLEMENTAL WATERSHED PLAN NO. I – ENVIRONMENTAL ASSESSMENT
for the
Rehabilitation of Floodwater Retarding Structure No. 2
of the
Upper Cibolo Creek Watershed
Kendall County, Texas
21st Congressional District

S.1 Authorization

The original watershed work plan was prepared, and works of improvement have been installed, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended. The rehabilitation of Floodwater Retarding Structure (FRS) No. 2 is authorized under Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. Sections 1001 to 1008, 1010, and 1012).

S.2 Sponsors

The project sponsors are the Kendall County Soil and Water Conservation District #216, the Kendall County Commissioners Court, and the City of Boerne.

S.3 Proposed Action

The proposed action is the rehabilitation of FRS No. 2 to meet current NRCS performance standards for a high hazard potential dam with a service life of 100 years.

S.4 Purpose and Need for Action

The original purpose of the Upper Cibolo Creek Watershed Plan was for watershed protection, flood prevention, and municipal and industrial water supply. Upper Cibolo Creek FRS No. 2 was constructed as a single-purpose, low hazard potential FRS. Due to downstream development, FRS No. 2 has been reclassified as a high hazard potential dam, yet it does not meet the current safety and performance standards for the high hazard potential classification. While there is a need for action to reduce safety risks and meet current safety standards, there is also a need for continued flood protection in the Upper Cibolo Creek Watershed. The authorized purpose for this project is to provide flood protection in a manner that takes into consideration economic, social, and environmental goals.

S.5 Description of Preferred Alternative

The recommended plan will rehabilitate FRS No. 2 to meet current safety and performance standards for a high hazard potential dam, provide 100 years of submerged sediment storage after construction, and continue to provide flood protection downstream.

Measures for the high hazard potential rehabilitation of FRS No. 2 include:

- Removing the existing principal spillway system consisting of:
  - A drop inlet riser with debris guard;
  - Crest at elevation 1,590.45 feet;
  - Two Low-level ports on two sides (four total) at elevation 1,585.75; and
  - 24-inch-diameter prestressed, concrete lined, steel cylinder pipe discharging into a plunge pool;
- Installing a new principal spillway system consisting of:
  - A standard covered riser;
  - Crest at elevation 1,585.75 feet (4.7 feet lower than existing crest and the same elevation as existing low-level ports); and
  - 36-inch-diameter RCP discharging into a new impact basin;
- Regrading the inlet and outlet channels of the auxiliary spillway, widening the crest from 200 to 350 feet, adding a splitter dike, and lowering the crest 0.7 foot to elevation 1,611.30 feet;
- Protecting the downstream end of auxiliary spillway with rock riprap;
- Adding a concrete cutoff wall at the control section of the auxiliary spillway:
- Raising and grading the top of dam level 2.3 feet from an elevation of 1,614.5 feet to 1,616.8 feet; and
- Replacing rock blanket on 2.5:1 upstream embankment slope.

S.6 Resource Information

FRS No. 2 is located in Kendall County, Texas on Ranger Creek, a tributary of the Cibolo Creek, and a tributary of the Lower San Antonio River, located approximately 4 miles west of Boerne, Texas.

The dam was constructed in 1980 to provide flood damage reduction. The embankment is 3 zone, compacted earthfill dam. A 20-foot-wide core trench with 1:1 side slopes was constructed at the centerline of the dam. The dam is approximately 50 feet tall and 1,545 feet long. The upstream and downstream slopes of the embankment have a slope of approximately 2.5:1 (horizontal:vertical). A 10-foot-wide berm is located on the upstream slope, and a 14-foot-wide berm is located on the downstream slope. The top width of the structure is shown to be 14 feet in the as-builts, but was observed to be approximately 10 feet. The land upstream of FRS No. 2 is predominantly private ownership.

Climate:

- Temperature: The average coolest month is January with temperatures ranging from 35 degrees Fahrenheit (ºF) to 61ºF. The average warmest month is August with temperatures ranging from 69ºF to 94°F.

- Precipitation: Total annual precipitation is approximately 38.2 inches. The wettest month of the year is May, averaging 4.64 inches. The driest month of the year is January, averaging 2.08 inches.
- Topography: The area of interest is located in southern Kendall County, Texas, within the Ranger Creek Quadrangle from the United States Geological Survey (USGS) 7.5-minute topographic map series. The elevations in the Quadrangle range from approximately 1,440 to 2,000 feet above mean sea level and the topography ranges from nearly level to strongly sloping.

Table S-1 lists the resource information for FRS No. 2 and land use upstream from FRS No. 2.

Table S-1. Resource Information

Resource	Description	
Latitude / Longitude	29.807º / -98.790º	
Hydrologic Unit Code	12100304	
Hydrologic Unit Code Name	Cibolo	
Watershed Size (square miles)	2.57	
Land Use (acres)	Open Water	23.7
	Developed, Open Space	47.3
	Developed, Low Intensity	11.3
	Developed, Medium Intensity	34.2
	Deciduous Forest	68.9
	Evergreen Forest	207.3
	Mixed Forest	149.3
	Shrub/Scrub	1067.6
	Herbaceous	36.5
	Total	**1,646.1**

S.7 Population and Demographics

Table S-2 provides population and demographics characteristics of Census Tracts 9703.01 & 9703.02, 9704.06, 9705, Kendall County, and Texas.

Table S-2. Population and Demographics Characteristics

Characteristic	Census Tracts 9703.01	Census Tract 9703.02	Census Tract 9704.06	Census Tract 9705	Kendall County	Texas
Population	6,699	4,309	7,446	7,432	45,491	28,635,442
Median Age	42.6	53.3	38.8	36.9	42.1	34.8
Hispanic or Latino	17.0%	16.6%	18.5%	40.3%	24.2%	39.4%
Not Hispanic or Latino – White Alone	76.2%	80.1%	79.0%	57.0%	71.9%	41.4%
Median Household Income	$86,098	$101,820	$133,011	$73,797	$98,692	$63,826
Poverty Rate (all people)	3.9%	7.1%	4.3%	6.8%	4.8%	14.2%
Unemployment Rate	3.0%	8.4%	0.1%	2.6%	2.6%	3.4%

Source: 2016-2020 American Community Survey 5-Year Estimates

S.8 Scoping Concerns

Resource concerns identified through scoping are summarized in Table S-3.

Table S-3. Resource Concerns Identified Through Scoping

ITEM/CONCERN	RATIONALE
SOILS	
Prime and Unique Farmland	There are areas of Prime Farmland downstream of FRS No. 2 that are potentially at risk of flooding from Ranger Creek should FRS No. 2 be removed. There are also areas identified as Prime Farmland immediately adjacent to and within the floodpool of FRS No. 2, although they do not appear to be actively farmed. Potential impacts to areas of Prime Farmland resulting from modifications to FRS No. 2 must be considered.
Erosion and Sediment	The impact of sediment accumulation in FRS No. 2 is relevant to the existing and future service life of the FRS. In addition, downstream erosion and sedimentation could be impacted positively or negatively by modifications to the FRS. Potential erosion and sedimentation impacts resulting from modifications to FRS No. 2 must be considered.
WATER	
Floodplain Management	The FRS currently provides flood protection for downstream areas, which is required to prevent routine flooding of agricultural lands and residences and routine overtopping of local roads. Potential impacts to flood protection resulting from modifications to FRS No. 2 must be considered.
Sole Source Aquifers	FRS No. 2 is located within the Edwards Aquifer Sole Source Aquifer (SSA) Drainage Area. While FRS No. 2 is not within the Edwards Aquifer Authority jurisdictional area, it is located within a designated EPA SSA (Edwards Aquifer - Streamflow Source Area). The impacts to Sole Source Aquifers resulting from modifications to FRS No. 2 must be considered.
Streams, Lakes, and Wetlands	Based on field investigations, one open water feature, Upper Cibolo Creek FRS No. 2 Reservoir, and one perennial stream feature, Ranger Creek, were identified within the project area. Potential impacts to these features resulting from modifications to FRS No. 2 must be considered. Coordination with the USACE will be required.

ITEM/CONCERN	RATIONALE
Water Quality	Upper Cibolo Creek (located approximately 2.7 miles downstream of FRS No. 2) is currently listed as being impaired for bacteria. FRS No. 2 is underlain by the Trinity aquifer and is in the drainage area for the Edwards Aquifer. Water quality impacts specifically related to the Edwards Aquifer SSA are discussed under the SSA resource concern. In addition, construction activities and the resulting modifications could have impacts to downstream water quality. Potential impacts to water quality resulting from modifications to FRS No. 2 must be considered.
PLANTS	
Threatened and Endangered Species	There are no element of occurrence records (EORs) for federal or state-listed plant species within the project area. No suitable habitat for the federally- listed plant species was identified within the project area. Coordination with USFWS may be required, so this item is considered relevant to the proposed action.
Woodland Vegetation/Forest Resources	Woodland vegetation is present in the project area. It is not anticipated that there would be impacts to large areas of woodland vegetation resulting from modifications to FRS No. 2, but potential impacts resulting from modifications to FRS No. 2 must be considered.
Invasive Species	Invasive species have the potential to occur within the project area and could be transported into or out of the project area by construction activities. Potential impacts resulting from modifications to FRS No. 2 must be considered.
Riparian Areas	Riparian areas are present surrounding the FRS No. 2 normal pool/sediment pool area as well as downstream along Ranger Creek. Potential impacts to riparian areas resulting from modifications to FRS No. 2 must be considered
ANIMALS	
Threatened and Endangered Species	Four EORs for Federal and State listed species were recorded within 5 miles of FRS No. 2. Suitable nesting habitat for the federally listed golden-cheeked warbler was identified within the project area. In addition, suitable habitat for the federally proposed endangered/state threatened Guadalupe fatmucket and Guadalupe orb mussel species; and one federal candidate species, the monarch butterfly was identified within the project area. Mussel species surveys may be required prior to construction activities or dewatering per TPWD protocols. Consultation with USFWS will be required and potential impacts to these species resulting from modifications of FRS No 2. must be considered.
Fish and Wildlife	FRS No. 2 could potentially provide habitat for fish and provides habitat for other wildlife. Potential impacts to fish and wildlife resulting from modifications to FRS No. 2 must be considered.
Migratory Birds/Bald and Golden Eagles	Migratory bird pathways, stopover habitats, wintering areas, and breeding areas occur within and/or adjacent to the project area and may be associated with wetlands, ponds, riparian corridors, fallow fields, grasslands, and woodlands. Bald Eagles/Golden Eagles were not observed in the project area during a site visit. However, Bald Eagles occur throughout the state and therefore have the potential to utilize the site for hunting and/or stopover. Potential impacts to Migratory Birds/Bald and Golden Eagles resulting from modifications to FRS No. 2 must be considered.

ITEM/CONCERN	RATIONALE
HUMANS	
Costs/Public Benefits	Per PR&G, Public Benefits relative to Costs must be considered in the evaluation of potential modifications to FRS No. 2.
Cultural Resources	One previously unrecorded archeological site, one previously unrecorded isolated find, and one previously unrecorded historic-age resource were documented within the Area of Potential Effect. NRCS consultation with the Texas State Historical Preservation Office (SHPO) and relevant tribes will be required.
Environmental Justice	Potential impacts to minority and low-income populations could result from modifications to FRS No. 2 and must be considered
Land Use	Downstream land use could potentially be impacted by modifications to FRS No. 2. Potential impacts to land use resulting from modifications to FRS No. 2 must be considered.
Local and Regional Economy	Impacts to the local and regional economy could occur as a result of modifications to FRS No. 2 and must be considered.
Public Health and Safety	FRS No. 2 is classified as a high hazard potential dam and in its existing condition is a risk to the public. Potential impacts to Public Health and Safety resulting from modifications to FRS No. 2 must be considered.
Social Issues/Community Cohesion	Potential impacts to social issues/community cohesion could result from modifications to FRS No. 2, so this item must be considered in the evaluation of potential modifications to FRS No. 2

S.9 Alternative Plans Considered

Alternatives that were analyzed in detail for FRS No. 2 include Alternative 1 – No Action/Future without Federal Investment (FWOFI), Alternative 2 – Decommission (Future with Federal Investment [FWFI], and the Alternative 3 – High Hazard Potential Rehabilitation (FWFI).

Alternative 1 – No Action/Future without Federal Investment (FWOFI): No Action/FWOFI Alternative does not involve federal action or federal investment. Since the Sponsors do not have the resources allocated to bring FRS No. 2 into compliance with current dam safety regulations for a high hazard potential dam, it is anticipated that their course of action would be to continue maintain the dam in its current configuration until it has the resources available and specifically allocated to perform a local decommissioning of the dam to remove the risk of failure. This alternative would initially be a true no-action alternative in which no rehabilitation measures take place. Repairs would be performed to maintain the existing spillways and upstream and downstream slopes on an as-needed basis, such as if significant erosion occurred. The current level of flood protection would remain, though the overtopping risk associated with the dam not passing the federal requirements would also remain. It should also be noted that the dam likely would not meet State dam safety criteria and, if it does not, that the TCEQ could require that the dam be rehabilitated or removed at any time. As the timeline for when the Sponsors would have the resources available to locally decommission the dam is currently unknown and if or when the TCEQ would require that the dam be modified or removed, the potential for dam failure prior to those events occurring was also considered as part of the analysis. In the event that dam failure does occur prior to local decommissioning, it is assumed that some form of local decommission would still occur following the breach to stabilize the site.

The local decommissioning would consist of excavating a breach in the dam of sufficient size to safely pass the 1% Annual Exceedance Probability (AEP), 24-hour flood event. This breach would be a minimum size opening in the dam from top of dam down to the valley floor, which would eliminate the structure's ability to store water. To not impede flows through the breached embankment and to reduce certain safety and health factors, some of the principal spillway components would also be removed. This course of action would minimize the Sponsors' dam safety liability but would not eliminate all liability. The excavated material (about 29,165 cu. Yd.) would be placed in the present easement area and all exposed areas would have vegetation established for erosion control (approximately 24 acres). Construction activities would require that a Storm Water Pollution Prevention Plan (SWPPP) be in effect. Downstream flooding conditions would be similar to those that existed prior to the construction of the dam. Existing and proposed floodplains were mapped approximately 10.4 miles downstream of FRS No. 2, ending 3.6 miles downstream of Herff Road. Since the 1% AEP inundation area (modeled for the purposes of this plan) would be enlarged from 399 acres to 487 acres due to the absence of flood attenuation, potential present and future downstream development would be affected by the increased flood profiles. Future downstream development would be restricted by floodplain zoning. The number of residential and nonresidential structures inundated above the finished-floor elevation during the modeled 1% AEP, 24-hour flood event would increase from 42 structures to 88 structures. Floodwaters from a 1% AEP, 24-hour flood event would cause increased flooding on 14 roads. The estimated cost of this alternative is $664,000.

Alternative 2 – Decommission (FWFI): This alternative involves federal action and consists of removing the storage function of the dam and reconnecting, restoring, and stabilizing the upstream reservoir area/sediment pool and downstream floodplain functions. Although complete removal of the embankment is sometimes required for decommissioning, only partial removal of the embankment was evaluated in this alternative. Partial removal of the embankment would consist of excavating a breach in the dam of 14.5 feet bottom width to safely pass the 1% AEP flood with little influence on the water surface profile. The excavated material (about 29,165 cubic yards) would be placed in the sediment and detention pool areas and all exposed areas would be vegetated as needed for erosion control (approximately 24 acres). Channel work would be performed to reconnect the stream channel through the sediment pool. Riparian vegetation would be established along the stream channel (approximately 3 acres). A grade stabilization structure would be installed to stabilize sediment and prevent stream headcutting. To not impede flows through the breached embankment, some of the principal spillway components would also be removed. Construction activities will require that a SWPPP be in effect. Downstream flooding conditions from a 1% AEP, 24-hour storm would be similar to those described for the FWOFI alternative. Existing and proposed floodplains were mapped approximately 10.4 miles downstream of FRS No. 2, ending 3.6 miles downstream of Herff road. The number of residential and nonresidential structures inundated above the finished-floor elevation during the modeled 1% AEP, 24-hour flood event would increase from 42 structures to 88 structures. In order to meet the purpose and need of this project, mitigation for induced flooding would be necessary. This alternative assumes that 39 of the residential and non-residential structures would be acquired/removed and 49 would be floodproofed. Floodwaters from a 1% AEP, 24-hour flood would cause increased flooding on 14 roads. This alternative assumes that only the I-10 W frontage road would have barricades with flood warning lights installed on it to prevent induced flooding, as all of the other roads with increased flooding have flooding depths between

1.1 feet and 17.6 feet in the existing condition and would not be passable. No mitigation for induced flooding would be performed for 5 private driveways. The estimated cost of this alternative is $23,658,000.

Alternative 3 – High Hazard Potential Rehabilitation: The measures for the high hazard potential rehabilitation of FRS No. 2 include removing the existing principal spillway system; installing a new principal spillway system consisting of a standard covered riser with the crest at elevation 1,585.75 feet and a 36-inch-diameter RCP discharging into a new impact basin; regrading the inlet and outlet channels of the auxiliary spillway and widening the crest from 200 to 350 feet, adding a splitter dike and lowering the crest to elevation 1,611.30 feet (the current elevation of the low level ports), protecting the downstream end of auxiliary spillway with rock riprap and adding a concrete cutoff wall at the control section of the auxiliary spillway, raising the dam crest to 1,616.8 feet, and replacing the rock blanket on 2.5:1 upstream embankment slope. The estimated cost of this alternative is $7,692,000.

Recommended Plan: The recommended plan is Alternative 3 – High Hazard Potential Rehabilitation of FRS No. 2. This alternative is the locally, socially, and environmentally preferred alternative and maximizes the net national benefits. The project costs for the recommended plan are provided in **Table S-4**. The most likely scenario is for the project to be implemented over 36 months, including design and construction.

Table S-4. Resource Information

FRS No. 2 Project Costs	PL-83-566 Funds [a]		Other Funds		Total Dollars[b]
	Dollars[b]	%	Dollars[b]	%	
Construction	$3,840,000	65%	$2,023,000	35%	$5,863,000
Land Rights Acquisition	$0	0%	$30,000	100%	$30,000
NRCS Technical Assistance/ Engineering	$1,107,000	100%	$0	0%	$1,107,000
Project Administration	$578,000	97%	$15,000	3%	$593,000
Federal, State, and Local Permits	$0	0%	$99,000	100%	$99,000
TOTAL COSTS	$5,525,000	72%	$2,167,000	28%	$7,692,000

[a] Price Base: 2021 dollars
[b] Rounded to nearest $1,000

S.10 Project Benefits

Rehabilitation reduces the potential for loss of life and maintains protection of existing infrastructure downstream of the dam. Alternative 3 – High Hazard Potential Rehabilitation of the dam would reduce damages from $391,000 for Alternative 1 – No Action/ FWOFI to $271,000, providing benefits of $120,000.

Number of Direct Beneficiaries/Population at Risk FRS No. 2: On-Site - 372 (Population at Risk [PAR]), Offsite – N/A

Other Beneficial Effects:

- Complies with high hazard potential dam safety and performance standards established by NRCS;
- Reduces the potential for loss of life by reducing the possibility of dam failure;
- Reduces the Sponsors' liability associated with continuing to operate an unsafe and noncompliant dam;
- Continues to provide flood protection for downstream agricultural lands, houses, and infrastructure; and
- Extends the service life FRS No. 2 for 100 years after construction.

Benefit-to-Cost Ratio (discount rate of 2.5%): 0.5

Selected Plan: $7,692,000 for FRS No. 2

S.11 Funding Schedule

- Federal Funds (budget year): $1,107,000
- Federal Funds (year after budget year): $4,418,000
- Non-Federal Funds (budget year): $0
- Non-Federal Funds (year after budget year): $2,167,000
- Non-Federal Funds (future O&M): $5,000 annually

S.12 Period of Analysis

The standard evaluation period for dam rehabilitation under PL 83-566 is a minimum of 50 years and a maximum of 100 years. FRS No. 2 was analyzed for a benefit period of 100 years following construction. The project is planned for a phased installation totaling 36 months including design and construction.

S.13 Project Life

FRS No. 2: 100 years

S.14 Environmental Impacts

Impacts associated with the preferred alternative for FRS No. 2 are provided in Table S-5.

Table S-5. Summary of Environmental Effects for the Preferred Alternative

ITEM/CONCERN	FRS NO. 2 – SUMMARY OF EFFECTS OF HIGH HAZARD POTENTIAL REHABILITATION ALTERNATIVE
Prime and Unique Farmland	Would maintain the flood protection downstream of the dam resulting in inundation for short periods of time. A 2.3 foot dam raise would be required for this alternative and the inundation of approximately 5 additional acres of prime farmland from the backwater of FRS No. 2 are anticipated, although flooding of this area would be very infrequent and that the widening of the spillway may decrease flooding on upstream cropland for most storms. Less than 1 acre of prime farmland within the FRS No. 2 projected maximum LOD that would potentially be impacted during construction, although this area does not appear to be actively farmed.
Erosion and Sediment	Would continue to allow the dam to collect and retain sediment, would provide 100-yrs of sediment capacity following construction, and would reduce the downstream erosion potential by safely passing controlled storm flows through the new conduit.
Floodplain Management	The level of flood protection will be the 1% AEP event and the drawdown time in backwater will be less than 10 days. Based on flood routing for the 1% AEP event, the regulatory floodplain upstream of the dam (i.e., dam backwater elevation) is estimated to decrease by approximately 0.7 ft. The change in WSE downstream of the dam ranges from 0.13 ft to -0.8 ft. The downstream 1% AEP floodplain area would be similar to what it is in the existing condition.
Sole Source Aquifers	Would result in minor, temporary impacts to water quality in Cibolo Creek as a result of erosion and sedimentation during construction, which could impact the sole source aquifer. As FRS No. 2 is located within the EPAs review area for the Edwards Aquifer Sole Source Aquifer and would receive Federal funding under this alternative, if this alternative is selected the project will need to be evaluated by the EPA Region 6 Source Water Protection Branch. If the evaluation indicates that the project does not have significant potential to contaminate the SSA, the project may continue as planned.
Streams, Lakes, and Wetlands	Would result in a discharge of fill material into potential jurisdictional waters of the U.S. during construction. Aquatic habitat upstream and within the normal pool/sediment pool area would be maintained. In addition, the fringe wetlands and vegetation would be maintained; however, temporary impacts would likely occur during construction. A pre-application meeting was held with the U.S. Army Corps of Engineers (USACE) on January 10, 2023. Based on this meeting, it appears that a Nationwide Permit 3, Maintenance, with a Pre-Construction Notification would be required.
Water Quality	Would result in temporary impacts to water quality during construction. Sedimentation and erosion would be managed through the implementation of a SWPPP. BMPs would be identified in the SWPPP.
Woodland Vegetation/Forest Resources	Would result in the removal of approximately 1.8 acres of vegetation, including trees.
Invasive Species	Could result in the introduction of new invasive species by construction equipment or spreading of existing invasive species during construction, if preventative measures are not taken. All disturbed areas would be revegetated using adapted and/or non-invasive native species. All tools, equipment, and vehicles will be cleaned before transporting materials and before entering and leaving the worksites to prevent the introduction and spread of invasive species.

ITEM/CONCERN	FRS NO. 2 – SUMMARY OF EFFECTS OF HIGH HAZARD POTENTIAL REHABILITATION ALTERNATIVE
Riparian Areas	Would result in minor temporary impacts during construction. The normal pool/sediment pool area would remain the same size. The riparian areas would establish surrounding the normal pool/sediment pool area consistent with pre-construction conditions following rehabilitation activities.
Threatened and Endangered Species	The proposed project would not affect federal or state listed plant species. Potential nesting habitat for the federally listed golden-cheeked warbler was observed within the project area. In addition, potential suitable habitat was observed within the project area for the zone-tailed hawk, Guadalupe fatmucket, false spike, and monarch butterfly. Based on preliminary design, no direct impacts to these species are anticipated as a result of this alternative. Indirect impacts (i.e. noise) may occur but would be temporary in nature and would not result in a jeopardy to the species continued existence.
Fish and Wildlife	Would maintain the existing aquatic and terrestrial wildlife and their habitat in the long term as existing conditions would not be permanently impacted. In addition, downstream aquatic and terrestrial wildlife and their habitat would continue to be maintained and protected by controlling the stream flow and flood protection. Minor, temporary impacts to aquatic and terrestrial habitat may occur during construction. Highly-mobile species would be expected to leave the area; however, less-mobile species may be lost due to equipment during construction. It is expected that wildlife would return to the area post construction and all habitat areas would be re-established
Migratory Birds/Bald and Golden Eagles	Minor, temporary impacts to habitat during construction. Nesting activities and migratory birds would be disturbed if construction takes place during migratory bird season (March 1 to August 31). A qualified biologist will conduct nest presence/absence surveys during vegetation clearing and prior to construction to identify any active nests and mitigation measure will be implemented. Habitat areas would return to pre-construction conditions. No known eagle nesting sites occur surrounding the reservoir. No impacts to eagles are anticipated.
Cultural Resources	One previously unrecorded archeological site, one previously unrecorded isolated find, and one historic-age resource were documented within the Area of Potential Effects (APE). Coordination was completed with the Texas State Historic Preservation Office (SHPO) and concurrence was received on July 30, 2021 that no historic properties are present or affected. NRCS consultation with relevant Tribes has also been conducted.
Local and Regional Economy	Will result in a temporary positive impact on the local economy during construction and would continue to provide flood protection for downstream residential and commercial areas.
Environmental Justice	Would allow flood protection benefits to continue for 100 years and would avoid potential impacts to downstream minority and low-income populations.
Land Use	Will result in minimal changes to land use and vegetation cover adjacent to FRS No. 2 due to the widening of the existing auxiliary spillway crest. This alternative would provide increased protection against breach to properties downstream of the dam.

ITEM/CONCERN	FRS NO. 2 – SUMMARY OF EFFECTS OF HIGH HAZARD POTENTIAL REHABILITATION ALTERNATIVE
Costs/Public Benefits	The average annual costs to Rehabilitate the FRS are estimated to be $199,000 and the average annual benefits of the alternative are estimated to be $135,000, resulting in a benefit cost ratio of 0.7.
Public Health and Safety	Rehabilitation of the FRS would bring the dam into compliance with NRCS criteria. The threat of dam failure and loss of life would be reduced, and flood protection would continue.
Social Issues/Community Cohesion	Not anticipated to impact social issues or community cohesion.

S.15 Major Conclusions

<u>FRS No. 2</u>
The High Hazard Potential Rehabilitation Alternative will bring FRS No. 2 into compliance with NRCS safety and performance standards for a high hazard potential dam. This alternative has the greatest net economic benefit of all alternatives analyzed and a benefit-to-cost ratio of 0.5. This alternative is the Locally Preferred Alternative, Environmentally Preferred Alternative, the Socially Preferred Alternative, and the Economically Preferred Alternative. This alternative will be implemented with federal assistance.

S.16 Areas of Controversy and Issues to be Resolved

Controversial Issues: None identified.

Issues to be Resolved: Auxiliary spillway widening onto private land.

The anticipated issues to be resolved for the rehabilitation of FRS No. 2 include:

- Coordination with landowners on widening of auxiliary spillway onto private land. The Sponsors will acquire the necessary term easements for the period of analysis.
- A new Operation and Maintenance (O&M) Agreement will be developed with the Sponsors for the 100-year program life of FRS No. 2. The new O&M Agreement must be signed before the Project Agreement is signed.
- For projects with disturbances equal to or greater than five acres it is necessary to have a Storm Water Pollution Prevention Plan (SWPPP) in place at least 48 hours prior to and during construction of the proposed project and filing Notice of Intent with the Texas Commission on Environmental Quality is required. A Notice of Termination (NOT) must be filed once the site has reached final stabilization.
- The Sponsors will be responsible for developing an Emergency Action Plan (EAP) prior to construction and will review and update the EAP annually with local emergency response officials.

A pre-application meeting with the USACE was held on January 10, 2023. Based on this meeting, it appears that a Nationwide Permit 3, Maintenance, with a Pre-Construction Notification would be required.

S.17 Evidence of Unusual Congressional or Local Interest

No evidence of unusual Congressional or local interests was identified.

S.18 Compliance Certificate

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

1.0 INTRODUCTION

1.1 Changes Requiring Preparation of a Supplement

This Supplemental Watershed Plan No. I and Environmental Assessment formulated, evaluated, and resolved alternatives for the rehabilitation of Upper Cibolo Creek Floodwater Retarding Structure (FRS) No. 2 located within the Upper Cibolo Creek Watershed, a subwatershed of the Lower San Antonio River, in Kendall County, Texas (see Project Map in **Appendix B**).

FRS No. 2 is a single-purpose dam that was designed and constructed as a low hazard potential class structure in 1980. The classification of FRS No. 2 was changed to high hazard potential class structure in 2005 due to the presence of downstream development and roads that would be impacted in the event of a dam failure. Hydrologic and hydraulic analyses indicate that FRS No. 2 does not meet NRCS high hazard criteria for PS capacity (ability to pass the 100-year storm without engaging auxiliary spillway) or overall capacity requirements (overtopping during the PMP storm). TCEQ criteria were not evaluated for this structure.

This Supplemental Watershed Plan-EA documents the planning process by which NRCS provided technical assistance to the Sponsors and the public in addressing resource issues and concerns within the Upper Cibolo Creek Watershed and complied with the requirements of the National Environmental Policy Act (NEPA).

The format of this Plan-EA follows the plan format outline that must be followed for all Watershed Project Plans as outlined in the USDA-NRCS National Watershed Program Manual (USDA-NRCS 2015) Part 501 and USDA-NRCS National Watershed Program Handbook (USDA-NRCS 2014) Part 601. The Plan-EA assists USDA-NRCS in determining if the preferred alternative would have a significant impact on the quality of the human environment and, if so, requires preparation of an Environmental Impact Statement.

1.2 Project History

The original Upper Cibolo Creek Watershed work plan was prepared, and works of improvement were installed, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended. The original watershed work plan was developed in November 1968. The evaluated life of the project was 100 years. Construction of four Floodwater Retarding Structures (including FRS No. 2) was completed in Kendall County between 1978 and 1980.

United States Department of Agriculture (USDA)-Natural Resources Conservation Service (NRCS) completed an assessment of FRS No. 2 in August 2010 which concluded that the dam did not meet current USDA-NRCS criteria and engineering standards for a high hazard potential dam. As part of the dam assessments, an "Evaluation of Potential Rehabilitation Projects" worksheet was completed. The worksheet is used to evaluate each potential watershed rehabilitation project with a valid application by computing a risk index and preparing an evaluation of consequences of failure on each project for ranking purposes. The evaluation performed as part of the assessment indicates that the FRS No. 2 Risk Index is 327.

1.3 Purpose and Need for Action

The original purpose of the Upper Cibolo Creek Watershed Plan was for watershed protection, flood prevention, and municipal and industrial water supply. Upper Cibolo Creek FRS No. 2 was constructed as a single-purpose, low hazard potential FRS. Due to downstream development, FRS No. 2 has been reclassified as a high hazard potential dam, yet it does not meet the current safety and performance standards for the high hazard potential classification. While there is a need for action to reduce safety risks and meet current safety standards, there is also a need for continued flood protection in the Upper Cibolo Creek Watershed. The authorized purpose for this project is to provide flood protection in a manner that takes into consideration economic, social, and environmental goals.

1.4 Opportunities

The following is a general list of opportunities that will be recognized by implementation of an alternative for each dam that address the Project purpose and need. Some quantification of these opportunities will be provided in other sections of this report, as appropriate.

- Bring the dam into compliance with high hazard potential dam safety and performance standards established by NRCS and TCEQ;
- Mitigate the potential for loss of life and property damage by reducing the possibility of a dam failure;
- Reduce Sponsor liability associated with operation of a dam that does not meet State and Federal requirements; and
- Continue to provide flood protection for downstream agricultural lands, houses, and infrastructure.

2.0 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

On September 3, 2020, a Public Scoping Meeting was held virtually via Microsoft Teams to identify issues of economic, environmental, cultural, and social importance in the watershed. The Public Scoping Meeting could not be held in-person, due to the COVID-19 Pandemic. Input was provided by the Kendall County Soil and Water Conservation District #216 (SWCD), Kendall County Commissioners Court, the City of Boerne, the Edwards Aquifer Authority, the Texas NRCS, and the Texas State and Soil Water Conservation Board (TSSWCB). Factors that would affect soil, water, air, plant, animals, and human resources were identified by an interdisciplinary planning team composed of the following areas: engineering, biology, economics, resource conservation, water resources, archeology, and geology.

There were no additional concerns identified by local citizens at the first Public Scoping Meeting.

The scoping process identified (1) the objectives, needs, and primary concerns for the Sponsors; (2) the relevant issues associated with the FRS; and (3) the environmental concerns associated with the Project. **Table 2-1** identifies the specific concerns and their relevance to the proposed action.

Table 2-1. Resource Concerns Considered and Identified Through Scoping

ITEM/CONCERN	Relevant to the Proposed Action? YES	NO	RATIONALE
SOILS			
Prime and Unique Farmland	X		There are areas of Prime Farmland downstream of FRS No. 2 that are potentially at risk of flooding from Ranger Creek should FRS No. 2 be removed. There are also areas identified as Prime Farmland immediately adjacent to and within the floodpool of FRS No. 2, although they do not appear to be actively farmed. Potential impacts to areas of Prime Farmland resulting from modifications to FRS No. 2 must be considered.
Erosion and Sediment	X		The impact of sediment accumulation in FRS No. 2 is relevant to the existing and future service life of the FRS. In addition, downstream erosion and sedimentation could be impacted by modifications to the FRS. Potential erosion and sedimentation impacts resulting from modifications to FRS No. 2 must be considered.
WATER			
Floodplain Management	X		The FRS currently provides flood protection for downstream areas, which is required to prevent routine flooding of agricultural lands and residences and routine overtopping of local roads. Currently, there is development within the floodplain downstream and is expected that this will continue in the future. Potential impacts to flood protection resulting from modifications to FRS No. 2 must be considered.

ITEM/CONCERN	Relevant to the Proposed Action? YES	NO	RATIONALE
Coastal Zone Management Plans		X	The project is not located in an area subject to Coastal Zone Management Act requirements, so this item is not considered to be relevant to the proposed action.
Potable Water Supply/Regional Water Management Plans/Water Resources		X	Water supply was not a designated purpose of FRS No. 2, so this is not considered relevant to the proposed action. FRS No. 2 does contribute to Cibolo Creek, which passes through the Edwards Aquifer Recharge Zone. Impacts associated with the Edwards Aquifer are considered under the Sole Source Aquifer resource concern.
Sewer Utilities		X	There are no known sewer utilities in the project area, so this item is not considered to be relevant to the proposed action.
Sole Source Aquifers	X		FRS No. 2 is located within the Edwards Aquifer Sole Source Aquifer (SSA) Drainage Area. While FRS No. 2 is not within the Edwards Aquifer Authority jurisdictional area, it is located within a designated EPA SSA (Edwards Aquifer – Streamflow Source Area. In addition, FRS No. 2 is located above the Trinity aquifer which contributes to the Edwards Aquifer. The impacts to Sole Source Aquifers resulting from modifications to FRS No. 2 must be considered.
Streams, Lakes, and Wetlands/Waters of the U.S.	X		Based on field investigations, one open water feature, Upper Cibolo Creek FRS No. 2 Reservoir, and one perennial stream feature, Ranger Creek, were identified within the project area. Potential impacts to these features resulting from modifications to FRS No. 2 must be considered. Coordination with the USACE will be required.
Water Quality	X		Upper Cibolo Creek (located approximately 2.7 miles downstream of FRS No. 2) is currently listed as being impaired for bacteria. In addition, construction activities and the resulting modifications could have impacts to downstream water quality. Potential impacts to water quality resulting from modifications to FRS No. 2 must be considered. Water quality impacts specifically related to the Edwards Aquifer SSA are discussed under the SSA resource concern.
Wild and Scenic Rivers		X	No designated Wild and Scenic Rivers were identified in the project area. Nationwide Rivers Inventory listed segments are also protected by the Wild and Scenic Rivers act. The closest Nationwide Rivers Inventory-listed segment to Ranger Creek/Cibolo Creek are outside of the area of effects of the proposed action. This item is not considered to be relevant to the proposed action.

ITEM/CONCERN	Relevant to the Proposed Action? YES	NO	RATIONALE
AIR			
Air Quality / Clean Air Act		X	FRS No. 2 is located in an attainment/unclassifiable county (Kendall) for National Ambient Air Quality Standards, so this item is not considered to be relevant to the proposed action. There could be some temporary effects during construction (dust and exhaust) when the dam is modified.
PLANTS			
Threatened and Endangered Species	X		No suitable habitat for federal or state listed plant species was identified within the project area. The proposed project would not affect federal or state listed plant species. Formal consultation with USFWS will be required as part of any project, so this item is considered relevant to the proposed action.
Woodland Vegetation/Forest Resources	X		Woodland vegetation is present in the project area. It is not anticipated that there would be impacts to large areas of woodland vegetation resulting from modifications to FRS No. 2, but potential impacts resulting from modifications to FRS No. 2 must be considered.
Invasive Species	X		Invasive species have the potential to occur within the project area and could be transported into or out of the project area by construction activities. Potential impacts resulting from modifications to FRS No. 2 must be considered.
Natural Areas		X	The project is not located within a designated Natural Area, so this item is not considered to be relevant to the proposed action.
Riparian Areas	X		Riparian areas are present surrounding the FRS No. 2 normal pool/sediment pool area as well as downstream along Ranger Creek. Potential impacts to riparian areas resulting from modifications to FRS No. 2 must be considered.
ANIMALS			
Coral Reefs		X	No coral reefs were identified within or near the project area, so this item is not considered to be relevant to the proposed action
Ecologically Critical Areas		X	The project is not located within or near a designated Ecologically Critical Area, so this item is not considered to be relevant to the proposed action.
Threatened and Endangered Species	X		Suitable nesting habitat for the federally listed golden-cheeked warbler was identified within the project area. In addition, suitable habitat for the federally proposed endangered/state threatened Guadalupe fatmucket and Guadalupe orb mussel species; and one federal candidate species, the monarch butterfly was identified within the project area. Formal consultation with USFWS will be required as part of any project and potential impacts to these species resulting from modifications of FRS No 2. Must be considered.

ITEM/CONCERN	Relevant to the Proposed Action? YES	NO	RATIONALE
Essential Fish Habitat		X	No essential fish habitats have been identified within the project area, so this item is not considered to be relevant to the proposed action.
Fish and Wildlife	X		FRS No. 2 provides habitat for fish and other wildlife. Potential impacts to fish and wildlife resulting from modifications to FRS No. 2 must be considered.
Invasive Species		X	It is not anticipated that modifications to FRS No. 2 would result in the spread of any invasive species that could presently be found at the site (beyond what would likely occur without modification), so this item is not considered to be relevant to the proposed action.
Migratory Birds/Bald and Golden Eagles	X		Migratory bird pathways, stopover habitats, wintering areas, and breeding areas occur within and/or adjacent to the project area and may be associated with wetlands, ponds, riparian corridors, fallow fields, grasslands, and woodlands. Bald Eagles/Golden Eagles were not observed in the project area during a site visit. However, Bald Eagles occur throughout the state and therefore have the potential to utilize the site for hunting and/or stopover. Potential impacts to Migratory Birds/Bald and Golden Eagles resulting from modifications to FRS No. 2 must be considered.
HUMANS			
Costs/Public Benefits	X		Per PR&G, Public Benefits relative to Costs must be considered in the evaluation of potential modifications to FRS No. 2.
Cultural Resources	X		One previously unrecorded archeological site, one previously unrecorded isolated find, and one historic-age resource were documented within the APE. NRCS consultation with the Texas State Historical Preservation Office (SHPO) and relevant tribes will be required. .
Drought		X	FRS No. 2 was not designed to provide water supply benefits, so this item is not considered to be relevant to the proposed action.
Environmental Justice and Civil Rights	X		Potential impacts to minority and low-income populations could result from modifications to FRS No. 2 and must be considered.
Land Use	X		Impacts to upstream and downstream land use could occur as a result of modifications to FRS No. 2. Potential impacts to land use resulting from modifications to FRS No. 2 must be considered.
Local and Regional Economy	X		Positive and negative impacts to the local economy could occur as a result of modifications to FRS No. 2 and must be considered.

ITEM/CONCERN	Relevant to the Proposed Action? YES	Relevant to the Proposed Action? NO	RATIONALE
Park Lands, Scenic Areas		X	FRS No. 2 is not within designated park lands or a designated scenic area, so this item is not considered to be relevant to the proposed action.
Public Health and Safety	X		FRS No. 2 is classified as a high hazard potential dam and in its existing condition is a risk to the public. Potential impacts to Public Health and Safety resulting from modifications to FRS No. 2 must be considered.
Public Recreation		X	There have been no public recreation opportunities identified within the project area, so this item is not considered to be relevant to the proposed action.
Scenic Beauty		X	FRS No. 2 is not located within an area that has been identified as an area of scenic beauty and the project would not degrade scenic beauty of the general landscape or viewsheds, and may protect and/or contribute to it, so this item is not considered to be relevant to the proposed action.
Scientific Resources		X	No scientific resources/studies have been identified within the project area, so this item is not considered to be relevant to the proposed action.
Social Issues/Community Cohesion	X		Potential impacts to social issues/community cohesion could result from modifications to FRS No. 2 and must be considered.

3.0 AFFECTED ENVIRONMENT

The affected environment includes ecological, cultural, social, aesthetic, and economic resources that could potentially be affected by proposed alternatives. The purpose of describing the affected environment is to define the context in which the potential impacts could occur. Additional information regarding the affected environment of the Upper Cibolo Creek Watershed can be found in the Watershed Work Plan. Existing conditions that are specific to FRS No. 2 are described in the following sections.

3.1 Planning Activities

The following hydrologic and hydraulic analysis planning activities were considered when defining the affected environment for FRS No. 2:

- Development of watershed boundaries and hydraulic model topography from current LiDAR;
- Development of structure (culvert, bridge, and dam) critical dimensions from currently available information and site visits;
- Development of a watershed hydrologic model for FRS No. 2 and the aggregate watershed above the confluence of Cibolo Creek with an unnamed tributary that is 1.9 miles downstream of Menger Creek, for 8 statistical storms: 50% AEP through 0.2% AEP;
- Development of a HECRAS 1-D model for Ranger Creek, from the FRS No. 2 outlet to the confluence with Cibolo Creek, and for Cibolo Creek to the confluence with an unnamed tributary that is 1.9 miles downstream of Menger Creek. The model cross sections were developed from the current FEMA effective model cross sections, were modified as needed, and additional cross-sections were added;
- Development of Water Resources Site Analysis Program (SITES) model for FRS No. 2, to include development of NRCS design floods per TR-210-60 (USDA NRCS, 2019);
- Development of a HEC-FDA model based on hydrologic and hydraulic data and residential and nonresidential structure data to analyze flood damages; and
- Use of the above tools to evaluate existing conditions and to develop and evaluate potential alternatives.

Other planning activities considered when defining the affected environment included land use inventory, geologic analyses, natural resources inventories, cultural resources inventories, wetland assessments, and the identification of threatened and endangered species.

3.2 Physical Features

3.2.1 Project Location

FRS No. 2 is located in Kendall County, Texas on Ranger Creek, a tributary of Cibolo Creek, and a tributary of the Lower San Antonio River, located approximately 4 miles west of Boerne, Texas. The project location is depicted in Appendix B, Figure B-1.

3.2.2 Topography

The area of interest is located in southern Kendall County, Texas, within the Ranger Creek Quadrangle from the USGS 7.5-minute topographic map series. The elevations in the Quadrangle range from approximately 1,440 to 2,000 feet above mean sea level and the topography ranges from nearly level to strongly sloping.

3.2.3 Soils

According to the *Soil Survey of Kendall County, Texas* (Dittemore and Hensell, 1981), the County lies on the southern edge of the Edwards Plateau physiographic province. This province has been dissected by stream erosion which led to the formation of its characteristic rugged topography that includes step-sided, narrow canyons, instream divides and uplands, broad valleys, and streams. Altitudes range from 1,100 feet at the southeastern edge of the County to about 2,100 feet in the north-central region (Dittemore and Hensell, 1981). Kendall County is further described as having a well-integrated drainage system of which Cibolo Creek and its tributaries form part by draining the southern portion of the County. The predominant soil associations identified in the vicinity of the project site are summarized below.

<u>Brackett Association</u>
Brackett association, 1 to 8 percent slopes: Shallow, well drained loamy soils with moderately slow permeability. Typically, soils in this associations have a layer of grayish brown clay loam near the surface and is underlain by limestone and marl. This association is present on ridges and foot slopes.

Brackett-Real association, 10 to 30 percent slopes: Shallow, well drained, gravelly and loamy soils with moderate to moderately slow permeability. Horizontal limestone outcrops have characteristic stair stepped appearance. Typically, this association consists of surficial layer of light brownish gray, gravelly clay loam followed by zones of limestone gravel and beds of weakly cemented limestone interbedded with marl. These soils are generally on hilly zones.

<u>Doss Association</u>
Doss-Bracket association, undulating: Shallow, well drained, loamy and clayey soils with moderately slow permeability. These soils are observed in uplands and typically consist of dark grayish-brown to brown silty clay followed by white, soft, chalky materials at deeper depths.

Krum Association
Krum silty clay, 1 to 3 percent slopes: Deep, well drained, gently sloping soils with moderately slow permeability. This association generally consists of dark grayish-brown to grayish-brown silty clay near the surface followed by pale brown to yellowish-brown silty clay with limestone fragments at deeper depths. This association is present at the base of limestone hills.

Krum silty clay, 3 to 5 percent slopes: Deep, well drained, gently sloping soils with moderately slow permeability. This association generally consists of dark grayish-brown to brown silty clay near the surface followed by light yellowish-brown silty clay with limestone fragments and calcium carbonate concretions at deeper depths. This association is present on foot slopes of limestone hills.

3.2.4 Regional Geology

Per the Physiographic Map of Texas (Wermund, 1996), Kendall County is located within the Edwards Plateau physiographic province of Texas. The Edwards Plateau is primarily represented by the Hill Country, an area sculpted by stream erosion of the Balcones fault escarpment. This escarpment, which bounds the eastern and southern portions of the Edwards Plateau physiographic region, developed as a result of faulting which uplifted the Plateau as much as 600 feet above the surrounding physiographic regions. Hard, Cretaceous limestones with abundant solutioning features (i.e., sinkholes, caves) that form a network of caverns cap the Edwards Plateau. Limestone bedrock is typically exposed at the surface, cracks and fissures allow for penetration of groundwater into the subsurface as well as for the formation of springs near surface. A stairstep topography is characteristic of this physiographic region as a result of the presence of alternating hard and soft marly limestone of the Glen Rose Formation. Moreover, local streams cut through the plateau as much as 1,800 feet in 15 miles (Wermund, 1996).

Quaternary
Pleistocene age terrace deposits are comprised of gravel, sand, silt, and clay in various proportions. Gravel, fragmented limestone, dolomite, and chert are more predominant adjacent to the Edwards Plateau. Gravel is generally rounded to angular limestone and chert pebbles and cobbles with trace boulders. Locally, these deposits may be indurated with calcium carbonate (caliche) and commonly contain gravelly quartz and lithic sand and silt to sandy gravel (Moore and Wermund, 1993).

Cretaceous
The Upper Cibolo Creek watershed is primarily underlain by Cretaceous deposits of the Upper Glen Rose Formation. This rock unit, designated as “Kgru”, is primarily composed by limestone, dolomite, and marl which form alternating beds with characteristic stairstep topography. The limestone is typically hard to soft, marly, and light gray to yellowish gray (Brown et al., 1983). The dolomite is also described by Brown et al. (1983) as porous, fine grained, and yellowish brown. Marine megafossils are commonly observed. The Upper Glen Rose formation has thicknesses of approximately 400 feet in the vicinity of the project site and is relatively thinner bedded, more dolomitic, and less fossiliferous than the lower portion of the Glen Rose formation which has thickness of nearly 900 feet near the area of interest.

West of the project site and at the approximate boundaries of the watershed of FRS No. 2, the Fort Terrett Member of the Edwards Formation is identified. This member is primarily composed of limestone and dolomite and has thicknesses ranging from 230 to 300 feet in the vicinity of the area of interest (Brown et al., 1983). The upper portion of the Fort Terrett Member consists of collapsed breccia and aphanitic to recrystallized limestone. The middle portion of the member is composed by light to dark gray, cherty limestone with shell fragments and brownish-gray dolomite. The bottom most segment of this member contains nodular limestone and a thin layer of fossil bearing clay.

Occurrence of Groundwater

The *Aquifers of Texas* Report No. 380 (George et al., 2011) developed by the Texas Water Development Board describes the Trinity Aquifer as a major aquifer extending across much of the central and northeastern portion of the state of Texas. Outcrops of this aquifer are observed in most of Kendall County including the area of interest for this project. The aquifer is one of the most extensive and highly used groundwater resources in the State. The Trinity aquifer includes several smaller aquifers which are predominantly composed of limestone, sand, clay, gravel, and conglomerate. The Trinity group is divided into different formations and each formation is composed by several members. The Glen Rose Formation, part of the Trinity Group, underlies the area of interest for this project and is mainly comprised by limestone that thickens toward the Gulf, alternating beds of blue shale, and nodular marl. The limestone is fossiliferous and generally yields small quantities of relatively mineralized water. Reeves (1967) highlights that slow circulation in the thinly bedded limestone contributes to the relatively high mineralization of the groundwater in the aquifer.

The Trinity aquifer recharges slowly, largely by direct infiltration of rainfall in the Glen Rose member, but it contributes significantly to recharge of the neighboring Edwards aquifer. In the Upper member of the Glen Rose, water is contained within solution channels which are tubular and parallel to the bedding planes of the thin-bedded limestone. Groundwater in the Glen Rose member (as is the case at the project site), occurs primarily under artesian pressures due to the presence of shale beds which act as confining layers for the water bearing limestone beds (Reeves, 1967).

The combined freshwater saturated thickness of the different sub-aquifers that form the Trinity aquifer averages 600 feet in North Texas (George et al., 2011) and about 1,900 feet in Central Texas. Groundwater of the Trinity aquifer is primarily used for municipalities, domestic supply, livestock, and irrigation as water quality is generally fresh but very hard in the outcrop of the aquifer. Total dissolved solids concentration increases from less than 1,000 mg/L in the east and southeast to between 1,000 and 5,000 mg/L as the depth of the aquifer increases. Thus, at greater depths, the water becomes slightly to moderately saline and shows increased sulfate and chloride concentrations.

3.2.5 Local Geology

FRS No. 2 is underlain by bedrock of the Upper Glen Rose formation (Kgru). This formation is generally comprised by limestone, dolomite, and marl which form alternating beds with characteristic stairstep topography. The limestone is typically described as light gray to yellowish gray, hard to soft and is generally marly (Brown et al., 1983). The dolomitic portion of this formation, on the other hand, is characterized as yellowish brown, porous, and fine grained.

Based on data from historical boreholes drilled during the original site investigation (McClelland Engineers, 1978), the embankment is underlain by stream-deposited alluvial soils consisting of lean clay (CL) with gravel and layers of silty sand (SM) and clayey gravel (GC). Thicknesses of this stratum ranged from 0 to 6 feet at the abutments, auxiliary spillway, and near the original stream channel and between 8 to 19 feet along the lower portions of the original valley. Residual soils were identified underlying the alluvium and were generally described as calcareous, stiff to very stiff, lean clays (CL) and fat clays (CH) with limestone layers. Thicknesses of this stratum varied between 2 and 16 feet. Limestone and claystone were identified as the parent bedrock underlying the soil overburden to the termination depths of the borings completed. Groundwater measurements collected during the original geotechnical exploration were reported (McClelland Engineers, 1978) and indicate the presence of groundwater along the centerline of the dam at approximately El. 1563 to El. 1564 (NGVD29), roughly correspondent to the bottom of the stream channel.

Field permeability tests identified pervious zones in the overburden soils and bedrock. Permeabilities of 5.0 and 6.5 ft/day were reported for the overburden soils and permeabilities of 7.2 and 13.7 ft/day were reported for zones of weathered limestone. On the other hand, intact bedrock had reported permeabilities of 0.4 ft/day or less. The original exploration report highlights that zones of high permeability were likely associated with stream deposited gravel layers and positive cutoff was not considered feasible. Thus, installation of a 5 to 8 feet deep key trench was recommended with the goal of bonding the impervious zone of the embankment to the in-situ soils of the foundation. Moreover, a drainage blanket extending from Sta. 11+30 to Sta. 12+50 and between Sta. 23+00 and Sta. 24+00 was also recommended. The drainage blanket was to be underlain by a 2.5-foot-wide trench drain which was recommended for placement at each of the abutments and extending to the principal spillway for discharge.

The existing auxiliary spillway is underlain by thin alluvial soils, generally lean clay (CL) with gravel, deposited over interbedded weathered limestone and claystone. The overburden, weathered claystone and limestone materials were identified in the original exploration report as suitable sources of fill material for the present embankment.

The existing principal spillway, corresponding to location one of the original investigation, at Sta. 14+70, was found to be underlain by 8 to 9.5 feet of alluvial soils, generally lean clay (CL) and clayey sand (SC) with some gravel, underlain by interbedded limestone and claystone. The limestone bedrock was described as sound and relatively flat and was identified at approximately El. 1560. Groundwater table was identified in boreholes drilled in the vicinity of the existing principal spillway between 4 and 5 feet below the ground surface at about El. 1564.

An upstream zone located within the present day reservoir was investigated as potential borrow source for fill material. The borrow area studied consisted primarily of lean clay (CL) with gravel. Granular soils ranging from silty sand (SM) to clayey gravel (GC) were identified in proximity to the original stream channel along grid lines A, B, and C, investigated as part of the original exploration. Overburden soils in the borrow areas extended to depths of 4 feet to more than 13 feet, the deepest depth investigated in this zone during the original site exploration.

3.2.6 Estimates of Geologic Parameters for SITES Evaluations

Hydraulic analysis and design of vegetated earthen spillways for dams are typically performed using the Water Resources Site Analysis computer program (SITES) developed by NRCS. SITES is used to evaluate erosional stability and head-cutting potential for auxiliary spillway channels subjected to flows associated with the design flood event. Development of recommended geologic input parameters for SITES analysis was performed according to published NRCS guidance (NRCS 2001, NRCS 2011) and other publications (McCook, 2005).

A geologic investigation was not included in the scope of work for this project. Therefore, historical boring logs reported in the Detailed Geologic Investigation (GI) (McClelland, 1978a), review of laboratory testing results included in the Interpretation of Soil Test Data and Recommendations report (McClelland, 1978b), published literature, engineering judgement, and experience in the general project area were relied upon to develop estimates of geologic input parameters for SITES evaluations.

To account for inherent variability in the geologic units and parameter uncertainty, the headcut erodibility index (Kh) and other geologic input parameters were estimated considering both “favorable” and “unfavorable” soil properties and bedrock characteristics. While there were not adequate data to perform an actual statistical analysis for this project, the unfavorable values could generally be considered a “low average” and the favorable could be considered a “high average” based on engineering judgment. It should be noted that the selected values are heavily reliant on judgement and experience with similar soils and geologic units in the general project area.

The SITES parameters recommended for the concept design analysis are presented in **Table 3-1**. Additional information on the development of estimates for these parameters is provided in Appendix D. Based on limitations of the existing geologic data as discussed above, a supplemental geologic investigation is recommended to confirm the preliminary estimates of site stratigraphy and material properties herein. The recommended supplemental investigation would include a detailed geologic reconnaissance with surface mapping, geotechnical test borings, and soil mechanics laboratory testing. Note that results of the supplemental investigation may warrant revision of the stratigraphy and/or material parameters presented below.

Table 3-1. Recommended Material Properties for FRS No. 2 SITES Concept Design Analysis

Stratum Description	Post-Grading Thickness (ft)	USCS	Bounding Case	Dry Unit Weight (pcf)	PI	Clay Fraction (%)	D_{75} (mm)	K_h
CL	0 – 10	CL	Unfavorable Values	95 [b]	21 [c]	22 [c]	0.38 [c]	0.11
			Favorable Values	105 [b]	14 [c]	15 [c]	0.70[c]	0.22
Limestone	5 – 15	Limestone	Unfavorable Values	130 [d]	- [a]	- [a]	- [a]	44
			Favorable Values	140 [d]	- [a]	- [a]	- [a]	256

[a] "-" indicates no data available at the time of this report.
[b] Estimated based on typical properties of CL soils per NAVFAC Design Manual 7.02 dated 1 September 1986.
[c] Historical test results for CL soils reported in the Detailed Geologic Investigation (McClelland, 1978a).
[d] Results reported are conservatively estimated based on literature available for moderately weak to moderately strong limestone.

3.2.7 <u>Climate</u>

According to Boerne, Texas Monthly Weather at The Weather Channel, accessed December 6, 2020, the average annual precipitation at Boerne is about 38.2 inches. The wettest month of the year is May, averaging 4.64 inches. The driest month of the year is January, averaging 2.08 inches. The coolest month is January with temperatures ranging from 35 degrees Fahrenheit (ºF) to 61ºF. The warmest month is August with temperatures ranging from 69ºF to 94°F. Historical extreme (record) temperatures range from -4ºF to 112°F.

3.3 Land Use

The total drainage area above FRS No. 2 is 1646.8 acres. The drainage area was derived using ArcMap 10.8 (ESRI, 2019), the Arc Hydro tool, and LiDAR topography (TNRIS, 2010, 2011, 2014). Automatic ArcMap delineations were checked and edited as necessary against the LiDAR topography. The land use/land cover data were extracted from the 2019 National Land Cover Dataset (NLCD). Table 3-2 lists the land uses in the watershed area upstream of FRS No. 2 as well as in the breach inundation zone below FRS No. 2. It should be noted that there is a privately owned dam located upstream of FRS No. 2 that was not considered in the watershed delineation or land use analysis. Located approximately 31 driving miles from San Antonio, TX, land use in the watershed is primarily shrub/scrub and forest land use types with a small amount of medium-density and low-density residential development. Appendix C contains land use maps of the upstream contributing watershed and the downstream sunny day breach zone (Figures C-1 and C-2).

Table 3-2. Existing Land Use

Land Cover Type	Drainage Area Controlled by FRS No. 2		Breach Inundation Zone Below FRS No. 2[a]	
	(acres)	(%)	(acres)	(%)
Deciduous Forest	68.9	4.2%	15.5	3.6%
Developed, High Intensity	0	0.0%	3.7	0.9%
Developed, Low Intensity	11.3	0.7%	41.4	9.5%
Developed, Medium Intensity	34.2	2.1%	21.6	5.0%
Developed, Open Space	47.3	2.9%	38.3	8.8%
Evergreen Forest	207.3	12.6%	138.6	32.0%
Hay/Pasture	0	0.0%	0.7	0.2%
Herbaceous	36.5	2.2%	12.0	2.8%
Mixed Forest	149.3	9.1%	0.0	0.0%
Open Water	23.7	1.4%	0.0	0.0%
Shrub/Scrub	1067.6	64.9%	147.1	33.9%
Woody Wetlands	0	0.0%	14.7	3.4%
Total	**1646.1**	**100%**	**433.6**	**100%**

[a] Acreages were estimated below FRS No. 2 from the structure to the downstream limit of the sunny day breach zone as depicted on Figure C-2.

3.4 Prime and Unique Farmland

According to the U.S. Department of Agriculture soil data access website, Prime Farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. The soil quality, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management and acceptable farming methods are applied. Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, and other fruits and vegetables. It has the special combination of soil quality, growing season, moisture supply, temperature, humidity, air drainage, elevation, and aspect needed for the soil to economically produce sustainable high yields of these crops when properly managed. In some areas, land that does not meet the criteria for prime or unique farmland is considered to be farmland of statewide importance for the production of food, feed, fiber, forage, and oilseed crops. The criteria for defining and delineating farmland of statewide importance are determined by the appropriate State agencies.

Based on the NRCS Soil Survey, there are areas adjacent to and immediately surrounding the flood pool for FRS No. 2 that have been identified as prime farmland, although none of these areas appear to be being actively farmed. There are areas downstream of FRS No. 2 adjacent to Ranger Creek (nearest area is 0.5 miles downstream of FRS No. 2) that have been identified as prime farmland that appear to be possibly being actively farmed and areas of prime farmland adjacent to Upper Cibolo Creek (nearest area is 2.7 miles downstream of FRS No. 2) that appear to be being actively farmed. A map of farmland designations is provided as **Figure C-3** in **Appendix C**.

3.5 Woodland Vegetation/Forest Resources

Woodland vegetation is present surrounding the FRS No. 2 site. Dominant species include live oak (*Quercus fusiformis*), Ashe juniper (*Juniperus ashei*), honey mesquite (*Prosopis glandulosa*), cedar elm (*Ulmus crassifolia*), black willow (*Salix nigra*), and American sycamore (*Platanus occidentalis*).

3.6 Invasive Species

Invasive plant species have the potential to occur throughout Texas and can establish themselves and then spread aggressively, threating the existing biodiversity of native plants. According to the Texas Invasives website (Texas Invasives, 2022), the following invasive plant species have been identified as being particularly worrisome within the Edwards Plateau Ecoregion, in which FRS No. 2 is located:

- Glossy privet (*Lingustrum lucidum*);
- Chinese tallow tree (*Triadica sebifera*);
- Johnson grass (*Sorghum halepense*);
- Heavenly bamboo (*Nandina domestica*);
- Chinaberry tree (*Melia azedarach*);
- Japanese honeysuckle (*Lonicera japonica*);
- Giant reed (*Arundo donax*);
- Golden rain tree (*Koelreuteria oulde*);
- Elephant ears (*Colocasia esculenta*);
- Paper mulberry (*Broussonetia papyrifera*);
- Tree of heaven (*Ailanthus altissima*); and
- King Ranch bluestem (*Bothriochloa ischaemum var. songarica*).

According to the Texas Invasives website (Texas Invasives, 2022), the following are common invasive wildlife species that have the potential to occur within the project area or in the surrounding watershed:

- Asian clam (*Corbicula fluminea*);
- Zebra Mussel (*Dreissena Polymorpha*);
- European Starling (*Sturnus vulgaris*);
- Red imported fire ants (*Solenopsis invicta*);
- Feral pig (*Sus scrofa*); and
- Nutria (*Myocastor coypus*).

3.7 Threatened and Endangered Species

A desktop analysis and field survey were performed to determine the presence of suitable habitat for any threatened, endangered, or candidate species within the FRS No. 2 site. Information was obtained from TPWD Texas Natural Diversity Database (TXNDD) (TPWD, 2022) and USFWS

Information for Planning and Consultation (IpaC) database (USFWS, 2022) concerning the occurrence of state and federally listed wildlife and plant species in and surrounding FRS No. 2.

According to TPWD and USFWS, there are 24 federal and/or state listed wildlife and plant species/subspecies that have potential to or have historically occurred within Kendall County. Federally listed species include the following:

- Golden-cheeked warbler (*Setophaga chrysoparia*), Federal Endangered/State Endangered;
- Comal Springs dryopid beetle (*Stygoparnus comalensis*), Federal Endangered/State Endangered;
- Comal Springs riffle beetle (*Heterelmis comalensis*), Federal Endangered/State Endangered;
- Peck's Cave amphipod (*Stygobromus pecki*), Federal Endangered/State Endangered
- Piping plover (*Charadrius melodus*), Federal Threatened/State Threatened;
- Red knot (*Calidris canutus rufa*), Federal Threatened;
- Whooping crane (*Grus americana*), Federal Endangered/State Endangered;
- Guadalupe fatmucket (*Lampsilis bergmanni*), Federal Proposed Endangered/State Threatened;
- Guadalupe orb (*Cyclonaias necki*), Federal Proposed Endangered/State Threatened;
- False spike (*Fusconaia mitchelli*), Federal Proposed Endangered/State Threatened;
- Bracted twistflower (*Streptanthus bracteatus*), Federal Proposed Threatened; and
- Monarch butterfly (*Danaus plexippus*), Federal Candidate.

State listed threatened species include the following:

- Cascade Caverns salamander (*Eurycea latitans*);
- Texas salamander (*Eurycea neotenes*);
- White-faced ibis (*Plegadis chihi*);
- Zone-tailed hawk (*Buteo albonotatus*);
- Guadalupe darter (*Percina apristis*);
- Headwater catfish (*Ictalurus lupus*);
- Plateau shiner (*Cyprinella lepida*);
- Black bear (*Ursus americanus*);
- White-nosed coati (*Nasua narica*);
- Cagle's map turtle (*Graptemys caglei*);
- Texas horned lizard (*Phyrnosoma cornutum*); and
- Texas tortoise (*Gopherus berlandieri*).

Based on TXNDD data received on August 11, 2022, there are no element of occurrence records (EORs) within or adjacent to FRS No. 2. There are four EORs within 5 miles of FRS No. 2. These include:

- One EOR for the golden-cheeked warbler was recorded ~ 1.8 miles northeast;
- One EOR for the Cascade Caverns salamander was recorded ~3.8 miles southwest;

- One EOR for the Texas salamander was recorded ~4.5 miles southwest; and
- One EOR for the black bear was recorded ~4.5 miles southeast.

Field investigations occurred on July 23, 2020 and July 21, 2022 to assess the potential for suitable habitat at FRS No. 2. Based on field investigations, it was determined that suitable nesting habitat for the golden-cheeked warbler, including juniper/oak woodlands, was present within and surrounding FRS No. 2 totaling approximately 3 acres. In addition, suitable habitat was determined to be present for the zone-tailed hawk, Guadalupe fatmucket, false spike, and monarch butterfly.

No suitable nesting or stopover habitats for the piping plover, red knot, and whooping crane were identified within or adjacent to FRS No. 2.

No suitable habitat was determined to be present for the remaining federal or state listed species.

Golden-cheeked Warbler

The Golden-cheeked Warbler (*Setophaga* [=*Dendroica*] *chrysoparia*) is listed by both USFWS and TPWD as federally and state endangered in Texas and is known to occur in Kendall County, Texas. Golden-cheeked warblers are generally black, gray, and white with a yellow face. Males have a black throat and bib, black eyeline, and two white wing bars. Females appear similar; however, they lack the black bib and throat, with less overall color contrast than males. They are known to breed only in the Ashe juniper/ deciduous woodlands of central Texas, west and north of the Balcones Escarpment (USFWS 2014). Suitable nesting habitat for this species occurs in well-established juniper-oak woodlands, often on hill sides, including mature junipers which the species uses the peeling bark for nesting material. Suitable habitat also requires broad-leafed trees, usually *Quercus spp*., for foraging. Golden-cheeked warblers feed on insects and arthropods occurring with the Ashe juniper and associated deciduous trees. Species, such as Texas oak, Lacey oak (*Quercus laceyi*), shin oak (*Quercus havardii*), live oak, post oak, Texas ash (*Fraxinus texensis*), cedar elm, hackberry (*Celtis laevigata*), and pecan, typically occur in the deciduous tree composition (Campbell, 2003). The primary threat to the golden-cheeked warbler is habitat loss and urban encroachment within its breeding habitat (Wahl et al. 1990, USFWS 1992, Coldren 1998).

Zone-tailed Hawk

The Zone-tailed Hawk (*Buteo albonotatus*) is listed by TPWD as state threatened and is known to occur in Kendall County, Texas. Zone-tailed hawks are dark gray with yellow feet and barred wings and tail (Sibley 2003). They can be found in woodlands along the Rio Grande from February through May. This species hunt in arid open country, including open deciduous or pine-oak woodland, mesa or mountain county, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains. Zone-tailed hawk nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions (TPWD 2022).

Guadalupe Fatmucket

The Guadalupe Fatmucket (*Lampsilis bergmanni*), a species of freshwater mussel, is currently proposed for federal listing as endangered by USFWS and is a state-listed threatened species by TPWD. It is exclusively found in the Guadalupe River Basin. It is a medium sized mussel with an elongated elliptical shape and offset hinge. The mussel is commonly yellow to green or tan in color and often has green or brown lines that run from the hinge line to the margin of the shell. Preferred substrates for this species may include fine substrates of mud, silt, sand, and gravel in bank and pool habitats of small sized rivers and streams (Guadalupe Blanco River Authority (GBRA) 2022).

False Spike

The False Spike (*Fusconaia mitchelli*), a species of freshwater mussel, is currently proposed for federal listing as endangered by USFWS and is a state-listed threatened species by TPWD. It was historically found in the Rio Grande, San Antonio, Guadalupe, Colorado, and Brazos river basins (Howells et al., 1996). Preferred substrates for this species may include stable substrates of sand, gravel, and cobble (Randklev et al. 2012). This species occurs in small streams to medium-size rivers in habitats such as riffles and runs with flowing water. This species was thought to have been extinct until the discovery of several live individuals in the Guadalupe River and a fresh dead individual in the San Saba River in 2011 (Randklev et al. 2012). Individual remains of the species has been reported in three of five surveyed water basins including the middle Colorado River basin, upper Guadalupe River basin, and Little River basin. The false spike is currently known to be extant in portion of the Little River basin, the Llano River, the San Saba River, and the lower Guadalupe River. The highest abundances reported occurred in the lower Guadalupe River. In the Brazos basin, live false spike individuals were discovered and collected within Brushy Creek, Leon, San Gabriel, Little Rivers, and the Llano River (Randklev et al. 2017).

Monarch Butterfly

The monarch butterfly (*Danaus plexippus*) is currently considered a candidate species for listing by USFWS and does not have federal protection; however, habitat was assessed as a matter of due diligence. Monarch butterflies are habitat generalists but require milkweed species (*Asclepias* spp.) as larval hosts and a nectar source for adults (TPWD 2016). The presence of milkweeds indicates potential monarch habitat. Monarch butterflies complete a multi-generational migration from Mexico northward starting in Spring. Monarch butterflies fly to Texas from Mexico beginning in March and lay their eggs on milkweed species present in the state. Those monarch butterflies have completed their journey and reproduction. The eggs and resulting larvae present on milkweeds in Texas then use the milkweed as a food source to prepare for metamorphosis to their butterfly form. Those butterflies then mate and continue to lay eggs on milkweed species as they move north for the summer. In the fall, monarch butterflies start moving into the panhandle of Texas during migration to overwintering grounds in Mexico. In Texas, monarch butterflies and their eggs and larvae are present from March-June and September- October (TPWD 2016).

3.8 Fish and Wildlife

FRS No. 2 currently provides habitat for fish and wildlife within its impoundment and the area immediately surrounding the impoundment. In addition to the potential to provide habitat for the species identified in Section 3.7 above, FRS No. 2 has the potential to provide habitat for other native species of fish and wildlife.

3.9 Cultural Resources/Historic Properties

Cultural resources include, but are not limited to, archeological sites, historic properties or districts, buildings, structures, objects, cemeteries, historic trails, and historical markers. Historic properties and districts are listed in, or are eligible for listing in, the National Register of Historic Places.

NRCS is required to consider the effects of proposed actions and undertakings on historic properties. Historic properties and districts are listed in, or are eligible for listing in, the National Register of Historic Places (NRHP). Consultation with the SHPO/THC, Tribal Historic Preservation Offices (THPOs), and federally- recognized tribes, as appropriate, is required when an agency action may alter the characteristics that qualify a historic property for inclusion in the NRHP.

Section 106 of the National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) of 1966 required Federal Agencies to consider the impacts of their actions on historic properties and establish a program for the preservation of historic properties and archeological sites. The NRCS identifies the Area of Potential Effects (APE) as the areas of potential ground disturbance (using the maximum possible extent of ground disturbance). The indirect APE is the viewshed from any identified historic resource to the proposed undertaking (using the maximum possible extent of ground disturbance). The APE considers areas that would be directly or indirectly affected by the proposed undertaking in addition to the viewshed of historic properties that would be affected by the project. The viewshed includes all of the visible area in the line of sight of the project and excludes areas obstructed by terrain or other features. The APE for FRS No. 2 was defined as a 66-acre study area including the dam embankment and proposed modification areas, potential staging areas, haul roads, and borrow sources.

A cultural resources desktop review was performed in March 2021. The desktop review included a search of archeological records available on the Texas Archeological Sites Atlas maintained by the THC to determine if any previously recorded cultural resources sites, including archeological sites, historic properties, cemeteries, or State Antiquities Landmarks (SALs), were located within one kilometer of the APE at FRS No. 2. The desktop review revealed no previous cultural resources sites occur inside the APE. However, the desktop review indicated that the area has potential to contain unrecorded archeological resources.

Following consultation between NRCS and the SHPO/ THC initiated on March 22, 2021, NRCS and the SHPO/THC have agreed that a cultural resources survey should be conducted in all areas of new disturbance associated with potential rehabilitation measures. A cultural resources survey of the Upper Cibolo Creek Watershed FRS No. 2 Area of Potential Effects was completed on April 20, 2021, under Texas Antiquities Permit No. 30077. The survey resulted in the identification of one previously unrecorded archeological site and one prehistoric isolated find. In addition, one historic-age resource was identified, which included a small concrete dam structure spanning a section of Ranger Creek located approximately 600 feet downstream from FRS 2.

Based on the results of the background review and survey, there are no properties included in or eligible for inclusion in the NHRP within the APE of the alternative resulting in the rehabilitation of FRS No. 2. NRCS consultation with the SHPO/THC is complete and concurrence of a No Effect determination was received from SHPO/THC on July 30, 2021 (Appendix E).

If any unmarked prehistoric or historic human remains or burials are encountered at any point during the project implementation, the area of the remains is considered a cemetery under current Texas law and all construction activities must cease immediately to avoid impacting the remains. The THC must be notified immediately by contacting the Archeology Division at (512) 463-6096 as all cemeteries are protected under State law and cannot be disturbed. Further protection is provided in Section 28.03(f) of the Texas Penal Code, which provides that intentional damage or desecration inflicted on a human burial site is a state jail felony.

A search of the Tribal Directory Assessment Tool (TDAT) v2.0 and other sources, including the Bureau of Indian Affairs (BIA) Tribal Leaders Directory, and Forest Service Tribal Connections, was conducted in July 2021 to determine if there are any Indian tribes that might attach religious significance to properties within the FRS No. 2 project area. The search found that several tribes have a stated interest in ancestral lands and might attach religious or cultural significance to historic properties or have claims to land areas within Kendall County, Texas. These include: the Comanche Nation of Oklahoma; the Apache Tribe of Oklahoma; the Tonkawa Tribe of Indians of Oklahoma; the Wichita and Affiliated Tribes (Wichita, Keechi, Waco, and Tawakonie) of Oklahoma, and the Coushatta Tribe of Louisiana. NRCS initiated consultation with each of these tribes by letter on July 6, 2022 (Appendix E).

In accordance with the National Prototype Programmatic Agreement (PPA) among NRCS and the Texas SHPO, the National Programmatic Agreement among NRCS, the National Conference of State Historic Preservation Officers, and the ACHP, and according to NRCS General Manual 420, Part 401 guidance, NRCS will consult with the Texas SHPO to determine what additional cultural resource investigations must be undertaken, should the no action, rehabilitation, decommission, or relocation alternative be selected.

National Historic Landmarks Program

The National Parks Services (NPS) National Historic Landmarks Program identifies nationally significant historic places or properties designated by the Secretary of the Interior and listed in the NRHP. These places or properties possess a high degree of historic integrity, which can be defined as the ability of a place or property to convey its historical associations or attributes (NPS, 2021).

Per the NPS's National Historic Landmarks Program website, there are no National Historic Landmarks listed in Kendall County, Texas. Therefore, the National Historic Landmarks Program is not applicable to the project's affected environment and will not be carried forward for impact analysis in the Environmental Consequences section.

3.10 Water Quality

The 2020 305(b)/303(d) Integrated Water Quality Assessment and Impaired Waters Report (TCEQ, 2020) identifies Upper Cibolo Creek segment 1908 (from the confluence of Upper Cibolo Creek with Balcones Creek 2 mi upstream of Hwy 87 in Boerne) as being impaired for Bacteria. The segment was first listed in 2006. Due to the impairment, the segment does not support the contact recreation use designation. The potential source of the impairment is listed as unknown. The confluence of Ranger Creek with the impaired segment is located approximately 2.6 miles downstream of FRS No. 2.

3.11 Sole Source Aquifers

FRS No. 2 is located within the Drainage Area for the Edwards Aquifer Sole Source Aquifer (SSA). This area is outside of the Edwards Aquifer Authority (EAA) jurisdictional area (EAA, 2022), but is within the EPA designated area for the Edwards Aquifer I (San Antonio Area) S–A - Streamflow Source Area. FRS No. 2 is located on Ranger Creek, which contributes to Cibolo Creek prior to Cibolo Creek passing through the EAA jurisdictional area and the Edwards Aquifer Recharge Zone. In addition, FRS No. 2 is located within the Trinity Aquifer area. The Trinity aquifer recharges very slowly, but contributes significantly to the recharge of the Edwards Aquifer

3.12 Streams, Lakes, and Wetlands/Waters of the U.S.

FRS No. 2 was surveyed for streams, lakes, and wetlands on July 23, 2020 and July 21, 2022 (Report included in **Appendix E**). Two potentially jurisdictional water features were observed including the Upper Cibolo Creek FRS No. 2 Reservoir and Ranger Creek, a perennial tributary to Cibolo Creek. Ranger Creek is approximately 10 feet wide and less than one foot deep immediately downstream of FRS No. 2. The substrate of the stream is a combination of silt, clay, gravel, and limestone. The riparian areas adjacent to Ranger Creek are a combination of woodland and herbaceous vegetation. No wetlands were observed within the survey area of FRS No. 2.

3.13 Riparian Areas

Riparian areas are present in a narrow band surrounding the FRS No. 2 normal pool/sediment pool area as well as downstream along Ranger Creek. These areas are dominated by trees, shrubs, and various grasses, sedges, and rushes. Wildlife species within the sites are those typically found in natural settings, including migratory birds and other native wildlife.

3.14 Migratory Birds

Migratory bird pathways, and stopover, wintering, and breeding habitats, including disturbed areas, may be present within and/or adjacent to FRS No. 2, and may be associated with ponds, riparian corridors, fallow fields, grasslands, and woodlands identified in the FRS No. 2 survey area.

3.15 Social and Economic Conditions

The following presents the social and economic conditions of the Project study area. The Project's study area was delineated using U.S. Census-defined geographic boundaries. The Project study area for social and economic conditions are delineated by Census Tracts 9703.01, 9703.02, 9704.06, and 9705 (hereafter, referred to as the affected census tracts). These census tracts are shown on **Figure C-4** in **Appendix C**. County-level and state-level data on social and economic conditions were compiled for comparative purposes and socioeconomic conditions of the Project area are presented for the affected census tracts, Kendall County and the state of Texas.

Kendall County is part of the San Antonio-New Braunfels Metropolitan Statistical Area and has an approximate population of 45,000 (U.S. Census Bureau). **Table 3-3** provides relevant information regarding the Project beneficiary profile for the affected census tracts, Kendall County, and Texas.

Table 3-3. Project Beneficiary Profile

	Census Tract	**Census Tract**	**Census Tract**	**Census Tracts**	**County**	**State**
Beneficiary	**9703.01**	**9703.02**	**9704.06**	**9705**	**Kendall**	**Texas**
Population	6,699	4,309	7,446	7,432	45,491	28,635,442
Median Age	42.6	53.3	38.8	36.9	42.1	34.8
Total Number of Households	2,087	1,801	2,231	2,267	14,789	9,906,070
Median Value of Owner-Occupied Housing Units	$363,200	$390,600	$478,100	$311,500	$378,500	$187,200

Source: 2016-2020 American Community Survey 5-Year Estimates

3.15.1 Local and Regional Economy

There are developed residential and commercial areas downstream of Upper Cibolo Creek FRS No. 2 project area in the City of Boerne, however the dam and impoundment are located on private property. The property owner utilizes the lake for recreational purposes, and access is not provided to the general public.

3.15.2 Agriculture

According to the USDA's 2017 Census of Agriculture, harvested cropland in Kendall County was dominated by winter wheat (for grain), corn (for grain), and sorghum (for grain). **Table 3-4** lists 1969 and 2017 statistical data on agricultural land and products for Kendall County that were obtained from the 1969 and 2017 Census of Agriculture data. The data from the 1969 Census of Agriculture data are significant because the original Upper Cibolo Creek Watershed Plan was developed in 1968, so these data serve as a comparison point in land and product statistics in Kendall County, between when planning for FRS No. 2 was completed and the most recent completed Census of Agriculture.

Table 3-4. Land and Product Statistics for Kendall County

Statistic	1969	2017
Number of farms	625	1,349
Land in farms	365,896	393,935 acres
Average size of farm	585.4	292 acres
Market value of products sold	3,985,947	$12,440,000
Average per farm	$5,453	$9,222

Source: US Department of the Census 1969 Census of Agriculture and USDA 2017 Census of Agriculture

Table 3-4 presents how the number of acres in farms has increased in Kendall County between 1969 and 2017. While there has been increase in agricultural land use in Kendall County as a whole, the 2019 NLCD shows no agricultural crops in the watershed controlled by FRS No. 2 and only 0.7 acres of hay/pasture within the Breach Inundation Zone downstream FRS No. 2.

3.15.3 Population

Table 3-5 provides characteristics of the population for the affected census tracts, Kendall County, and Texas. The shares of selected population characteristics as a percent of the populations in the study area are provided in parenthesis. Within all affected census tracts, except 9704.06, and Kendall County the percentage of the population 65 & over was higher than within Texas as a whole.

Table 3-5. Population Characteristics

Socioeconomic Criteria		Census Tract	Census Tract	Census Tract	Census Tract	County	State
		9703.01	**9703.02**	**9704.06**	**9705**	**Kendall**	**Texas**
Total Population		6,699	4,309	7,446	7,432	45,491	28,635,442
Gender	Male	3,337 (49.8%)	2,150 (49.9%)	3,637 (48.8%)	3,810 (51.3%)	22,310 (49.0%)	14,221,720 (49.7%)
	Female	3,362 (50.2%)	2,159 (50.1%)	3,809 (51.2%)	3,622 (48.7%)	23,181 (51.0%)	14,413,722 (50.3%)

Socioeconomic Criteria		Census Tract 9703.01	Census Tract 9703.02	Census Tract 9704.06	Census Tract 9705	County Kendall	State Texas
Age	Under 18	1,542 (23.0%)	629 (14.6%)	2,253 (30.3%)	1,954 (26.3%)	10,635 (23.4%)	7,381,482 (25.8%)
	18 & over	5,157 (77.0%)	3,680 (85.4%)	5,193 (69.7%)	5,478 (73.7%)	34,856 (76.6%)	21,253,960 (74.2%)
	20-24	560 (8.4%)	255 (5.9%)	174 (2.3%)	344 (4.6%)	2,418 (5.3%)	2,000,883 (7.0%)
	25-34	496 (7.4%)	328 (7.6%)	769 (10.3%)	764 (10.3%)	4,457 (9.8%)	4,210,488 (14.7%)
	35-44	837 (12.5%)	424 (9.8%)	999 (13.4%)	972 (13.1%)	5,826 (12.8%)	3,888,044 (13.6%)
	45-54	992 (14.8%)	638 (14.8%)	1,026 (13.8%)	842 (11.3%)	5,785 (12.7%)	3,542,967 (12.4%)
	55-59	380 (5.7%)	591 (13.7%)	514 (6.9%)	437 (5.9%)	3,606 (7.9%)	1,702,570 (5.9%)
	60-64	364 (5.4%)	514 (11.9%)	648 (8.7%)	264 (3.6%)	2,739 (6.0%)	1,512,413 (5.3%)
	65 & over	1,392 (20.8%)	901 (20.9%)	848 (11.4%)	1,457 (19.6%)	8,749 (19.2%)	3,593,369 (12.5%)

Source: 2016-2020 American Community Survey 5-Year Estimates

3.15.4 Race and Ethnicity

Race and ethnicity data for the affected census tracts, Kendall County, and Texas are provided in **Table 3-6** and **Table 3-7**. The shares of selected population characteristics as a percent of the populations in the study area are provided in parenthesis. As shown in **Table 3-6**, Hispanic and Latino populations make up a smaller percentage of the populations in three of four affected census tracts and Kendall County than Texas at large. Census Tract 9705 is the exception, with approximately the same Hispanic population percentage as Texas. As shown in **Table 3-6**, the affected census tracts and Kendall County have a higher percentage of white and a lower percentage of all other races (combined) than Texas does at large. Census Tract 9705, however, has higher percentages of people identifying as 'Some other race' and 'Two or more races' than other affected census tracts, Kendall County, and the state of Texas.

Table 3-6. Population by Ethnicity

Ethnicity	Census Tract 9703.01	Census Tract 9703.02	Census Tract 9704.06	Census Tract 9705	County Kendall	State Texas
Hispanic or Latino	1,139 (17%)	714 (16.6%)	1,381 (18.5%)	2,997 (40.3%)	10,996 (24.2%)	11,294,257 (39.4%)
Not Hispanic or Latino	5,560 (83.0%)	3,595 (83.4%)	6,065 (81.5%)	4,435 (59.7%)	34,495 (75.8%)	17,341,185 (60.6%)

Source: 2016-2020 American Community Survey 5-Year Estimates

Table 3-7. Population by Race

Race	Census Tract 9703.01	Census Tract 9703.02	Census Tract 9704.06	Census Tract 9705	County Kendall	State Texas
White	6,161 (92.0%)	3,886 (90.2%)	6,811 (91.5%)	5,648 (76.0%)	39,909 (87.7%)	19,805,623 (69.2%)
African American	88 (1.3%)	19 (0.4%)	5 (0.1%)	48 (0.6%)	196 (0.4%)	3,464,424 (12.1%)
American Indian and Alaska Native	71 (1.1%)	10 (0.2%)	0 (0.0%)	0 (0.0%)	175 (0.4%)	137,921 (0.5%)
Asian	0 (0.0%)	114 (2.6%)	58 (0.8%)	9 (0.1%)	472 (1.0%)	1,415,664 (4.9%)
Native Hawaiian and other Pacific Islander	13 (0.2%)	0 (0.0%)	0 (0.0%)	51 (0.7%)	64 (0.1%)	25,328 (0.1%)
Some other race	0 (0.0%)	95 (2.2%)	213 (2.9%)	961 (12.9%)	1,997 (4.4%)	1,788,398 (6.2%)
Two or more races	366 (5.5%)	185 (4.3%)	359 (4.8%)	715 (9.6%)	2,678 (5.9%)	1,998,084 (7.0%)

Source: 2016-2020 American Community Survey 5-Year Estimates

3.15.5 Employment and Income

Table 3-8 summarizes labor force characteristics of the affected census tracts, Kendall County, and Texas. While Census Tact 9703.02 has higher unemployment than Texas at large, the other affected census tracts and Kendall County have lower unemployment than Texas at large.

Table 3-8. Labor Force

Characteristic	Census Tract 9703.01	Census Tract 9703.02	Census Tract 9704.06	Census Tract 9705	County Kendall	State Texas
Population 16 years and older	5,286	3,777	5,527	5,716	35,960	22,078,090
Civilian labor force	2,822	2,209	3,703	3,554	21,910	14,214,242
Civilian labor force participation rate	53.4%	58.5%	67.0%	62.2%	60.9%	64.4%
Employed	2,666	1,891	3,697	3,408	20,961	13,461,358
% Employed	50.4%	50.1%	66.9%	59.6%	95.7%	94.7%
Unemployed	156	318	6	146	949	752,884
% Unemployed	3.0%	8.4%	0.1%	2.6%	4.3%	5.3%

Source: 2016-2020 American Community Survey 5-Year Estimates

The distribution of employment by industry is provided in **Table 3-9**. The top three employment industry sectors in Kendall County are as follows: "educational services, and health care and social assistance", "professional, scientific, and management, and administrative and waste management services", and "construction".

Table 3-9. Employment by Industry

	Census Tract	Census Tract	Census Tract	Census Tract	County	State
Industry Sector	**9703.01**	**9703.02**	**9704.06**	**9705**	**Kendall**	**Texas**
Agriculture, forestry, fishing and hunting, and mining	0	46	111	58	577	382,157
Construction	332	316	413	156	2,512	1,162,805
Manufacturing	192	111	115	47	1,137	1,136,354
Wholesale trade	94	53	103	82	544	376,139
Retail trade	244	239	339	284	1,900	1,511,963
Transportation and warehousing, and utilities	99	95	83	58	507	808,075
Information	18	20	0	0	141	227,404
Finance and insurance, and real estate and rental leasing	181	190	520	304	2,014	911,531
Professional, scientific, and management, and administrative and waste management services	362	258	526	740	3,098	1,576,600
Educational services, and health care and social assistance	670	379	867	532	4,436	2,932,061
Arts, entertainment, and recreation, and accommodation and food services	203	59	190	455	1,496	1,212,944
Other services, except public administration	126	87	288	487	1,686	680,503
Public administration	145	38	142	205	913	542,822

Source: 2016-2020 American Community Survey 5-Year Estimates

Income statistics for the affected census tracts, Kendall County, and Texas are provided in **Table 3-10**. As shown in **Table 3-10**, median household income and mean household income for the affected census tracts and Kendall County are higher than those of Texas at large. Per capita income is also higher in the affected census tracts, except in Census Tract 9705, and Kendall County than in Texas at large.

Table 3-10. Median Income (in 2020 Inflation-Adjusted Dollars)

	Census Tract	Census Tract	Census Tract	Census Tract	County	State
Characteristic	**9703.01**	**9703.02**	**9704.06**	**9705**	**Kendall**	**Texas**
Median Household Income	$86,098	$101,820	$133,011	$73,797	$98,692	$63,826
Mean Household Income	$134,171	$142,398	$157,489	$94,547	$141,794	$89,506
Per Capita Income	$42,736	$53,548	$47,243	$31,904	$47,724	$32,177

Source: 2016-2020 American Community Survey 5-Year Estimates

3.15.6 Poverty

Poverty Statistics are provided in **Table 3-11**. As shown in **Table 3-11**, the affected census tracts and Kendall County have a lower percentage of people living below the poverty level than Texas at large, a lower percentage of people 18 years and older living below the poverty level and a lower percentage of families living below the poverty level than Texas does at large.

Table 3-11. Poverty Rates

Characteristic	Census Tract 9703.01	Census Tract 9703.02	Census Tract 9704.06	Census Tract 9705	County Kendall	State Texas
Percent all people living below poverty level	3.9%	7.1%	4.3%	6.8%	4.8%	14.2%
Percent people living below poverty level (between 18-64)	3.1%	6.9%	5.5%	5.3%	4.3%	12.5%
Percent people living below poverty level (65 and over)	7.9%	7.3%	7.7%	6.1%	6.5%	10.7%
Percent families living below poverty level	2.4%	3.2%	2.5%	6.1%	3.0%	10.9%

Source: 2016-2020 American Community Survey 5-Year Estimates

3.15.7 Environmental Justice

Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations directs federal agencies to identify and address the disproportionally high and adverse human health or environmental effects of their actions on minority and low-income populations (USEPA, 2020).

Following a review of social and economic conditions, it appears that the affected census tracts have a higher share of white residents and lower share of all other races compared to the entire state of Texas. Similarly, the affected census tracts, except Census Tract 9705 have a smaller share of residents identifying as Hispanic or Latino compared to the entire state of Texas. However, EJScreen, EPA's Environmental Justice Screening and Mapping Tool shows 28% and 19% people of color for the areas representing Census Tract 9703.01 and 9703.02, respectively. EJScreen also reports that the area representing Census Tract 9705 has 36% people of color. EJScreen's data suggest the area reported may contain a more racially diverse population than the Census estimates capture.

It also appears that affected census tracts have a lower share of all people living below the poverty level, residents aged 18 and over living below the poverty level, and families living below the poverty level than Texas does at large. However, American Community Survey data measures the poverty level by the percentage of families and people whose income in the past 12 months is below the poverty level. This is not a perfect method of capturing poverty, and it does not account for low-income people and families who live just above the poverty level and are vulnerable to shocks. According to EJScreen the area representing Census Tract 9705 is 30% low-income, while the areas representing Census Tracts 9703.01 and 9703.02 are 20% and 19%, respectively. This suggests that approximately almost a quarter of the population impacted by the Project are low-income.

3.16 Description of Existing Dam

The below record of the existing conditions of FRS No. 2 is a compilation of the *Dam Assessment Report* (NRCS, 2010), the 2010 Dam Safety Inspection Report (NRCS, 2010), the 2020 Dam Field Inspection Report (NRCS, 2020), the most recent O&M Inspection Report (Kendall SWCD, 2020), the FRS No. 2 As-Builts (USDA SCS, 1978) in addition to observations made during site visits associated with this Supplemental Watershed Plan effort.

3.16.1 Current Condition of the Dam

FRS No. 2 is located approximately 4 miles west of Boerne, Texas and outflows to Ranger Creek, then to Cibolo Creek, and then to the Lower San Antonio River. FRS No. 2 is a typical NRCS earthen embankment dam with storage allocated for sediment storage and flood control. The 2010 Dam Safety Report (NRCS, 2010) classifies the dam as Not Unsafe. FRS No. 2 is in overall good condition. Observations from the 2010 Dam Safety Inspection Report (NRCS, 2010), 2020 Dam Field Inspection Report (NRCS, 2020) and the most recent O&M Inspection Report (Kendall SWCD, 2020) are included below.

- The crest was observed to be in good condition, but the crest width is 10 feet, not 14 feet as indicated in the as-built documentation.
- Riprap is shown on the upstream slope (at the berm) in the as-built document, but is not present.
- There was a small seep (clear seepage) at the toe of the downstream slope on the bench above the plunge pool in line with the principal spillway conduit.
- There were some trees/brush growing near the outlet conduit.
- Approximately six rodent holes were observed on the dam crest, upstream slope, downstream slope, and auxiliary spillway.
- There are small trees growing on the downstream embankment.
- There is a fence and small trees/brush in the auxiliary spillway that could act as obstructions, if the auxiliary spillway was engaged.
- There are areas of fencing that require repairs to control livestock access.
- It was noted that the area is being slightly overgrazed by cattle and wildlife.
- A road that travels up and over the right side of the embankment was observed. The area where the road crosses the crest of the embankment is lower than the top of dam elevation.
- Erosion was observed in the flood pool area.

- Embankment toe drains were partially blocked with iron bacteria build-up.
- An erosion gulley in the exit channel continued to headcut upstream into the auxiliary spillway.

The Sponsors are aware of the items noted above. These observations are not impacting the performance of the dam and are not the cause of the needed dam rehabilitation. It should be noted that O&M must be up to date for the dam to be eligible for rehabilitation and O&M costs may not be included in the cost of any rehabilitation alternatives.

3.16.2 Potential Dam Safety Deficiencies

FRS No. 2 was designed in 1978 and constructed in 1980 to be a single-purpose, low hazard potential dam. Because there is a potential for loss of life downstream due to residential development and multiple roads should the dam breach, the structure is now classified as a high hazard potential dam. However, the dam does not have the auxiliary spillway capacity to safely pass the Freeboard Hydrograph (FBH) for a high hazard potential dam without overtopping the embankment. The dam does meet the 10-day drawdown requirement during the Principal Spillway Hydrograph (PSH) event, but the auxiliary spillway is engaged during the event.

3.16.3 As-Built Dam Specifications

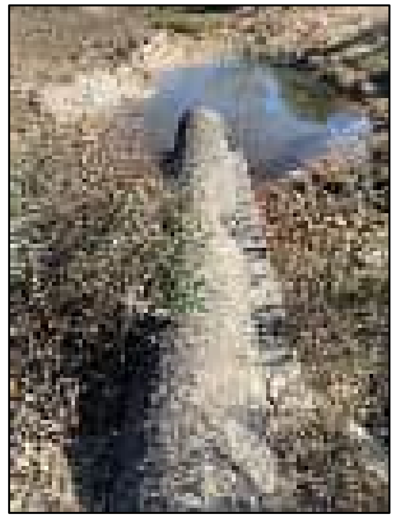
The dam was constructed in 1980 and “As-Built” drawings are available. The original as-built elevations were based on NGVD29 vertical datum. All elevations referenced in this report have been converted to the NAVD88 vertical datum using a conversion factor of +0.351 foot, unless otherwise noted. The embankment is shown on the as-builts as a 3 zone, compacted earthfill dam. A 20-foot-wide core trench with 1:1 side slopes is shown at the centerline of the dam.

The dam is shown on the as-builts as being approximately 50 feet tall and 1,545 feet long. The upstream and downstream slopes of the embankment are shown to have slopes of approximately 2.5:1 (horizontal:vertical). A 10 foot wide berm with riprap is shown at an elevation of 1584.75 feet on the upstream slope and a 14 foot wide berm is shown at the downstream side at an elevation of 1576.35 feet. It should be noted that no riprap is present on the upstream slope, as shown on the as-builts. The top width of the structure is shown to be approximately 14 feet on the as-built drawings. **Table 3-12** summarizes as-built and existing structural data for FRS No. 2.

3.16.4 Principal Spillway

The principal spillway inlet structure is a drop inlet (24 inches x 72 inches x 22 feet tall) with a steel debris guard and crest of 1590.45 feet. There are two low-level ports on two sides of the riser (4 total ports, each 12 inches tall x 18 inches wide) at elevation 1585.75 feet The conduit is 300 feet of 24-inch-diameter prestressed, concrete lined, steel cylinder pipe with eight anti-seep collars. The spillway is generally in good condition. The riprap shown in the plunge pool on the as-builts was not present during the 2020 inspection. Photographs of the existing principal spillway system are provided in **Figure 3-1**.

Inlet structure (2020)



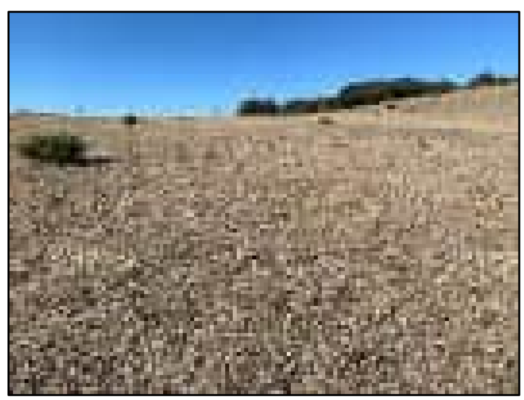
Outlet pipe and plunge pool (2020)

Figure 3-1. FRS No. 2 Principal Spillway Inlet and Outlet

3.16.5 Auxiliary Spillway

A 200-foot-wide, grass-lined auxiliary spillway with a crest elevation of 1612.0 feet was excavated over erosion resistant rock at the left abutment. The auxiliary spillway has experienced flows on at least two occasions, including the June 1997 and July 2002 storm events. The as-built drawings show a grassed inlet section sloping at a mild 0.4% up to the control section, a 50-foot-long control section, and an exit section at a 7.7% slope for a distance of about 230 feet before transitioning back to the original ground. The spillway currently has adequate grass cover. There were rodent holes observed in the auxiliary spillway during the 2020 inspection. There is a fence and small trees/brush located in the auxiliary spillway that could act as obstructions if the auxiliary spillway is engaged. Photographs of the existing auxiliary are provided in **Figure 3-2**.

Auxiliary spillway (2020)



Auxiliary spillway (2020)

Figure 3-2. FRS No. 2 Auxiliary Spillway

3.16.6 Embankment

The dam crest (effective elevation of 1614.5 feet) was found to be in good condition during the 2020 inspection. It was noted that the crest width is 10 feet, not the 14 feet indicated in the as-builts. There were rodent holes observed on the dam crest and on both the upstream and downstream slopes. The upstream and downstream embankments were found to be in adequate condition, during the 2020 inspection. Small trees were observed growing on the downstream embankment. The riprap that is shown on the upstream embankment in the as-builts (at the berm) was not present during the site visit. During the 2020 inspection, it was observed that there is a road that travels up the right side of the embankment and over the dam crest. The elevation where the road crosses the dam crest is lower than the top of dam elevation. There was a small seep of clear water observed at the toe of the downstream slope on the bench above the plunge pool. Embankment photos are provided in **Figure 3-3**.

Upstream embankment and crown of dam (2020)

Downstream embankment (2020)

Downstream seep (2020)

Rodent hole (2020)

Figure 3-3. FRS No. 2 Embankment Condition

3.16.7 <u>Topographic Data</u>

No topographical survey was performed in support of plan development. A topographical survey will be required as part of a future final design phase. Light Detection and Ranging (LiDAR) data were the basis for critical elevations and the design of rehabilitative measures. The three LiDAR data sources that provided coverage for the analysis include:

- Texas Natural Resource Information System (TNRIS). StratMap Program 50-cm resolution Light Detection and Ranging (LiDAR) for Bexar County. Data collected by TerraPoint May- August 2010 with third party quality assurance/quality control by Dewberry. Published January 28, 2011.
- Texas Natural Resource Information System (TNRIS). StratMap Program 50-cm resolution Light Detection and Ranging (LiDAR) for Blanco, Caldwell, Gonzales, Kendall, & Kerr Counties. Data collected by Merrick & Company January - March 2011 with third party quality assurance/quality control by URS. Published May 09, 2011.
- Texas Natural Resource Information System (TNRIS). StratMap Program 50-cm resolution Light Detection and Ranging (LiDAR) for Bandera and Lampasas Counties. Data collected by Fugro December 2013 - January 2014 with third-party quality assurance/quality control by URS. Published August 13, 2014.

The extracted LiDAR coverage with respect to the location of FRS No. 2, the contributing watershed, and the area used for evaluation is shown in **Figure 3-4**. The datasets for Bexar County and for Blanco, Caldwell, Gonzales, Kendall, & Kerr Counties were originally referenced to GEOID 09 and were converted to GEOID12A to be consistent with the datasets for Bandera and Lampasas Counties. The Mosaic tool within ArcGIS was used to combine tiles from the three datasets into a single Digital Elevation Model (DEM) at 1-meter resolution. The DEM was re-projected from UTM to Texas State Plane Zone 4 coordinate system and elevations were converted from meters to feet. The re-projected DEM was used to verify as-built elevations (adjusted from NGVD29 to NAVD88) and to develop 1-foot interval contours for use in the analysis. The LiDAR DEM was also used to develop the elevation-storage relationship presented in **Section 3.13.8**.

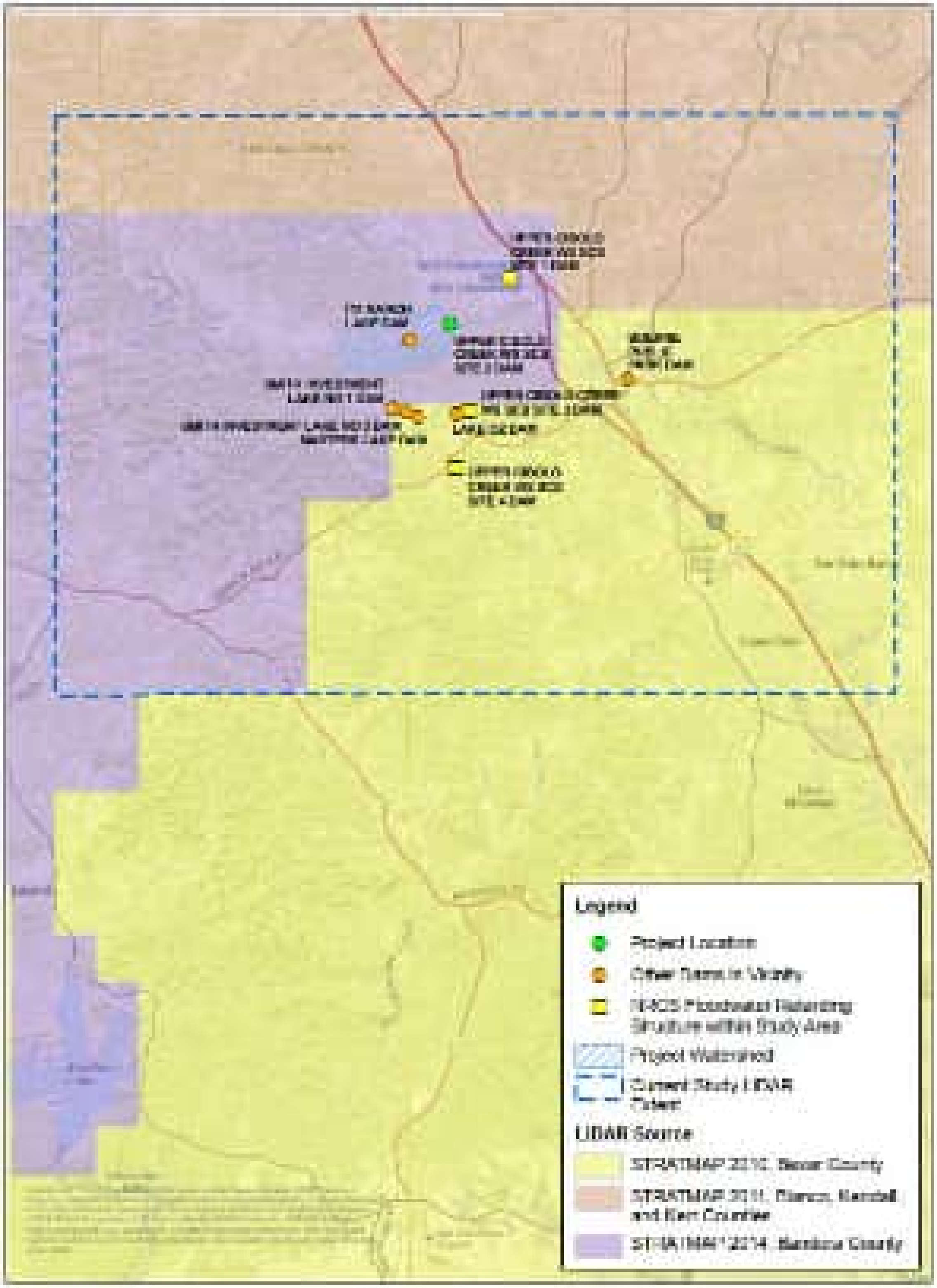


Figure 3-4. LiDAR Coverage Extracted for FRS No. 2

Table 3-12. As-Built and Existing Structural Data for FRS No. 2

Item	FRS No. 2	
	As-Built	**Existing** [a]
Local Name	NA	
Latitude / Longitude	29.807 / -98.790	
Site Number	TX04902	
Year Completed	1980	
Purpose	Flood Control	
Drainage Area (mi^2)	2.58	2.57
Dam Height (ft)	50	
Dam Type	Earthfill	
Dam Volume (yds^3)	230,804	
Dam Crest Length (ft)	1,545	1,560
Total Capacity (ac-ft)		
Sediment Submerged (ac-ft) [b]	139	236.1
Sediment Aerated (ac-ft)	8.0	8.0
Floodwater Retarding (ac-ft)	897	1,055.8
Surface Area (ac)		
Submerged Sediment Pool (ac) [c]	18	23
Flood Pool (ac)	56	61
Principal Spillway		
Type	Drop Inlet, Two Stage	
Riser Height (ft)	22	
Conduit Size (in)	24	
Low Level Port Elevation (ft)	1585.75	1585.75
Riser Crest Elevation (ft)	1590.45	1590.45
Capacity at Aux Crest (cfs)	77	74
Energy Dissipater	Plunge Pool	Plunge Pool
Auxiliary Spillway		
Type	Earthen channel with protective vegetative cover	
Aux. Spillway Width (ft)	200	
Normal Pool Elevation (ft)	1585.75	1585.75
Flood Pool Elevation (ft)	1611.55	1612.0
Top of Dam Elevation (ft)	1614.45	1614.5
Datum [d]	1988	

[a] No site topographic survey was performed as part of this plan. Any updates to existing conditions are based on LiDAR data..
[b] Submerged sediment storage for 100-year design life
[c] Submerged sediment pool for 100-year design life
[d] Original as-built elevations based on NGVD29 but all elevations shown have been converted to NAVD88 using conversion factor of +0.351 foot.

3.16.8 Sedimentation and Reservoir Storage

FRS No. 2 was designed for a service life of 100 years. This includes 70 acre-feet of submerged sediment storage below the low-level ports in the principal spillway riser for the first 50 years of service life, per **Table 3-13**. These ports set the normal pool surface area at 12 acres. The total sediment storage for the 100-year service life was set at 147 acre-feet, including 139 acre-feet of sediment storage below the principal spillway crest at elevation 1590.45 feet (NAVD 88 adjusted) (includes an additional 69 acres of submerged sediment storage for the second 50 years of service life), and an additional 8 acre-feet of aerated sediment storage below elevation 1590.84 feet (NAVD 88 adjusted). The surface area at the principal spillway riser crest was planned at 18 acres.

A comparison was performed between the available sediment volume reported in the as-builts for FRS No. 2 and the volume calculated from the LiDAR data at the same elevation to estimate the annual sediment yield to the structure **(Table 3-13)**. Note at the time of LiDAR data collection, there was very little water in the reservoir, thus no sediment or bathymetric survey was necessary for FRS No. 2. The comparison shows that at the principal spillway crest elevation, there is currently 236.1 acre-feet of storage available compared to the 139 acre-feet estimated at the time of construction. One possible explanation for this is that the borrow area may not have been accounted for in the as-built stage-storage calculations. It was determined that this was a reasonable explanation based on the following information:

- The as-builts show the capacity of the FRS to be 178 ac-ft at elevation 1,592.0 feet (NGVD 29);
- The volume of fill for the embankment is 143.1 ac-ft (230,804 CY), according to the as-builts);
- If all of the embankment fill came from the borrow area, the actual volume at elevation 1,592.0 ft would have been 321.1 ac-ft, at the time the FRS was constructed;
- Using the original estimated deposition rate of 0.57 acre-feet/per square mile of watershed area/year (1.47 acre-feet/per year for FRS No. 2) from the watershed work plan, the estimated volume of sediment accumulated at the time of the most recent LiDAR data collection (2015) would be approximately 55 ac-ft;
- The difference between the estimated volume (including the borrow area) of the FRS at elevation 1592.0 feet (NGVD 29) (321.1 ac-ft) and the estimated volume of sediment accumulation from construction to 2015 (55 ac-ft) is 266.7 ac-ft;
- Per **Table 3-13**, the volume of the FRS at elevation 1592.0 that was estimated using the LiDAR data that were collected in 2015 is 279.5 ac-ft; and
- The difference between the volume at elevation 1592.0 (NGVD 29) that was estimated considering the as-built volume, the borrow volume, and estimated sediment accumulation rate as of 2015 (266.7 ac-ft) and the volume that was estimated using the LiDAR data collected in 2015 (279.5 ac-ft) is only 13.2 ac-ft and may be due to a private dam located just upstream of FRS No. 2 that may be accumulating sediment before it reaches FRS No. 2.

The original deposition rate of 0.57 acre-feet/per square mile of watershed area/year (1.47 acre-feet/per year for FRS No. 2) estimated in the watershed work plan for the structure was utilized to determine the future sediment capacity required. As the watershed contributing to FRS No. 2 has remained relatively undeveloped and there has been little sediment accumulation in the reservoir, it was estimated that the original sediment yield estimate was still applicable.

The principal spillway crest at FRS No. 2 can reasonably be lowered for any rehabilitation alternatives considered to approximately 1585.75. This elevation will provide 143.7 acre-feet of sediment storage (approximately 100 years) and will maintain the existing normal pool elevation.

Table 3-13. As-Built and Existing Storage for FRS No. 2

Notes	Elevation (ft NGVD 29)	Elevation (ft NAVD 88)	Storage As-Built (ac-ft)	Storage Current (ac-ft)
	1568.0	1568.35	1.0	0.0
	1572.0	1572.35	5.0	0.0
Lowest Ground Surface Elevation per LiDAR	1576.0	1576.35	12.0	25.5
	1580.0	1580.35	25	66.4
	1584.0	1584.35	55	120.9
Low Level Port Elevation [a]	1585.4	1585.75	70.0	143.7
	1588.0	1588.35	107.0	192.0
Principal Spillway Crest [b]	1590.1	1590.45	139.0	236.1
Aerated Sediment Elevation	1590.5 [c]	1590.84 [c]	147.0	245.0
	1592.0	1592.35	178.0	279.5
	1596.0	1596.35	268.0	384.0
	1600.0	1600.35	388.0	514.8
	1604.0	1604.35	542.0	678.7
	1608.0	1608.35	726.0	874.7
Auxiliary Spillway Crest	1611.2	1611.55	897.0	1055.8
	1612.0	1612.35	940.0	1104.3
Dam Crest Effective	1614.1	1614.45	1060.0	1237.3
	1616.0	1616.35	1187.0	1362.6

[a] Submerged Sediment Storage (First 50 years).
[b] Submerged Sediment Storage (Second 50 years).
[c] Interpolated point.

3.17 Status of Operations and Maintenance

O&M of FRS No. 2 is performed by and Kendall County. O&M Inspections are done annually by representatives of the Kendall County, Kendall County SWCD, and NRCS. Formal inspections have occurred on an approximate 10-year interval, with a recent dam safety inspection having been performed in 2010 and a dam field inspection performed in 2020. Routine tree/brush management and repairs are conducted as needed. Based on inspection reports and site visits to FRS No. 2, there are a number of O&M items that need to be addressed. Adequate O&M for FRS No. 2 must be performed by the Sponsor and associated costs cannot be included as construction costs for this project.

3.18 Floodplain Management

Kendall County and incorporated areas participate in the National Flood Insurance Program (NFIP). The current effective FEMA flood hazard delineation included on Flood Insurance Rate Map (FIRM) panel 48259C0400G (**Figure C-5**) and the countywide Flood Insurance Study (FIS) were published on May 15, 2020. The FEMA Map Service Center website indicates that no Letters of Map Revision (LOMRs) have been filed for this FIRM panel since the effective date of the existing Digital Flood Insurance Rate Map (DFIRM).

The effective FEMA Flood Zone for the reach of Ranger Creek upstream of FRS No. 2, through the auxiliary spillway, and into the downstream channel was developed in 1995 using detailed methods and is classified as zone AE. The reach downstream of FRS No. 2 was developed in 1995 using approximate methods and is classified as Zone A. The models were re-validated in May of 2020.

There are approximately 51 habitable structures within the regulatory floodplain boundary downstream of FRS No. 2 for same modeling extents that were evaluated for this plan (Ranger Creek from FRS No. 2 to approximately 1000 feet downstream of the old railroad bridge over Cibolo Creek located within the Cibolo Nature Center). The regulatory floodplain for these extents was compared to the modeled floodplain for the same extents to highlight differences in the modeled floodplains. According to the existing condition modeling performed for this plan, there are an estimated 42 residential and nonresidential structures at risk of flooding above the finished-floor elevation (FFE) during the 1% AEP 24-hour flood downstream of FRS No. 2. However, during the 0.2% AEP 24-hour flood the same modeling estimates approximately 291 structures at risk of flooding above the finished-floor elevation downstream of FRS No. 2.

3.19 Breach Analysis and Hazard Potential Classification

Breach analyses were performed for a sunny day scenario with the water level at the existing top of dam elevation using the methods provided in Technical Release No. 60 (TR-210-60) *Earth Dams and Reservoirs* (USDA NRCS, 2019) and Technical Release No. 66 *Simplified Dam-Breach Routing Procedure* (NRCS SCS, 1985) to confirm the high hazard potential classification and estimate the downstream inundation zones. Impacts to downstream properties and road crossings were assessed. A breach map (**Figure C-6**) depicting the results of the breach analyses for FRS No. 2 are provided in **Appendix C**.

A sunny day top of dam breach of FRS No. 2 is predicted to impact 76 homes, 12 commercial buildings, and 25 roads downstream of the dam. The breach analysis for FRS No. 2 was terminated at the location where the modeled breach boundary was inside the modeled 1% AEP 24-hour storm event floodplain, approximately 6.7 miles downstream of the FRS at Herff Road.

Revised breach analyses will be performed during the design phase of the FRS No. 2 rehabilitation and the updated inundation data will be provided to the Sponsors for use in an Emergency Action Plan (EAP) update.

It should be noted that there is a privately owned dam located upstream of and in-series with FRS No. 2 that was not considered in the breach analysis. While complete information on the dimensions/capacities of the components of the privately owned upstream dam were not available for review for this project, the National Inventory of Dams (NID) shows the maximum capacity of the upstream dam to be 212 acre-ft. In the event of a top of dam breach of the upstream dam, the capacity of the dam is approximately 1/5 of that of the downstream Cibolo FRS No. 2. As the dam is privately owned, information on how it is operated, and how and if it is being maintained was not available for this project. In addition, because the original NRCS watershed plan was developed without considering the structure (the structure was in place at the time the plan was developed) and NRCS has no control over whether it is maintained or decommissioned in the future, the analysis for this Plan did not consider the upstream structure.

3.20 Evaluation of Potential Failure Modes

3.20.1 Sedimentation

The land uses in the watershed above FRS No. 2 are provided in **Table 3-1** and include 64.9% Shrub/Scrub, 12.6% Evergreen Forest, 9.1% Mixed Forest, 4.2% Deciduous Forest, 2.9% Developed- Open Space, 2.2% Herbaceous, 2.1% Developed – Medium Intensity, 1.4% Open Water, and 0.7% Developed – Low Intensity. While it is expected that there will be some increases in the percentages of developed- low intensity and developed – medium intensity land uses in the watershed above FRS No. 2, it is not expected that they will change significantly. The future sediment accumulation rate is therefore planned to be equal to deposition rate used in design of the dam. Based upon the future sediment deposition rate of 1.47 acre-feet/year (0.57 acre-feet/per square mile of watershed area/year) and the available 236.1 acre-feet of sediment storage at the principal spillway crest, the remaining sediment storage life of FRS No. 2 in the existing condition is over 100 years. Therefore, the potential for failure due to inadequate sediment storage capacity is low.

3.20.2 Hydrologic Capacity

Hydrologic failure of a dam occurs when the auxiliary spillway is breached or when the dam is overtopped and fails. FRS No. 2 was originally designed with a floodwater capacity of 897 acre-feet. It was designed as a low-hazard potential dam and is currently performing as intended. However, due to downstream development since dam construction, it has been reclassified as a high hazard potential dam and currently does not meet dam safety criteria as required by the NRCS to prevent overtopping or breaching of the auxiliary spillway and/or embankment during a probable maximum precipitation (PMP) event as required for a high hazard potential dam. The water in the reservoir would flow over the top of the embankment during the probable maximum flood (PMF) and could cause it to erode and collapse. Therefore, FRS No. 2 is categorized as having high potential to fail due to deficient hydrologic capacity.

3.20.3 Embankment Seepage

Embankment and foundation seepage can contribute to failure of an embankment by removing (piping) soil material from the embankment and/or foundation. As the soil material is removed (i.e., internal erosion), the resulting void allows more water flow through the embankment or foundation. Progressive internal erosion, if unchecked, can lead to breaching and/or collapse of the dam. Two general types of seepage can develop in earthen embankment dams: under-seepage and through-seepage. Under-seepage occurs when differential hydrostatic head causes excessive flow gradients to develop in relatively pervious dam foundation materials, producing upward vertical flow at the downstream toe of the dam which may result in the formation of seeps, sand boils, and/or piping under the dam. Through-seepage develops when differential hydrostatic head causes the phreatic surface through the embankment to daylight on the downstream slope face, which can produce seeps and/or piping through the dam embankment.

Based on review of the as-built drawings dated 1978, the embankment is a zoned earthfill dam with distinct core and shell zones. The upstream and downstream slopes are 2.5H:1V, and a 14-foot wide berm is shown on the lower 1/3 of the downstream slope. The embankment core and cutoff trench was specified as a fat clay (CH) borrow source, and the upstream and downstream shell was specified as a lean clay (CL) to silty sand (SM) borrow source. The typical section also includes upstream exterior zone of rockfill below the normal pool level. The cutoff trench terminates at the bedrock contact near the original creek centerline and some areas to the left, but terminates within clayey (CL) foundation soils along much the dam centerline alignment. The 1978 Geologic Investigation (GI) Report indicates a positive seepage cutoff was not possible due to high permeability is the fractured/weathered limestone and overburden soils.

Internal drainage consists of a trench drain located under the downstream slope along approximately 75% of the dam length. The drain is comprised by a fine filter zone (specified as ASTM C-33 Fine Aggregate) and coarse filter zone (specified as one of several standard aggregate gradations) surrounding a 6-inch diameter perforated asbestos-cement drain pipe discharging to the principal spillway outlet channel. Based on the specified filter gradations and site soils, it is likely the drain is filter compatible internally and with surrounding soils and/or would prevent the development of excessive or continuing erosion.

The typical dam section considered in the original Soil Mechanics Report (SMR) dated 1978 differs from the as-builts. The typical section included a 2.5H:1V downstream slope in the upper half of the embankment, and a flattened "variable slope" (visually about 10H:1V) in the lower half of the embankment. This typical section included a long, horizontal fine filter blanket drain under the downstream slope. The report also considered an "Alternative Section", which included a uniform 2.5H:1V downstream slope and a foundation trench drain. Based on the 2.5H:1V slopes shown on the as-builts, the design is evidently based on the "Alternative Section" shown in the SMR. The seepage analysis in the SMR shows the phreatic surface daylighting 7 feet above the downstream toe on a 2.5H:1V slope without a berm. The 14-foot downstream berm shown in the as-builts appears to have been intended to prevent daylighting of the phreatic surface, which otherwise could present a through-seepage piping risk. The existing principal spillway include concrete anti-seep collars around the conduit, which exacerbate the risk of piping due to potential defects resulting from inadequate compaction of the surrounding backfill during construction.

One small area of potential seepage (shown in **Figure 3-3**) has been identified at the toe of the downstream slope on the bench above the plunge pool in line with the principal spillway conduit.

This area was noted in the 2010 Dam Safety Inspection Report (NRCS, 2010) and the 2020 Dam Field Inspection Report (NRCS, 2020). The 2010 inspection report also noted that the embankment toe drains were partially blocked with iron bacteria build-up. It was recommended in the 2010 Dam Safety Report that this area be monitored, and it is recommended that monitoring be continued in the future. No evidence of other potential areas of historic under-seepage or through-seepage has been reported at this site. The embankment appears to be performing adequately to date from the standpoint of seepage control. Defensive measures against seepage were included in the original design to address potential through-seepage and under-seepage (e.g., impervious core, cutoff trench, and foundation drain). However, the concrete anti-seep collars and lack of a filter diaphragm on the principal spillway conduit may increase the risk of through-seepage and related piping erosion. Additionally, the relatively high permeability of the limestone indicated in the original GI suggests that if adversely-oriented open fractures are present under the dam, there could be a risk of concentrated seepage and related piping erosion of overlying soil materials; however, fracture orientations are not known based on available data. Based on the foregoing, the risk of dam failure due to under-seepage and through-seepage is estimated to be low to moderate. Future geologic investigation is recommended during the design phase to further assess seepage and stability performance of the dam. The scope of the investigation may include geotechnical test borings and geophysical investigation. The purpose of the test borings would be to collect undisturbed samples of embankment and foundation soils for laboratory shear strength and permeability testing, and to obtain continuous core samples of the bedrock to evaluate rock quality. Down-hole geophysics such as borehole televiewer could be considered to evaluate bedrock fracture type, frequency, and orientation, as well as characterizing potential solution features. In situ permeability testing (packer testing in rock and falling-head tests in piezometer) are suggested to evaluate for the presence of high-permeability zones that may convey concentrated seepage. Piezometer installation at the dam crest and downstream toe would be valuable to investigate the position of the phreatic surface through the dam and fluctuations over time. Geophysical survey consisting of surface-based methods including electrical resistivity (ER), seismic refraction (SR), electromagnetic frequency domain (FDEM), and self-potential (SP) may be used to identify potential zones of concentrated seepage, saturation, and/or solution features that may affect dam seepage performance

Recommended maintenance activities include cleaning and inspecting the existing toe drain outlet pipes to confirm whether they are functioning properly. Positive gravity drainage from the outlet end of the toe drain pipes to the normal water level of the plunge pool should also be re-established. These activities may serve to identify whether the adjacent wet "seepage area" is merely due to partial blockage of the toe drain outlets and seepage through the surrounding downslope riprap, or if some other seepage source (i.e., under-seepage and through-seepage) is producing the observed wet area. Periodic inspection of this area should be performed before and after toe drain maintenance to see if the extent of the wet area decreases over time or continues to persist to inform whether additional actions are required.

3.20.4 Embankment Stability

Slope stability analyses were conducted in the 1978 SMR for this project for the typical embankment section, and the "Alternative Section" which was ultimately constructed with inclusion of a downstream berm. The analyses included end of construction, rapid drawdown, and steady-state seepage conditions for the typical section. Only steady-state seepage conditions were analyzed for the Alternative Section, but the rapid drawdown results from the typical section are valid since the upstream slope geometry is identical in both cases. The reported factors of safety applicable to the as-constructed embankment ranged from 1.58 to 2.22 for the upstream slope (rapid drawdown conditions), and was 1.5 for the downstream slope (steady-state seepage conditions) without the downstream toe berm that was ultimately constructed. The analyses procedures appear to be consistent with modern slope stability analysis procedures, with due consideration of both drained and undrained strength parameters which were supported by laboratory shear test data. The calculated factors of safety exceed minimum NRCS requirements for steady state and rapid drawdown conditions.

According to the 2010 Dam Safety Inspection Report (NRCS, 2010), 2020 Dam Field Inspection Report (NRCS, 2020) and the most recent O&M Inspection Report (Kendall SWCD, 2020), the downstream slope and crest of the embankment have adequate vegetative cover. No evidence of depressions, cracking, or deep-seated slope instability was observed. No documented reported evidence of prior or ongoing deep-seated and/or surficial dam instability (e.g., crest deformation, cracking, toe bulges, depressions, etc.) was identified through review of existing documentation. Design features included in the as-built construction of the dam that positively influence slope stability include favorable embankment zoning which placed coarser-grained and lower plasticity fill materials in the upstream and downstream shell zones, and inclusion of internal drainage elements (i.e., foundation trench drain) which was intended to maintain a lowered phreatic surface through the embankment. Based on the foregoing, the risk of dam failure due to embankment instability is estimated to be low.

3.20.5 Spillway Integrity

The auxiliary spillway is in adequate condition according to the most recent NRCS Dam Safety Inspection (NRCS, 2010). SITES integrity analysis for the existing spillway using the unfavorable soil parameters (i.e., more likely to erode) per **Table 3-1** indicates that significant headcutting during the FBH will occur but will not breach through the control section, causing the dam to fail. While monitoring of this spillway will continue in the future, the risk of dam failure due to integrity is judged to be moderately low.

3.20.6 Seismic

FRS No. 2 is located in an area of low potential seismic activity per the USGS National Seismic Hazard Maps (2018) and its risk of failure due to a seismic event is judged to be low.

3.20.7 Material Deterioration

The materials used in the principal spillway system are subject to weathering and chemical reactions due to natural elements within the soil, water, and atmosphere. Concrete risers and conduits can deteriorate and crack, metal components can rust and corrode, and leaks can develop. Embankment failure can occur from internal erosion caused by these leaks. To date, a camera survey of the principal spillway conduit has not been performed. Based on visual inspection of the site, the principal spillway appears to be in overall good condition. Therefore, the risk of failure due to material deterioration is judged to be low to moderate.

3.20.8 Conclusions

Currently, a hydrologic failure is the most likely failure mode for FRS No. 2. The other potential modes of failure present low to moderate risk.

3.21 Consequences of Dam Failure

Inundation due to dam failure potentially has the following consequences at FRS No. 2.

Both the population-at-risk (PAR) estimate (**Appendix E**) and breach zone analyses (**Section 3.16**) estimate depths of inundation based upon LiDAR natural ground elevations at a structure. A structure was considered to be at risk for the PAR estimate when the depth of floodwater exceeded one foot above the finished-floor elevation. For the breach map (**Figure C-6**) located in **Appendix C**, structures inundated above the finished-floor elevation by a depth greater than or equal to 1 foot are included in the breach zone.

Loss of Life
The breach inundation study indicates that a dam failure may result in inundation of residential structures, nonresidential structures, and transportation infrastructure. Details regarding the breach inundation studies can be found in Section 3.16.

To estimate the PAR from a sunny day, top of dam breach scenario, the following infrastructure was taken into consideration: the lives of people in 76 residences, 12 commercial buildings, motorists on 20 “Main Local Roads and Minor State Highways”, motorists on 2 “Major State and Minor Federal Highways”, and motorists on 3 “Major Federal and Interstate Highways” would be at-risk in the event of a breach. Using an average of 3 people per residence and 6 people per commercial building would result in 300 people in structures being at risk from a breach. Due to the estimated depth combined with the velocity of the breach floodwaters, there could be many other people at risk of serious injuries. It was estimated that 2 people per “Main Local Road and Minor State Highway” would be at risk from a breach, 4 people per “Major State and Minor Federal Highway” would be at risk from a breach, and 8 people per “Major Federal and Interstate Highway” would be at risk from a breach. This would result in 72 motorists being at risk from a breach of FRS No. 2. Given the number of properties and potential vehicles located within the breach zone, it is estimated that at a minimum the number of people at risk due to a breach of FRS No. 2 would be 372.

Release of Harmful Materials
The minimal volume of sediment stored in the reservoir and eroded embankment material released to Ranger Creek would harm water quality, degrade aquatic habitat, and reduce downstream channel capacity.

Infrastructure Destruction
Residential dwellings, fences, roads, bridges, and public utilities may be damaged or destroyed.

4.0 ALTERNATIVE FORMULATION

The alternatives were developed with the stated objectives in mind: 1) modify the dam to meet current safety and performance standards, and 2) maintain a level of flood protection that minimizes change to conditions for downstream properties in a manner that takes into consideration economic, social, and environmental goals. These objectives can be achieved by installing dam rehabilitation measures, decommissioning the dam and providing mitigation, or by removing structures at risk from breach of the dam. In rehabilitating the dam, decommissioning the dam, or removing at risk structures, the risks to life and property from a potential catastrophic dam failure would be mitigated.

All cost estimates provided in this report shall be considered as preliminary "order of magnitude" cost estimates. It is assumed that a more thorough cost estimate will be completed for the selected alternative during the design phase. All cost estimates are based on 2021 dollars and should be inflated accordingly to determine the estimated cost of these improvements in future years.

4.1 Formulation Process

Formulation of the alternative rehabilitation plan for Cibolo Creek Watershed FRS No. 2 followed procedures outlined in the NRCS *National Watershed Program Manual* (USDA-NRCS 2015) and the NRCS *National Watershed Program Handbook* (USDA-NRCS, 2014). Other guidance incorporated into the formulation process included the *Principles and Requirements for Federal Investments in Water Resources* (U.S. Council on Environmental Quality (CEQ), 2013) and *Interagency Guidelines for Principles and Requirements for Federal Investments in Water Resources s* (U.S. CEQ, 2014) (documents collectively referred to as PR&G), Departmental Regulation 9500-013 (USDA 2017), Departmental Manual 9500-013 (USDA 2017), and other NRCS watershed planning policies. Alternatives are eligible for financial assistance under the Watershed Protection and Flood Prevention Act (PL 83-566), as amended (16 U.S.C. Sections 1001 to 1008, 1010, and 1012).

The formulation process began with discussions between the Sponsors, NRCS, and the Texas State Soil and Water Conservation Board (TSSWCB). Alternative plans of action were developed based on NRCS planning requirements and the ability of the alternatives to bring FRS No. 2 up to date with current safety and design criteria and performance standards, resolve existing safety deficiencies, and address the Sponsors' concerns since the dam does not meet criteria for a high hazard potential dam.

The No Action/Future without Federal Investment (FWOFI) alternative serves as a baseline to evaluate the other alternatives against. It represents the most probable future conditions in the absence of a federally assisted project. The Sponsors are responsible for determining what action to take if the dam is not brought up to current performance and safety standards. Based on conditions set forth by the No Action/FWOFI baseline, an existing condition was developed for the dam. The dam does not meet current safety standards for high hazard dams, and there is a risk of the dam failing from overtopping. Appendix C-6 (Breach Inundation Map) depicts the areas that could be flooded if the dam breached under fair weather conditions with the water surface in the reservoir static at the top of dam elevation, per Technical Report 210-60 guidelines.

Failure of the dam could result in significant damage and risk to loss of life. The Sponsors considered the following options in deciding the most likely course of action in the absence of Federal assistance:

- Take no action and accept the risk of potential dam failure.
- Locally decommission (breach) the dam to eliminate the risk of failure from an extreme storm event.
- Modify the dam to comply with current dam safety standards without Federal assistance.

After considering the options, the Sponsors decided that their best option in the absence of Federal assistance would be to perform a local decommission to remove the risk of dam failure. As the Sponsors do not currently have funds allocated to locally decommission the dam, the Sponsors would initially accept the risk of damages from failure and continue to maintain the dam in its current state without any major modifications, until they have the funds allocated for the local decommissioning. Thus, in the absence of updated guidance, the baseline conditions assume that the dam is not in place, since it is expected that the dam would be locally decommissioned by the Sponsors, unless the dam fails prior to be locally decommissioned, in which case it is assumed that the Sponsors would still perform a local decommission (following the initial failure) to stabilize the site.

The alternatives that were considered for FRS No. 2 in the development and identification of the selected alternative were:

- No Action / FWOFI;
- Dam Decommissioning (Future with Federal Investment [FWFI]);
- Low Hazard Potential Rehabilitation (FWFI) - rehabilitate dam to meet current low hazard potential criteria and perform non-structural measures to reduce risk in the breach zone, i.e., relocating structures; and
- High Hazard Potential Rehabilitation (FWFI) - rehabilitate and upgrade dam to meet current high hazard potential criteria.

4.2 Alternatives Considered but Eliminated from Detailed Study

Some of the alternatives considered in the planning process were eliminated from detailed evaluation because these alternatives either did not meet the purpose or need for federal action or they were logistically impractical to implement. These alternatives for FRS No. 2 are described below.

4.2.1 Low Hazard Potential Classification with Nonstructural Measures

Reclassification of FRS No. 2 to a low hazard potential dam considers the purchase of deed restrictions for all areas within the breach zone where an easement does not already exist, relocation or floodproofing of 88 residential and nonresidential structures below FRS No. 2 within the breach area, modification of 25 roads downstream or installation of flood warning systems to ensure traffic would not be at risk from a breach, and upgrades to the dam to meet TR-210-60 low hazard potential criteria. Reclassification of the dam as a low hazard potential structure would require removal of the PAR within the breach zone.

Modifications to the dam that would be required to meet low hazard potential classification include:

- Keep the existing principal spillway system;
- Provide 100-years of future sediment storage;
- Add rock blanket on 2.5:1 upstream embankment slope;
- Lower the existing auxiliary spillway to an elevation of 1,611.10 feet, keeping the existing 200-foot width;
- Protect downstream end of auxiliary spillway with rock riprap per stability evaluation; and
- Add a concrete cutoff wall at the control section of the auxiliary spillway.

This alternative meets the purpose and need of the Project but is not considered feasible due to the high cost of implementation and potential disruption to community cohesion because of the large number of home relocations that would be required to remove the PAR within the breach zone. The estimated cost of modifications to FRS No. 2 that would be required for this alternative is $1,113,000. It is estimated that cost to remove the PAR associated with structures within the breach inundation zone would easily exceed $15,000,000 and that the modifications to the 29 downstream roads that would be required to remove the PAR associated with roads that would overtop in the event of breach would also exceed $15,000,000. These estimated costs would exceed the cost of the high hazard rehabilitation presented in **Section 4.3.3**. This alternative was therefore eliminated from further evaluation.

4.2.2 Other Non-Rehabilitation Alternatives

While there are potential structural and non-structural measures that could be implemented within the original Upper Cibolo Creek Watershed Work Plan area to address current and potential flooding issues, the scope of this Supplemental Watershed Plan is to address safety concerns associated with Upper Cibolo Creek FRS No. 2 while continuing to provide downstream flood protection in a manner that takes into consideration economic, social, and environmental goals. Alternatives for FRS No. 2 were developed following Part 505 of the NWPM (USDA NRCS, 2015) and to specifically meet the Purpose and Need for this project and as such, do not consider structural and non-structural measures outside of the required rehabilitation alternatives defined in Part 505 of the NWPM. Any such measures developed as part of a larger incremental analysis of the watershed could not be included in the cost-share agreement and would be the responsibility of the local Sponsors to fund and implement.

4.3 Description of Alternatives Considered for Detailed Analysis

4.3.1 Alternative–1 - No Action/Future without Federal Investment (FWOFI)

No Action/FWOFI Alternative does not involve federal action or federal investment. Since the Sponsors do not have the resources allocated to bring FRS No. 2 into compliance with current dam safety regulations for a high hazard potential dam, it is anticipated that their course of action would be to continue maintain the dam in its current configuration until they have the resources available and specifically allocated to perform a local decommissioning to remove the risk of failure. This alternative would initially be a true no-action alternative in which no rehabilitation measures take place. Repairs would be performed to maintain the existing spillway and upstream and downstream slopes on an as-needed basis, such as if significant erosion occurred. The current level of flood protection would remain, though the overtopping risk associated with the dam not passing the federal requirements would also remain. It should also be noted that the dam would likely not meet State dam safety criteria and, if it does not, that the TCEQ could require that the dam be rehabilitated or removed at any time. As the timeline for when the Sponsors would have the resources available to locally decommission the dam is currently unknown and if or when the TCEQ would require that the dam be modified or removed, the potential for dam failure prior to those events occurring was also considered as part of the analysis. In the event that dam failure does occur prior to local decommissioning, it is assumed that some form of local decommission would still occur following the breach to stabilize the site.

The local decommission would consist of excavating a breach in the dam of sufficient size to safely pass the 1% AEP, 24-hour flood event. This breach would be a minimum size opening in the dam from top of dam down to the valley floor, which would eliminate the structure’s ability to store water. In order to not impede flows through the breached embankment and to reduce certain safety and health factors, some of the principal spillway components would also be removed. This course of action would minimize the Sponsors’ dam safety liability, but would not eliminate all liability. The excavated material (about 29,165 cu. yd.) would be placed in the present easement area and the remaining portion of the embankment and all exposed areas would have vegetation established for erosion control (approximately 24 acres). Construction activities would require that a Storm Water Pollution Prevention Plan (SWPPP) be in effect.

Following the future local decommissioning (prior to or after dam failure) and stabilization of the site, downstream flooding conditions would be similar to those that existed prior to the construction of the dam. Existing and proposed floodplains were mapped approximately 10.4 miles downstream of FRS No. 2, ending 3.6 miles downstream of Herff Road. Since the 1% AEP inundation area (modeled for the purposes of this plan) would be enlarged from 399 acres to 487 acres due to the absence of flood attenuation, potential present and future downstream development would be affected by the increased flood areas. Future downstream development would be restricted by floodplain zoning.

The number of residential and nonresidential structures inundated above the finished-floor elevation during the modeled 1% AEP, 24-hour flood event would increase from 42 structures to 88 structures as a result of this alternative. Floodwaters from a 1% AEP, 24-hour flood event would cause increased flooding on 14 roads (**Table 4-1**). No mitigation for this increased flooding is included with this alternative. The estimated cost to locally decommission the dam is $664,000.

Table 4-1. Alternative 1 Roadway Induced Flooding During 1% AEP Event

Road	Orientation to Ranger Creek/Cibolo Creek	Annual Average Daily Traffic (AADT)	Depth of Overtopping Existing Condition (ft)	Depth of Overtopping FWOFI (ft)	Difference (ft)
81 Ranger Creek - Private Road	Perpendicular	-	2.18	9.25	7.07
103 Ranger Creek - Private Road	Perpendicular	-	2.50	8.32	5.82
51 Ranger Creek - Private Road	Perpendicular	-	-10.63	-3.15	7.48
25 Ranger Creek - Private Road	Perpendicular	-	5.28	9.19	3.91
23 Ranger Creek - Private Road	Perpendicular	-	4.76	8.22	3.46
21 Ranger Creek - Private Road	Perpendicular	-	4.52	7.84	3.32
I-10 (FR-W)	Perpendicular	-	-1.12	1.46	2.58
I-10	Perpendicular	27340	-17.08	-14.85	2.23
I-10 (FR-E)	Perpendicular	-	-3.95	-1.64	2.31
Johns Rd	Perpendicular	-	1.09	3.69	2.6
School St	Parallel	-	12.18	13.67	1.49
San Antonio Ave	Parallel	-	1.71	3.15	1.44
Theissen St	Perpendicular	-	17.63	19.08	1.45
US 87 & Main St	Perpendicular	18348	5.43	6.88	1.45
US 87 & Main St (Right Turn)	Perpendicular	-	4.67	5.24	0.57
Herff Rd (SB)	Parallel	-	12.41	13.49	1.08
Herff Rd (NB)	Parallel	-	11.26	12.25	0.99

4.3.2 Alternative 2 – Decommission (FWFI)

Alternative 2 – Decommissioning involves federal action and consists of removing the storage function of the dam and reconnecting, restoring, and stabilizing the upstream reservoir area/sediment pool and downstream floodplain functions. Although complete removal of the embankment is sometimes required for decommissioning, only partial removal of the embankment was evaluated in this alternative. Partial removal of the embankment would consist of excavating a breach in the dam of 14.5 feet bottom width to safely pass the 1% AEP 24-hour flood with little influence on the water surface profile.

The excavated material (about 29,165 cubic yards) would be placed in the sediment and detention pool areas and all exposed areas would be vegetated as needed for erosion control (approximately 24 acres). Channel work would be performed to reconnect the stream channel through the sediment pool. Riparian vegetation would be established along the stream channel (approximately 3 acres). A grade stabilization structure would be installed to stabilize sediment and prevent stream headcutting. To not impede flows through the breached embankment, some of the principal spillway components would also be removed. Construction activities will require that a SWPPP be in effect.

Downstream flooding conditions from a 1% AEP, 24-hour storm would be similar to those described for Alternative 1 - FWOFI with regard to induced flooding on roadways and inundated structures if no additional actions were taken. To continue to provide downstream flood protection as required to meet the Purpose and Need of the project, mitigation for additional flood impacts would be included in this alternative. Existing and proposed floodplains were mapped approximately 10.4 miles downstream of FRS No. 2, ending 3.6 miles downstream of Herff road. The number of residential and nonresidential structures inundated above the finished-floor elevation during the modeled 1% AEP, 24-hour flood event would increase from 42 structures to 88 structures as a result of this alternative. Floodwaters from a 1% AEP, 24-hour flood would cause increased flooding on 14 roads (**Table 4-1**). This alternative assumes that only the I-10 W frontage road would have barricades with flood warning lights installed on it to prevent induced flooding, as all of the other roads with increased flooding have flooding depths between 1.1 feet and 17.6 feet in the existing condition and would not be passable. No barricades or flood warning lights would be installed on private driveways. Based on the estimated depth of flooding at each of the impacted residential and nonresidential structures, it was assumed that 39 structures would be acquired and removed and 49 would be floodproofed to prevent induced flooding. The estimated cost to decommission the dam is $830,000. Additional costs, including roadway mitigation and house relocation and/or floodproofing are estimated to be $22,828,000, for a total alternative cost of $23,658,000. A conceptual figure is included as **Appendix C-8**.

4.3.3 Alternative 3 - High Hazard Potential Rehabilitation (FWFI)

For the High Hazard Alternative, different principal spillway sizes, the addition of a second auxiliary spillway, adding a RCC spillway, and widening the existing auxiliary spillway were all considered. The optimal configuration for Alternative 3 – High Hazard Potential Rehabilitation consists of the following components:

- Remove the existing principal spillway system;
- Install a new principal spillway system consisting of a standard inlet tower with a lower crest at elevation 1,585.75 feet (this elevation will provide 100-years of future sediment storage) and 36-inch RCP conduit discharging into a new impact basin;
- Regrade inlet and outlet channel of the existing vegetated auxiliary spillway, widen crest from 200 feet to 350 feet, adding a splitter dike (as specified for spillways over 200 feet wide, per section 628.5004 of the National Engineering Handbook) and lower crest to elevation of 1,611.30 feet (0.7 foot decrease);
- Protect downstream end of auxiliary spillway with rock riprap;

- Add a concrete cutoff wall at the control section of the auxiliary spillway:
- Raise and grade top of dam level 2.3 feet from an elevation of 1,614.5 feet to 1,616.8 feet; and
- Replace rock blanket on 2.5:1 upstream embankment slope.

During construction, best management practices would be utilized to avoid and minimize any potential adverse impacts. Construction activities would require that a SWPPP be in effect. All disturbed areas would be revegetated using adapted and/or non-invasive native species. No compensatory mitigation would be required as a result of implementing this alternative. No major change in reservoir or downstream operation would result from this alternative. The cost of this alternative is $7,692,000 and a conceptual figure is included as **Appendix C-9**.

It should be noted that the auxiliary spillway crest can be lowered in the high hazard potential rehabilitation alternative because, although the dam was constructed as a low hazard potential dam and is now classified as a high hazard potential dam, it was constructed with additional capacity (the borrow area) that was not accounted for in the original design. This high hazard potential rehabilitation alternative utilizes that additional capacity. It should also be noted that the high hazard potential rehabilitation alternative includes a cutoff wall in the auxiliary spillway, even though the integrity analysis does not show breaching through the auxiliary spillway crest. The proposed modifications will include an earthen cap over the in-situ rock auxiliary spillway. An earthen cap over in-situ rock auxiliary spillway has been allowed on other dam sites and has been allowed to erode under very large storm events. A concrete cutoff wall at the control section is included in this alternative to minimize erosion to the earthen cap.

4.4 Comparison of Alternatives

Table 4-2 provides a comparison of the social, environmental, and economic impacts and benefits of each of the considered alternatives. Table 4-3 provides a summary of the impacts and benefits of the considered alternatives in the context of the Guiding Principles from the PR&G. Alternative 3 for FRS No. 2 meets the purpose and need for the project while presenting the fewest impacts to the surrounding environment as well as few impacts to the community. Therefore, it is considered the Environmentally- and Socially-preferred alternative. Representatives from the Kendall County Commissioners Court and the Kendall County Soil and Water Conservation District have expressed their support for Alternative 3. Therefore, Alternative 3 is considered the Locally-preferred alternative. Finally, the economic analysis shows that Alternative 3 provides a higher benefit-cost ratio and greater economic net benefits when compared to Alternative 2. Therefore, it is considered the Economically Preferred federally assisted alternative. As such, Alternative 3 is the recommended plan. The plan reasonably meets the following four criteria: completeness, effectiveness, efficiency, and acceptability. NRCS and the Sponsors are in agreement on the recommended plan.

Table 4-2. Summary and Comparison of Alternative Plans

Item	Alternative # 1: No Action/FWOFI	Alternative # 2: Federal Decommission	Alternative # 3: High Hazard Potential Rehabilitation
Optimizing Criteria			
Locally Preferred			✓
Environmentally Preferred			✓
Economically Preferred			✓
Socially Preferred			✓
Guiding Principles			
Healthy and Resilient Ecosystems			✓
Sustainable Economic Development			✓
Floodplains			✓
Public Safety		✓	✓
Environmental Justice		✓	✓
Watershed Approach			✓
Evaluation Framework (Ecosystem Services)			
Provisioning Services - Tangible goods provided for direct human use (e.g., timber, food, fiber, water)			
Prime and Unique Farmlands	Initially, no changes. Breach would cause damage to downstream prime farmlands. Local decommissioning would eliminate current flood protection for downstream prime farmlands.	Would eliminate current flood protection for downstream prime and unique farmlands. Areas of prime and unique farmland that are currently inundated by the dam impoundment would be available for farming once the dam is decommissioned.	Would continue to provide flood protection for prime and unique farmlands. AS widening and TOD raise may result in potential impacts to prime and unique farmland, but the impacted areas do not appear to be actively farmed.
Streams, Lakes, and Wetlands	Initially, no changes. Breach and local decommission would result in discharge of fill/sediment into potentially jurisdictional waters of U.S. The controlled breach of the dam would increase the potential for flooding that would likely impact streams, lakes, and wetlands downstream of FRS No. 2 and would result in the loss of upstream aquatic habitat, hydrology, and fringe wetlands.	Would result in a discharge of fill material into potentially jurisdictional waters of the U.S. The controlled breach of the dam would increase the potential for flooding that would likely impact streams, lakes, and wetlands downstream of FRS No. 2. and would result in the loss of upstream aquatic habitat, hydrology, and fringe wetlands.	Could result in discharge of fill into potentially jurisdictional waters of U.S. Would maintain upstream aquatic habitat, hydrology, and fringe wetlands. Would maintain downstream flood protection. A pre-application meeting with the USACE was held on January 10, 2023. Based on this meeting, it appears that a Nationwide Permit 3, Maintenance, with a Pre-Construction

Item	**Alternative # 1: No Action/FWOFI**	**Alternative # 2: Federal Decommission**	**Alternative # 3: High Hazard Potential Rehabilitation**
			Notification would be required.
Regulating Services - Maintains the world we live in and is regulated (e.g., flood control, erosion, water quality, crop pollination)			
Erosion and Sediment	Initially, no change. Breach would result in excessive streambank erosion and sediment deposition downstream of FRS 2. Local decommission would eliminate the current function of the dam to collect and retain sediment, eliminate the flood protection and increase the potential for downstream erosion and sedimentation.	Would result in streambank erosion downstream and within the drained sediment pool, eliminate the current function of the dam to collect and retain sediment, and eliminate the flood protection.	Would continue to allow the dam to collect and retain sediment, would provide 100-yrs of sediment capacity following construction, and would reduce the downstream erosion potential by safely passing controlled storm flows through the new conduit.
Water Quality	Initially, no change. Breach would cause impacts due to discharge of fill and sediment. Local decommission would allow sediment to move downstream impacting the water quality. Minor, temporary impacts to water quality during construction. No significant impacts on bacterial impairment of Upper Cibolo Creek.	Would allow sediment to move downstream impacting the water quality. Minor, temporary impacts to water quality during construction. No significant impacts on the bacterial impairment of Upper Cibolo Creek.	Would provide 100-yrs of sediment storage, following construction. Minor, temporary impacts to water quality during construction. No significant impacts on the bacterial impairment of Upper Cibolo Creek.
Sole Source Aquifers	Initially, no change. Breach would cause impacts due to discharge of fill and sediment into Cibolo Creek, which passes through the Edwards Aquifer Recharge Zone. Local decommission would allow sediment to move downstream impacting the water quality in Cibolo Creek. Minor, temporary impacts to water quality in Cibolo Creek during construction.	Would allow sediment to move downstream impacting the water quality in Cibolo Creek, which passes through the Edwards Aquifer Recharge Zone. Minor, temporary impacts to water quality during construction.	Would provide 100-yrs of sediment storage. Minor, temporary impacts to water quality of Cibolo Creek, which passes through the Edwards Aquifer Recharge Zone during construction.
Floodplain Management	Initially, no change. Breach would result in extensive flooding downstream. Local decommissioning would result in induced flooding to downstream residences, businesses, and	Would require acquisition/removal of 39 structures, floodproofing of 49 structures, and a flood warning system on one	Would continue to provide flood protection benefits and would have minimal impacts on the existing downstream floodplain.

Item	Alternative # 1: No Action/FWOFI	Alternative # 2: Federal Decommission	Alternative # 3: High Hazard Potential Rehabilitation
	roadways as a result of the storage function being removed from FRS 2.	roadway to prevent induced flooding.	
Riparian Areas	Initially, no changes. Breach and local decommission would result in the loss of riparian areas around the drained pool. Riparian areas along Ranger Creek and downstream would likely increase with the removal of FRS 2.	Would result in the loss of riparian areas around the drained pool. Riparian areas along Ranger Creek and downstream would likely increase with the removal of FRS 2.	Would result in minor temporary impacts during construction.
Plants - Threatened and Endangered Species	No changes. No potentially suitable habitat for listed Plants - Threatened and Endangered Species within project area. Breach and local decommission could affect downstream listed species due to increased flows.	No effect as no potentially suitable habitat for listed Plants - Threatened and Endangered Species was observed within the project area. Could affect downstream listed species due to increased flows.	No effect as no potentially suitable habitat for listed Plants - Threatened and Endangered Species was observed within the project area.
Woodland Vegetation/Forest Resources	Initially, no change. Breach would result in loss of forest resources due to embankment failure and sudden release of flows. Local decommission is not anticipated to result in the removal of vegetation. Forest resources downstream would be subject to frequent flooding.	Is not anticipated to result in the removal of vegetation. Forest resources downstream would be subject to frequent flooding.	Would result in the removal of approximately 1.8 acre of vegetation including trees.
Invasive Species	Initially, no change. Breach could spread invasive species potentially found at sites to downstream area. During local decommission, efforts will be made to ensure invasive species are not introduced. All disturbed areas will be revegetated using adapted and/or non-invasive native species. All tools, equipment, and vehicles will be cleaned before transporting materials and before entering and leaving the worksites to prevent the introduction and spread of invasive species.	During construction, efforts will be made to ensure invasive species are not introduced. All disturbed areas will be revegetated using adapted and/or non-invasive native species. All tools, equipment, and vehicles will be cleaned before transporting materials and before entering and leaving the worksites to prevent the introduction and spread of invasive species.	During construction, efforts will be made to ensure invasive species are not introduced. All disturbed areas will be revegetated using adapted and/or non-invasive native species. All tools, equipment, and vehicles will be cleaned before transporting materials and before entering and leaving the worksites to prevent the introduction and spread of invasive species.

Item	**Alternative # 1: No Action/FWOFI**	**Alternative # 2: Federal Decommission**	**Alternative # 3: High Hazard Potential Rehabilitation**
Fish and Wildlife	Initially, no change. Breach would result in impacts to fish and wildlife within and downstream of the FRS 2 due to the sudden release of water and sediment. Local decommission could eliminate approximately 18 acres of shallow and deep water habitat. Would result in impacts to downstream aquatic and terrestrial wildlife and their habitat through both the lack of water as well as during flooding events. Minor, temporary impacts to aquatic and terrestrial habitat may occur during construction. Less-mobile species may be lost due to equipment during construction.	Would eliminate approximately 18 acres of shallow and deep water habitat. Would eliminate any aquatic wildlife and habitat present in the current sediment pool as well as damage the downstream aquatic and terrestrial habitat. Would result in impacts to downstream aquatic and terrestrial wildlife and their habitat through both the lack of water as well as during flooding events. Minor, temporary impacts to aquatic and terrestrial habitat may occur during construction. Less-mobile species may be lost due to equipment during construction.	Would maintain the existing aquatic and terrestrial wildlife and their habitat in the long term. Downstream aquatic and terrestrial wildlife and habitat would continue to be maintained and protected by similar flows as presented at existing conditions. Minor, temporary impacts to aquatic and terrestrial habitat may occur during construction. Less-mobile species may be lost due to equipment during construction.
Animals - Threatened and Endangered Species	Potential for direct and indirect impacts to species. Presence/absence surveys would be required to determine if the potentially suitable habitat is occupied by Animals - Threatened and Endangered Species. BMPs would be implemented to avoid harming state-listed animal species.	Potential for direct and indirect impacts to species. Presence/absence surveys would be required to determine if the potentially suitable habitat is occupied by Animals - Threatened and Endangered Species. BMPs would be implemented to avoid harming state-listed animal species.	No direct impacts to species are anticipated as a result of this alternative Presence/absence surveys would be required to determine if the potentially suitable habitat is occupied by Animals - Threatened and Endangered Species. BMPs would be implemented to avoid harming state-listed animal species.
Migratory Birds/Bald Eagle	Initially, no change. Breach could have effects on migratory birds as result of tree damage due to sudden release of flows. Local decommissioning may temporarily affect migratory birds if construction activities occur between March 1 and August 31. Appropriate measures will be implemented in accordance with the MBTA.	May temporarily affect migratory birds if construction activities occur between March 1 and August 31. Appropriate measures will be implemented in accordance with the MBTA.	May temporarily affect migratory birds if construction activities occur between March 1 and August 31. Appropriate measures will be implemented in accordance with the MBTA.

Item	**Alternative # 1: No Action/FWOFI**	**Alternative # 2: Federal Decommission**	**Alternative # 3: High Hazard Potential Rehabilitation**
Cultural Services – Makes the world a place people want to live (e.g., recreation, spiritual, aesthetics)			
Cultural Resources	Initially, no change. Breach could result in impacts to downstream cultural resources. if there are any located within the breach inundation area , as a result of sudden discharge of flows and fill. Coordination was completed with the Texas State Historic Preservation Office and concurrence was received on July 30, 2021 that no historic properties are present, and the proposed project would have no adverse effect on historic properties. Therefore cultural resources are not anticipated to be impacted by the local decommis-sioning. NRCS consultation with relevant Tribes was initiated on July 6, 2022.	Coordination was completed with the Texas State Historic Preservation Office and concurrence was received on July 30, 2021 that no historic properties are present, and the proposed project would have no adverse effect on historic properties. Therefore cultural resources are not anticipated to be impacted by this alternative. NRCS consultation with relevant Tribes was initiated on July 6, 2022.	Coordination was completed with the Texas State Historic Preservation Office and concurrence was received on July 30, 2021 that no historic properties are present, and the proposed project would have no adverse effect on historic properties. Therefore cultural resources are not anticipated to be impacted by this alternative. NRCS consultation with relevant Tribes was initiated on July 6, 2022.
Local and Regional Economy	Initially, no change. Breach would result in significant impacts to local economy as a result of damage to downstream areas from sudden discharge of flows and fill. Local decommissioning would initially result in a temporary positive impact on the local economy during construction efforts, but there would be potentially long-term negative impacts to the economy through the loss of flood protection to downstream residential and commercial areas.	Would initially result in a temporary positive impact on the local economy during construction efforts, but there would be potentially long-term negative impacts to the economy through the loss of flood protection to downstream residential and commercial areas.	Would result in a temporary positive impact on the local economy during construction and would continue to provide flood protection for downstream residential and commercial areas.
Environmental Justice	Initially, no change. Breach would result in significant impacts to downstream minority and low-income populations as a result of damage to properties and injuries to individuals Local decommissioning would remove the flood protection	Would remove the flood protection benefits and increase development restrictions downstream which could negatively impact minority and low-income populations.	Would allow flood protection benefits to continue for 100 years and would avoid potential impacts to downstream minority and low-income populations.

Item	Alternative # 1: No Action/FWOFI	Alternative # 2: Federal Decommission	Alternative # 3: High Hazard Potential Rehabilitation
	benefits and increase development restrictions downstream which could negatively impact minority and low-income populations.		
Land Use	Initially, no change. Breach would result in significant impacts to downstream land use as a result of sudden discharge of flows and fill. Local decommission would result in downstream land use changes because of more frequent flooding and development restrictions.	Would result in downstream land use changes as a result of more frequent flooding and development restrictions.	Minimal changes to land use and vegetation cover due to the widening of the existing auxiliary spillway crest. Would maintain flood protection for existing downstream land uses.
Public Health and Safety	Initially no changes. Breach would cause significant impacts to public health and safety due to sudden release of flows and fill. Local decommission would remove the risk associated with the potential for dam failure, after the dam has been removed. The 1% AEP floodplain would be expanded, and increased development restrictions would be implemented to protect public health and safety within the enlarged floodplain area.	Would remove the risk associated with the potential for dam failure. The 1% AEP floodplain would be expanded and increased development restrictions would be implemented to protect public health and safety within the enlarged floodplain area.	Would maintain the flood protection benefits for 100 years after construction. Upstream of the dam, the 1% AEP 24-hour flood pool will be 0.7 feet lower than the existing condition, and no homes will be at risk. The downstream water surface elevation during the 1% AEP 24-hour storm event will be similar to the current condition. The threat to loss of life from failure of the dam would be greatly reduced.
Social Issues/Community Cohesion	Initially, no changes. Breach would result in loss of community cohesion due to downstream flood damage. Local decommissioning could result in social issues/community cohesion issues due to loss of flood protection and increased flooding to downstream residences, businesses, and roadways.	Could result in social issues/community cohesion issues due to acquisition/removal of 39 structures, floodproofing of 49 structures, and installation of a flood warning system on one roads.	No impacts to social issues or community cohesion anticipated.

Item	Alternative # 1: No Action/FWOFI	Alternative # 2: Federal Decommission	Alternative # 3: High Hazard Potential Rehabilitation
National Economic Analysis			
Costs			
Project Investment			
Total	$0	$23,658,000	$7,692,000
Annual O&M Costs			
Total	$5,000	$0	$5,000
Total Discounted Annual Costs	$5,000	$647,000	$223,000
Benefits			
Structure, Content, and Automobiles, and Debris Removal	$0	$182,000	$106,000
Damages Avoided to Roads and Bridges	$0	$0	$13,000
Sediment and Erosion Damages Avoided	$0	$0	$1,000
Total Annual Benefits	**$0**	**$181,000**	**$120,000**
Evaluation			
Benefit-Cost Ratio	N/A	0.3	0.5
Net Benefit	N/A	-$466,000	-$103,000
Regional Economic Analysis (RED)			
Flood Damage Reduction Benefits Value Added	N/A	$296,000	$194,000
Annualized Value Added of Construction	N/A	$705,000	$229,000
Total Local Benefits	**N/A**	**$1,000,000**	**$423,000**
Annual Local Costs	N/A	$183,000	$65,000
RED Benefit-Cost Ratio to Texas	N/A	5.5	6.6
Net RED Benefits to Rest of US	N/A	-$275,000	-$88,000
RED Output (Sales) during Engineering, Project Administration and Construction	N/A	$49,542,000	$16,108,000
Construction Jobs (Annual)	N/A	245	80
Note: RED Benefits to Rest of US include 0 benefits since all occur in Texas, Federal share of construction costs, and minus value added of construction since similar effect could occur wherever federal funds were spent.			

Table 4-3. Consideration of PR&G Guiding Principles

PR&G GUIDING PRINCIPLES	No Federal Action/FWOFI – Sponsor Breach of FRS No. 2	Alternative 2 Decommission with Federal Assistance of FRS No. 2	Alternative 3 High Hazard Potential Rehabilitation of FRS No. 2
Healthy and Resilient Ecosystems	Initially maintain current ecological function of the impoundment area and protection for downstream habitat. Breach would cause damage to downstream habitat. Local decommission would return stream's ecological function to pre-impoundment and would impact downstream habitat because of the uncontrolled flows.	Return stream's ecological function to pre-impoundment and impact downstream habitat because of the uncontrolled flows.	Maintain current ecological function of impoundment area for wildlife habitat.
Sustainable Economic Development	Initially maintain current flood control function of the dam while still keeping downstream areas at risk of a potential breach. Breach would cause damage to downstream residences and businesses. Local decommission complies with sustainable use and management of water resources through return to natural conditions.	Complies with sustainable use and management of water resources through return to natural conditions.	Complies with sustainable use and management of water resources through maintaining flood protection.
Floodplains	Initially maintain current flood protection from dam while still keeping downstream areas at risk of a potential breach. Breach would cause damage to downstream residences and businesses. Local decommission would remove flood protection benefits from dam and increase 1% AEP floodplain.	Remove risk of breach, remove flood protection benefits from dam, and increase 1% AEP. 49 structures would be dry floodproofed and 39 structures would be acquired. Flood warning system to be installed on one road crossing to prevent increased flood risk.	1% AEP floodplain would be similar to existing conditions and risk of breach would be removed.
Public Safety	Initially maintain current level of public safety from dam while still keeping downstream areas at risk of a potential breach. Breach would cause temporary impacts to public safety. Local decommission would remove risk of breach, but would also remove flood protection benefits from dam	Remove risk of breach, remove public safety benefits from dam, and increase 1% AEP. 49 structures would be dry floodproofed, 39 structures would be acquired, and a flood warning system would be installed on one road crossing to prevent	Public safety benefits would remain unchanged, and risk of breach would be removed.

PR&G GUIDING PRINCIPLES	No Federal Action/FWOFI – Sponsor Breach of FRS No. 2	Alternative 2 Decommission with Federal Assistance of FRS No. 2	Alternative 3 High Hazard Potential Rehabilitation of FRS No. 2
	and increase frequency and extent of flooding.	increased risk to public safety.	
Environmental Justice	Initially, minority and low-income populations downstream will continue to be at risk of a dam breach. Local decommission will result in loss of flood protection for affected population downstream FRS 2.	Loss of flood protection for minority and low-income populations downstream FRS 2. Impacted structure would be acquired or floodproofed. Risk of breach removed.	Flood protection maintained with minimal change to existing condition and risk of dam breach removed for downstream minority and low-income populations.
Watershed Approach	Initially, maintain ecological function of Ranger Creek and Upper Cibolo Creek and contribution to ecological function of the San Antonio River System. Breach would result in temporary impacts to ecologic function. Local decommission could improve ecological function of System, but would also subject downstream habitat area to uncontrolled flows and sediment.	Could improve ecological function of Ranger Creek and Upper Cibolo Creek and contribution to ecological function of San Antonio River System, but would also subject downstream habitat area to uncontrolled flows and sediment.	Maintain ecological function of Ranger Creek and Upper Cibolo Creek and contribution to ecological function of San Antonio River System.

5.0 ENVIRONMENTAL CONSEQUENCES

Alternative plans of action can result in a multitude of effects on resources upstream and downstream of FRS No. 2. This section describes anticipated effects on resource concerns identified by the Sponsors, the public, and agency personnel in the Scoping meeting and the public meetings.

For the purpose of the following discussions, project areas within the affected environment are defined below.

- Project footprint – The area within the footprint of the proposed rehabilitated structure and expanded auxiliary spillway.
- Limit of disturbance (LOD) – The maximum extent that could potentially be temporarily disturbed during construction to accommodate for borrow areas, equipment staging, and camp site.
- Normal pool/sediment pool area – This term refers to the acreage of the normal pool (also known as the sediment pool) area directly upstream from FRS No. 2.
- Breach inundation area – This refers to the area downstream from the dam within the study reach that would be directly impacted by sudden dam failure.

5.1 Environmental Evaluation Worksheet (NRCS-CPA-52)

An Environmental Evaluation Worksheet, NRCS-CPA-52 form, was completed for the FRS No. 2 rehabilitation project. The NRCS-CPA-52 provides information on the effects of the various alternatives on the individual resource concerns in the watershed. As portions of the preferred alternatives at FRS No. 2 will be outside the limits of NRCS categorical exclusions (NWPM Part 501.38(A)), an Environmental Assessment was considered appropriate for this Supplemental Watershed Plan effort.

5.2 Environmental Concerns Excluded from Environmental Consequences Evaluation

The following environmental concerns identified through the scoping process were determined to not be relevant to the proposed action:

- Coastal Zone Management Plans
- Potable Water Supply/Regional Water Management Plans/Water Resources
- Sewer Utilities
- Wild and Scenic Rivers
- Air Quality/Clean Air Act
- Natural Areas
- Coral Reefs
- Ecologically Critical Areas
- Essential Fish Habitat

- Drought
- Park Lands, Scenic Areas
- Public Recreation
- Scenic Beauty
- Scientific Resources

5.3 Comparative Environmental Effects of Alternatives – FRS No. 2

5.3.1 Prime and Unique Farmland

Existing Conditions
Prime and unique farmland is land that has the soil quality, growing season, and moisture supply necessary for producing crops and is available for these uses. In addition, the land is not excessively eroded or saturated with water for a long period of time and is either protected from flooding or does not flood frequently.

Based on the NRCS Soil Survey, there are approximately 28 acres of prime farmland within the FRS No. 2 projected maximum LOD and there are approximately 45 acres of prime farmland below the TOD elevation, upstream of FRS No. 2, although none of the areas designated as prime farmland appear to be being actively farmed. There are approximately 14 acres of area designated as prime farmland and approximately 190 acres of area designated as farmland of statewide importance, if irrigated within the 1% AEP floodplain, downstream of FRS No. 2, although very little of those areas appear to be actively farmed.

Alternative 1 - No Action/FWOFI
The No Action/FWOFI Alternative would have no effect on the existing conditions of prime and unique farmland while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a catastrophic breach does occur, it has the potential to cause significant impacts to the downstream areas of prime farmland and farmland of statewide importance as a result of the sudden discharge of large flows, embankment fill, and sediment. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. Following local decommission of the dam, the elimination of the existing flood protection would subject larger areas of prime farmland and farmland of statewide importance to flooding due to the expansion of the floodplain. Due to the potential for flooding if flood protection is removed, these areas would potentially not be considered prime and unique farmlands. Impacts to prime and unique farmlands within the FRS No. 2 LOD could occur during construction. Areas of prime and unique farmland that are currently inundated by the dam impoundment would be available for farming once the dam is decommissioned.

Alternative 2 - Decommission (FWFI)
The Decommission Alternative eliminates the existing flood protection and subjects the areas downstream to more frequent and severe flooding. Due to the potential for frequent flooding if flood protection is removed, these areas would potentially not be considered prime and unique farmlands. Impacts to prime and unique farmlands within the FRS No. 2 LOD could occur

during construction. Areas of prime and unique farmland that are currently inundated by the dam impoundment would be available for farming once the dam is decommissioned.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alternative would maintain the flood protection for prime and unique farmlands downstream of the dam. A 2.3 foot dam raise would be required for this alternative and the inundation of approximately 5 additional acres of prime farmland from the backwater of FRS No. 2 are anticipated although flooding of this area would be very infrequent and that the widening of the spillway may decrease flooding on upstream cropland for most storms. Less than 1 acre of prime farmland within the FRS No. 2 projected maximum LOD would potentially be impacted during construction, although this area does not appear to be being actively farmed.

Cumulative Impacts
Potential long-term impacts to downstream prime farmland and farmland of statewide importance would occur if the storage function of the dam is removed either through catastrophic breach or local decommissioning. These long-term effects would be incremental to other regional impacts to prime and unique farmland resulting from future development, conversion of agricultural lands to other land uses, and rehabilitation or breach of other flood retarding structures within the watershed.

5.3.2 Erosion and Sediment

Existing Conditions
Soils and Erosion – Based on the NRCS Web Soil Survey, the predominant soil group in the FRS No. 2 LOD is Bracket-Real association, Doss-Bracket association, and Krum silty clay. Current conditions indicate some areas of erosion are present in the flood pool area and an erosion gulley has formed in the exit channel and continues to headcut into the auxiliary spillway.

Sedimentation – It is expected that FRS No. 2 is currently functioning to collect and retain sediment from the watershed. It should be noted the amount of sediment retained in FRS No. 2 could not be quantified using the analysis methods utilized for this plan, because there are uncertainties associated with the original submerged sediment volume available at the time of construction.

Alternative 1 - No Action/FWOFI (Sponsor Breach)
The No Action/FWOFI Alternative would have no effect on the existing conditions of erosion and sedimentation while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a catastrophic breach does occur, it has the potential to cause significant impacts to erosion and sedimentation downstream as a result of the sudden discharge of large flows, embankment fill, and sediment. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. Following local decommission of the dam, the current function of the dam to collect and retain sediment would be eliminated and the removal of flood protection would increase the potential for downstream erosion and sedimentation to private properties, roads, and utilities.

Alternative 2 - Decommission (FWFI)
The Decommission Alternative would result in streambank erosion downstream and within the drained sediment pool. This Alternative includes a controlled breach of the dam and would eliminate the current function of the dam to collect and retain sediment. This Alternative would eliminate the flood protection and increase the potential for downstream erosion and sedimentation to private properties, roads, and utilities. While the project could be designed to address streambank erosion, the nature of the uncontrolled flows associated with removal of the dam would likely subject the downstream areas to additional streambank erosion.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alternative would rehabilitate the dam to meet NRCS High Hazard Potential Class dam criteria. This Alternative would continue to allow the dam to collect and retain sediment as well as further reduce the downstream erosion potential by safely passing controlled storm flows through the new conduit. The flood protection to downstream properties, roads, and utilities would be improved through the proposed modifications.

Temporary impacts to erosion and sedimentation may occur during construction; however, these impacts would be reduced through the use of water quality BMPs identified in the SWPPP.

Cumulative Impacts
Temporary impacts to erosion and sedimentation would occur during construction associated with decommissioning or rehabilitation; however, these impacts would be reduced through the use of water quality BMPs identified in the SWPPP. Temporary, but significant impacts to erosion and sediment would occur in the event of catastrophic breach. Long-term impacts to downstream erosion and sedimentation would occur if the sediment and flood storage function of the dam is removed either through catastrophic breach or decommissioning. These long-term effects would be incremental to other regional impacts to erosion and sedimentation resulting from future development, conversion of agricultural lands to other land uses, and rehabilitation or breaching of other flood retarding structures within the watershed.

5.3.3 Floodplain Management

Existing Conditions
Kendall County and incorporated areas participate in the National Flood Insurance Program (NFIP). The current effective FEMA flood hazard delineation included on Flood Insurance Rate Map (FIRM) panel 48259C0400G and the countywide Flood Insurance Study (FIS) were published on May 15, 2020. The FEMA Map Service Center website indicates that no Letters of Map Revision (LOMRs) have been filed for this FIRM panel since the effective date of the existing Digital Flood Insurance Rate Map (DFIRM).

FRS No. 2 is within a Federal Emergency Management Agency (FEMA)-regulated 1% AEP floodplain for Kendall County Unincorporated Areas, effective date May 15, 2020. The effective FEMA Flood Zone for the reach of Ranger Creek upstream of FRS No. 2, through the auxiliary spillway, and into the downstream channel was developed in 1995 using detailed methods and is classified as zone AE. According to the FEMA Glossary, Zone AE indicates areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. Base

Flood Elevations (BFEs) are shown. The reach downstream of FRS No. 2 was developed in 1995 using approximate methods and is classified as Zone A. The models were re-validated in May of 2020. According to the FEMA Glossary, Zone A indicates areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown.

1% and 0.2% AEP floodplains were generated from the hydraulic models developed for this project and are shown on Figure C-7. The existing impoundment provides flood damage reduction benefits by reducing the peak flow and duration of storm events within the watershed. The peak WSE elevation achieved in the reservoir during the 1% AEP storm event is 1613.00 feet, which is 1.00 feet higher than the existing auxiliary spillway elevation of 1612.00 feet (per LiDAR). The corresponding peak outflow from FRS No. 2 during the 1% AEP event is 291 cfs. Floodplain impacts, including houses impacted, roads overtopped, and acres of floodplain at FRS No. 2 are summarized in **Table 5-1**.

The modeled floodplain areas for the existing conditions for the 4%, 2%, 1%, and .2% AEP storm events would be 229.7 acres, 274.1 acres, 398.5 acres, and 786.2 acres, respectively.

Alternative 1 - No Action/FWOFI (Sponsor Breach)
The No Action/FWOFI Alternative would have no effect on the existing conditions of floodplain management while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a catastrophic breach does occur, it has the potential to cause significant impacts to downstream as a result of the sudden discharge of large flows. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. Following local decommission of the dam, the current flood protection benefits would be removed, as the structure would no longer be able to store floodwater, store sediment, and reduce peak flows. The downstream floodplain extent would increase. The number of residential and nonresidential structures inundated above the finish floor elevation during the modeled 1% AEP, 24-hour flood event would increase from 42 structures to 88 structures. Floodwaters from a 1% AEP, 24-hour flood event would cause induced flooding on 14 roads.

The modeled floodplain areas for this alternative for the 4%, 2%, 1%, and .2% AEP storm events would be 277.9 acres, 347.1 acres, 486.5 acres, and 831.4 acres, respectively.

Alternative 2 - Decommission (FWFI)
The Decommission Alternative would remove the flood protection benefits, as the structure would no longer be able to store floodwater, store sediment, and reduce peak flows. The downstream floodplain extent would increase. The number of residential and nonresidential structures inundated above the finished-floor elevation during the modeled 1% AEP, 24-hour flood event would increase from 42 structures to 88 structures. Floodwaters from a 1% AEP, 24-hour flood event would cause increased flooding on 14 roads. Mitigation for the residential, non-residential, and road crossing structures would be necessary to meet the purpose and need of the project. This alternative assumes that only the I-10 W frontage road would have barricades with flood warning lights installed on it to prevent induced flooding, as all of the other roads with

increased flooding have flooding depths between 1.1 feet and 17.6 feet in the existing condition and would not be passable. No barricades or flood warning lights would be installed on private driveways. Based on the estimated depth of flooding at each of the impacted residential and nonresidential structures, it was assumed that 39 structures would be acquired and removed and 49 would be floodproofed to prevent induced flooding.

The modeled floodplain areas for this alternative for the 4%, 2%, 1%, and .2% AEP storm events would be 277.9 acres, 347.1 acres, 486.5 acres, and 831.4 acres, respectively.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)

The High Hazard Potential Rehabilitation Alternative would maintain the current flood protection benefits. No critical structures are impacted, and no residential structures will be added to the 1% AEP floodplain. The drawdown time in the dam backwater will be kept to less than 10 days. Based on the flood routing for the 1% AEP event, the peak WSE elevation in the dam backwater would be approximately 1,611.30 feet, or 0.7 feet lower than the existing condition. The peak outflow from FRS No. 2 during the 1% AEP event is approximately 185 cfs. Immediately below the dam to approximately 350 feet upstream up the private driveway for 25 Ranger Creek Road, the water surface elevation will be reduced by -0.13 foot to -0.8 foot from the existing condition. From approximately 350 feet upstream up the private driveway for 25 Ranger Creek Road Downstream of that location and to the downstream extent of the model, the water surface elevation increases from 0.01 foot to 0.13 foot.

The increased conduit size will allow larger, more routine flows immediately downstream of FRS No. 2 (50% AEP = 130.2 cfs) versus the existing condition conduit (50% AEP = 57.7 cfs). The increase in discharge (between Alternative 3 and the existing condition) at the 50% AEP event will cause only slight increase (maximum is 0.06 foot) in overtopping depths at downstream road crossings and will not cause any additional structures to be flooded.

The modeled floodplain areas for this alternative for the 4%, 2%, 1%, and .2% AEP storm events would be 232.4 acres, 277.0 acres, 399.7 acres, and 782.4 acres, respectively.

Cumulative Impacts

Temporary impacts to the downstream floodplain would occur in the event of catastrophic breach of the dam. Potential long-term impacts to the downstream floodplain would occur if the flood storage function of the dam is removed either through catastrophic breach or decommissioning. These long-term effects would be incremental to other regional impacts to floodplain management resulting from future development, conversion of agricultural lands to other land uses, and rehabilitation or breach of other flood retarding structures within the watershed.

5.3.4 Sole Source Aquifers

Existing Conditions

FRS No. 2 is located within the EPA designated area for the Edwards Aquifer I (San Antonio Area) SSA - Streamflow Source Area. FRS No. 2 is located on Ranger Creek, which contributes to Cibolo Creek prior to Cibolo Creek passing through the EAA jurisdictional area and the Edwards Aquifer Recharge Zone.

Alternative 1 - No Action/FWOFI
The No Action/FWOFI Alternative would have no effect on the existing conditions of Sole Source Aquifer while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a catastrophic breach does occur, it has the potential to cause significant downstream impacts to the sole source aquifer as a result of discharge of fill material and impounded sediment. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. Following local decommission of the dam, this Alternative would allow sediment from upstream erosion to move downstream, impacting the water quality of Cibolo Creek, which passes through the Edwards Aquifer Recharge Zone. Minor, temporary impacts to water quality in Cibolo Creek would occur as a result of erosion and sedimentation during construction, which could impact the sole source aquifer. Sedimentation and erosion would be managed through the implementation of a SWPPP. BMPs would be identified in the SWPPP.

Alternative 2 - Decommission (FWFI)
The Decommission Alternative would allow sediment from upstream erosion to move downstream, impacting the water quality of Cibolo Creek, which passes through the Edwards Aquifer Recharge Zone. Minor, temporary impacts to water quality in Cibolo Creek would occur as a result of erosion and sedimentation during construction, which could impact the sole source aquifer. Sedimentation and erosion would be managed through the implementation of a SWPPP. BMPs would be identified in the SWPPP. As FRS No. 2 is located within the EPA's review area for the Edwards Aquifer Sole Source Aquifer and would receive Federal funding under this alternative, if this alternative is selected the project will need to be evaluated by the EPA Region 6 Source Water Protection Branch. If the evaluation indicates that the project does not have significant potential to contaminate the SSA, the project may continue as planned.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alternative would result in minor, temporary impacts to water quality in Cibolo Creek as a result of erosion and sedimentation during construction, which could impact the sole source aquifer. Sedimentation and erosion would be managed through the implementation of a SWPPP. BMPs would be identified in the SWPPP. As FRS No. 2 is located within the EPA's review area for the Edwards Aquifer Sole Source Aquifer and would receive Federal funding under this alternative, if this alternative is selected the project will need to be evaluated by the EPA Region 6 Source Water Protection Branch. If the evaluation indicates that the project does not have significant potential to contaminate the SSA, the project may continue as planned.

Cumulative Impacts
Temporary impacts to water quality in Cibolo Creek would occur during construction associated with decommissioning or rehabilitation, which could impact the Edwards Aquifer when Cibolo Creek passes through the Recharge Zone. These impacts would be reduced through the use of water quality BMPs identified in the SWPPP. Temporary, but significant impacts to water quality in Cibolo Creek and its contribution to the Edwards Aquifer would occur in the event of a

catastrophic breach. Negative long-term impacts to the downstream water quality would result from uncontrolled sediment being discharged into downstream water bodies if the is dam removed either through a catastrophic breach or decommissioning. Potential positive long-term impacts to the Edwards Aquifer could occur through dam removal and the conversion of still water back to the free-flowing stream that existed prior to the dam being constructed. These potential long-term effects would be incremental to other regional impacts to the Edwards Aquifer resulting from future rehabilitation or breach of other flood retarding structures within the watershed.

5.3.5 Streams, Lakes, and Wetlands

Existing Conditions

The normal pool/sediment pool area associated with FRS No. 2 as well as Ranger Creek flowing into and out of the normal pool/sediment pool area would be considered potentially jurisdictional waters of the U.S under the Clean Water Act. During the site visit conducted July 23, 2020 and July 21, 2022 (**Appendix E**), Ranger Creek, was identified immediately downstream of the dam.

Alternative 1 - No Action/FWOFI

The No Action/FWOFI Alternative would have no effect on the downstream streams, wetlands, and springs/steeps or on the upstream fringe wetlands while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a catastrophic breach does occur, it has the potential to cause significant discharge of fill material into potentially jurisdictional waters of the U.S. and would cause temporary flooding that would impact the downstream streams, wetlands, and springs/steeps. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. Following local decommission of the dam, the potential for the discharge of fill material into potentially jurisdictional waters of the U.S would remain. The controlled breach of the dam would eliminate the normal pool/sediment pool area and likely decrease the surface water upstream resulting in the loss of aquatic habitat and hydrology.

Alternative 2 - Decommission (FWFI)

The Decommission Alternative would result in a discharge of fill material into potentially jurisdictional waters of the U.S. The controlled breach of the dam would eliminate the normal pool/sediment pool area and likely decrease the surface water upstream resulting in the loss of aquatic habitat and hydrology.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)

The High Hazard Potential Rehabilitation Alternative would result in a discharge of fill material into potential jurisdictional waters of the U.S. during construction. Aquatic habitat upstream and within the normal pool/sediment pool area would be maintained. In addition, the fringe vegetation would be maintained; however, temporary impacts would likely occur during construction. Formal stream delineations were performed on July 21, 2022. One open water feature, the Upper Cibolo Creek FRS No. 2 Reservoir; and one perennial stream, Ranger Creek, were observed within the project area. A pre-application meeting was held with the USACE on January 10, 2023. Based on this meeting, it appears that a Nationwide Permit 3, Maintenance, with a Pre-Construction Notification would be required.

Cumulative Impacts
Temporary impacts to downstream streams and wetlands would occur in the event of catastrophic breach, decommissioning, or rehabilitation of the dam. Potential negative long-term impacts to the downstream streams and wetlands due to uncontrolled flows and discharged fill could occur if the dam is removed either through catastrophic breach or decommissioning. Potential positive long-term impacts to streams and wetlands could occur through dam removal and the conversion of still water back to the free-flowing streams that existed prior to the dam being constructed. These potential long-term effects would be incremental to other regional impacts to streams and wetlands resulting from future rehabilitation or breach of other flood retarding structures within the watershed.

5.3.6 Water Quality

Existing Conditions
The 2020 305(b)/303(d) Integrated Water Quality Assessment and Impaired Waters Report identifies Upper Cibolo Creek segment 1908 (confluence is located approximately 2.6 miles downstream of FRS No. 2) as being impaired for Bacteria. The segment was first listed in 2006.

Alternative 1 - No Action/FWOFI
The No Action/FWOFI Alternative would have no effect on the existing conditions of water quality while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a catastrophic breach does occur, it has the potential to cause significant downstream water quality impacts as a result of discharge of fill material and impounded sediment. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. Following local decommission of the dam, this Alternative would allow sediment from upstream erosion to move downstream, impacting negatively the water quality. Minor, temporary impacts to water quality would occur as a result of erosion and sedimentation during construction. Sedimentation and erosion would be managed through the implementation of a SWPPP. BMPs would be identified in the SWPPP. It is not expected that this alternative would have significant impacts on the bacterial impairment.

Alternative 2 - Decommission (FWFI)
The Decommission Alternative would allow sediment from upstream erosion to move downstream as a result of the controlled breach of the dam impacting negatively the water quality. Minor, temporary impacts to water quality would occur as a result of erosion and sedimentation during construction. Sedimentation and erosion would be managed through the implementation of a SWPPP. BMPs would be identified in the SWPPP. It is not expected that this alternative would have significant impacts on the bacterial impairment.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alternative would result in temporary impacts to water quality during construction. Sedimentation and erosion would be managed through the implementation of a SWPPP. BMPs would be identified in the SWPPP. It is not expected that this alternative would have significant impacts on the bacterial impairment.

Cumulative Impacts
Temporary impacts to water quality would occur during construction associated with decommissioning or rehabilitation; however, these impacts would be reduced through the use of water quality BMPs identified in the SWPPP. Temporary, but significant impacts to water quality would occur in the event of catastrophic breach. Negative long-term impacts to the downstream water quality would result from uncontrolled sediment being discharged into downstream water bodies if the is dam removed either through catastrophic breach or decommissioning. Potential positive long-term impacts to water quality could occur through dam removal and the conversion of still water back to the free-flowing stream that existed prior to the dam being constructed. These potential long-term effects would be incremental to other regional impacts to water quality resulting from future rehabilitation or breach of other flood retarding structures within the watershed.

5.3.7 Woodland Vegetation

Existing Conditions
There are approximately 1.8 acres with trees within the LOD consisting primarily of Ashe juniper (*Juniperus ashei*), live oak (*Quercus fusiformis*), honey mesquite (*Prosopis glandulosa*), black willow (*Salix nigra*), American sycamore (*Platanus occidentalis*), and cedar elm (*Ulmus crassifolia)*.

Alternative 1 - No Action/FWOFI
The No Action/FWOFI Alternative would have no effect on the existing conditions of woodland vegetation/forest resources while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a catastrophic breach does occur, it has the potential to cause significant impacts to woodland vegetation/forest resources as a result of breach of the embankment and the sudden discharge of large flows downstream. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. The local decommission is not anticipated to result in the removal of vegetation. Forest resources downstream would be subject to frequent flooding.

Alternative 2 - Decommission (FWFI)
The Decommission Alternative is not anticipated to result in the removal of vegetation. Forest resources downstream would be subject to frequent flooding.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)
The High Hazard Rehabilitation Alternative would result in the removal of approximately 1.8 acres of vegetation including trees.

Cumulative Impacts
Construction activities associated with any of the alternatives would result in impacts to woodland vegetation/forest resources within the LOD. Temporary, but significant impacts to woodland vegetation/forest would occur in the event of catastrophic breach. Potential long-term impacts to downstream woodland vegetation/forest resources would occur if the storage function

of the dam is removed either through catastrophic breach or decommissioning. These long-term effects would be incremental to other regional impacts to woodland vegetation/forest resource resulting from future development and rehabilitation or breach of other flood retarding structures within the watershed.

5.3.8 Riparian Areas

Existing Conditions
Riparian areas are present in a narrow band surrounding the approximately 18-acre normal pool/sediment pool area as well as downstream along Ranger Creek. These areas are comprised of various grasses and trees/shrubs, sedges, and rushes. The vegetation outside of these areas is comprised of upland species.

Alternative 1 - No Action/FWOFI
The No Action/FWOFI Alternative would have no effect on the existing conditions of riparian areas while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a catastrophic breach does occur, it has the potential to cause significant impacts to downstream riparian areas as a result of breach of the embankment and the sudden discharge of large flows downstream. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. Following local decommissioning, downstream riparian areas would be subject to more frequent flooding. Riparian areas along Ranger Creek and downstream FRS 2 would likely increase with removal of the dam.

Alternative 2 - Decommission (FWFI)
The Decommission Alternative would result in the loss of riparian areas around the drained pool. Riparian areas along Ranger Creek and downstream FRS 2 would likely increase with removal of the dam.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)
The High Hazard Rehabilitation Alternative would result in minor temporary impacts during construction. The submerged sediment pool area would remain the same size, as the principal spillway crest would be lowered to the existing elevation of the low-level ports. The riparian areas would establish surrounding the normal pool/sediment pool area consistent with pre-construction conditions following rehabilitation activities.

Cumulative Impacts
Temporary impacts to downstream riparian areas would occur in the event of catastrophic breach. Negative long-term impacts to the downstream riparian areas would result from uncontrolled flows being discharged into downstream riparian areas if the is dam removed either through catastrophic breach or local decommissioning. Potential positive long-term impacts to riparian areas could occur through dam removal and the conversion of still water back to the free-flowing stream that existed prior to the dam being constructed. In addition, riparian areas along Ranger Creek and downstream would likely increase with removal of the dam. These potential long-term effects would be incremental to other regional impacts to water quality

resulting from future rehabilitation or breach of other flood retarding structures within the watershed.

5.3.9 Invasive Species

Existing Conditions
According to the Texas Invasives website (Texas Invasives, 2022), the following invasive plant species have been identified as being particularly worrisome within the Edwards Plateau Ecoregion, in which FRS No. 2 is located:

- Glossy privet (*Lingustrum lucidum*)
- Chinese tallow tree (*Triadica sebifera*)
- Johnson grass (*Sorghum halepense*)
- Heavenly bamboo (*Nandina domestica*)
- Chinaberry tree (*Melia azedarach*)
- Japanese honeysuckle (*Lonicera japonica*)
- Giant reed (*Arundo donax*)
- Golden rain tree (*Koelreuteria paniculata*)
- Elephant ears (*Colocasia esculenta*)
- Paper mulberry (*Broussonetia papyrifera*)
- Tree of heaven (*Ailanthus altissima*)
- King Ranch bluestem (*Bothriochloa ischaemum* var. *songarica*)

No Action/FWOFI
The No Action/FWOFI would initially result in no change to the existing condition of invasive species at the site. A breach could result in the spread of invasive plant and animal species through transportation to downstream areas following the breach. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. Local decommissioning could result in the introduction of new invasive species by construction equipment or spreading of existing invasive species during construction, if preventative measures are not taken. All disturbed areas would be revegetated using adapted and/or non-invasive native species. All tools, equipment, and vehicles will be cleaned before transporting materials and before entering and leaving the worksites to prevent the introduction and spread of invasive species.

Decommission (FWFI)
The Decommission Alternative could result in the introduction of new invasive species by construction equipment or spreading of existing invasive species during construction, if preventative measures are not taken. All disturbed areas would be revegetated using adapted and/or non-invasive native species. All tools, equipment, and vehicles will be cleaned before transporting materials and before entering and leaving the worksites to prevent the introduction and spread of invasive species.

High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alternative could result in the introduction of new invasive species by construction equipment or spreading of existing invasive species during

construction, if preventative measures are not taken. All disturbed areas would be revegetated using adapted and/or non-invasive native species. All tools, equipment, and vehicles will be cleaned before transporting materials and before entering and leaving the worksites to prevent the introduction and spread of invasive species.

Cumulative Impacts
Long term impacts to invasive species could occur if new invasive species are introduced to the site during construction. These potential long-term effects would be incremental to other regional impacts to invasive species resulting from future development in the watershed and rehabilitation or breach of other flood retarding structures within the watershed.

5.3.10 Threatened and Endangered Species – Plants and Animals

Existing Conditions
Based on the USFWS IPaC report and TPWD Rare, Threatened, and Endangered Species list, last modified on July 12, 2022, species with the potential to occur in Kendall County include:

Federal Species

- Golden-cheeked warbler (*Setophaga chrysoparia*), Federal Endangered/State Endangered;
- Comal Springs dryopid beetle (*Stygoparnus comalensis*), Federal Endangered/State Endangered;
- Comal Springs riffle beetle (*Heterelmis comalensis*), Federal Endangered/State Endangered
- Peck's Cave amphipod (*Stygobromus pecki*), Federal Endangered/State Endangered
- Piping plover (*Charadrius melodus*), Federal Threatened/State Threatened;
- Red knot (*Calidris canutus rufa*), Federal Threatened;
- Whooping crane (*Grus americana*), Federal Endangered/State Endangered;
- Guadalupe fatmucket (*Lampsilis bergmanni*), Federal Proposed Endangered/State Threatened;
- Guadalupe orb (*Cyclonaias necki*), Federal Proposed Endangered/State Threatened;
- False spike (*Fusconaia mitchelli*), Federal Proposed Endangered/State Threatened;
- Bracted twistflower (*Streptanthus bracteatus*), Federal Proposed Threatened; and
- Monarch butterfly (*Danaus plexippus*), Federal Candidate.

State Species

- Cascade Caverns salamander (*Eurycea latitans*);
- Texas salamander (*Eurycea neotenes*);
- White-faced ibis (*Plegadis chihi*);
- Zone-tailed hawk (*Buteo albonotatus*);
- Guadalupe darter (*Percina apristis*);
- Headwater catfish (*Ictalurus lupus*);
- Plateau shiner (*Cyprinella lepida*);

- Black bear (*Ursus americanus*);
- White-nosed coati (*Nasua narica*);
- Cagle's map turtle (*Graptemys caglei*);
- Texas horned lizard (*Phyrnosoma cornutum*); and
- Texas tortoise (*Gopherus berlandieri*).

Based on the field investigations performed, potential nesting habitat for the golden-cheeked warbler, a federal endangered/state endangered species, was observed within the project area. In addition, potential suitable habitat was observed within the project area for the zone-tailed hawk, Guadalupe fatmucket, false spike, and monarch butterfly.

No federally-designated critical habitat is present in the LOD.

Alternative 1 - No Action/FWOFI

The No Action/FWOFI Alternative would have no effect on the existing conditions of Threatened and Endangered species while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a catastrophic breach does occur, it has the potential to cause significant impacts to downstream threatened and endangered species as a result of the sudden discharge of fill/sediment and large flows. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. The local decommissioning may affect the federal and state listed species by removing individuals and habitat. Preliminary coordination with the USFWS was initiated. There is a potential for direct and indirect impacts to these species as a result of this alternative.

Alternative 2 - Decommission (FWFI)

The Decommission Alternative may affect the federal and state listed species by removing individuals and habitat. Preliminary coordination with the USFWS was initiated. There is a potential for direct and indirect impacts to these species as a result of this alternative.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)

The High Hazard Potential Rehabilitation Alternative may affect the federal and state listed species by removing individuals and habitat. Preliminary coordination with the USFWS was initiated. Based on preliminary design, no direct impacts to these species are anticipated as a result of this alternative. Indirect impacts (i.e. noise) may occur but would be temporary in nature and would not result in a jeopardy to the species continued existence.

Cumulative Impacts

Temporary impacts to threatened and endangered species would occur during construction associated with decommissioning or rehabilitation. Temporary, but significant impacts would occur in the event of catastrophic breach. Negative long-term impacts to downstream threatened and endangered species would result from uncontrolled flows being discharged into downstream habitat if the is dam removed either through catastrophic breach or decommissioning

5.3.11 Fish and Wildlife

Existing Conditions
The FRS No. 2 LOD and surrounding area is generally consistent with previously disturbed lands associated with the dam. As a result, the fish and wildlife resources include primarily native plants and animals and their habitats.

Habitat within and surrounding the LOD consists of the upland grazed grasses, woodland areas, and narrow riparian areas. Aquatic habitats are present in the normal pool/sediment pool area and stream channels within the LOD and downstream of the dam.

The sediment pool is approximately 18 acres and provides habitat for fish, waterfowl, and general wildlife. Habitat is also present within the normal pool area and within the stream channels upstream of the dam.

Alternative 1 - No Action/FWOFI (Sponsor Breach)
The No Action/FWOFI Alternative would have no effect on the existing conditions of fish and wildlife while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a catastrophic breach does occur, it has the potential to cause significant impacts to downstream fish and wildlife and associated habitat as a result of the sudden discharge of fill/sediment and large flows. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. Local decommissioning would eliminate approximately 18 acres of shallow and deep water habitat by converting it to unimproved riparian habitat, floodplain, or upland. In addition, the controlled breach of the dam would damage the downstream aquatic and terrestrial habitat through both the lack of water as well as during flooding events. Minor, temporary impacts to terrestrial habitat may occur during construction. Highly mobile species would be expected to leave the area; however, less-mobile species may be lost due to equipment during construction. It is expected that wildlife would return to the area post construction and all habitat areas would be re-established.

Alternative 2 - Decommission (FWFI)
The Decommission Alternative would eliminate approximately 18 acres of shallow and deep water habitat by converting it to unimproved riparian habitat, floodplain, or upland. In addition, the decommissioning of the dam would damage the downstream aquatic and terrestrial habitat through both the lack of water as well as during flooding events. Minor, temporary impacts to terrestrial habitat may occur during construction. Highly mobile species would be expected to leave the area; however, less-mobile species may be lost due to equipment during construction. It is expected that wildlife would return to the area post construction and all habitat areas would be re-established.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alternative would maintain the existing aquatic and terrestrial wildlife and their habitat in the long term as existing conditions would not be permanently impacted. In addition, downstream aquatic and terrestrial wildlife and their habitat

would continue to be maintained and protected by controlling the stream flow and flood protection.

Minor, temporary impacts to aquatic and terrestrial habitat may occur during construction. Highly-mobile species would be expected to leave the area; however, less-mobile species may be lost due to equipment during construction. It is expected that wildlife would return to the area post construction and all habitat areas would be re-established.

Cumulative Impacts

Temporary impacts to fish and wildlife would occur during construction associated with decommissioning or rehabilitation. Temporary, but significant impacts to fish and wildlife would occur in the event of catastrophic breach. Negative long-term impacts to downstream fish and wildlife would result from uncontrolled flows being discharged into downstream fish and wildlife habitat if the is dam removed either through catastrophic breach or decommissioning. Potential positive long-term impacts to fish and wildlife could occur through dam removal and the conversion of still water back to the free-flowing streams that existed prior to the dam being constructed. These potential long-term effects would be incremental to other regional impacts to fish and wildlife habitat resulting from future rehabilitation or breach of other flood retarding structures and development within the watershed.

5.3.12 Migratory Birds

Existing Conditions

Texas lies within the Central Flyway Migration Route. Many of the birds that migrate through North America rely on the Central Flyway for its diverse habitats. Migratory birds including, song birds, raptors, and waterfowl that may occur in the FRS No. 2 LOD are protected by the MBTA. During the site reconnaissance, no bald eagles or nests were observed.

Alternative 1 - No Action/FWOFI

The No Action/FWOFI Alternative would have no effect on the existing conditions of migratory birds while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a catastrophic breach does occur, it has the potential to cause significant impacts to migratory birds as a result of tree damage from the sudden discharge of large flows. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. The local decommissioning may temporarily affect migratory birds during the controlled breach of the dam if activities occur between March 1 and August 31. In accordance with the MBTA the following measures will be implemented:

- Construction activities and vegetation clearing should be conducted outside peak-nesting seasons (March-August) to avoid any adverse effects to the migratory birds and their habitat.
- Should construction and vegetation clearing occur from March through August, active bird nest surveys during vegetation clearing will be conducted daily by a biologist before clearing begins. During construction active bird nest surveys will be conducted by a biologist no more than 5 days prior to planned construction.

- Ground-nesting species such as Killdeer have the potential to be found on-site. Construction personnel should be made aware of these species, their habits, and regulatory status, and biological monitors clearing areas for construction should take these species into account.
- In the event that migratory birds or their nests are present prior to or during construction, actions should be implemented to ensure migratory birds, their nests, eggs, and young will not be harmed. This can be achieved by establishing buffer distances from the nests in which clearing and construction should not occur until the nests are no longer active. These distances will be determined on a case-by-case basis as different birds require varying buffer distances (i.e., raptor or passerine). Consultation with a qualified biologist will be necessary to determine these buffer distances.

Migratory birds and their nests may be permanently affected in areas around the sediment pool due to the elimination of the pool.

<u>Alternative 2 - Decommission (FWFI)</u>
The Dam Decommission Alterative may temporarily affect migratory birds if construction activities occur between March 1 and August 31. In accordance with the MBTA the following measures will be implemented:

- Construction activities and vegetation clearing should be conducted outside peak-nesting seasons (March-August) to avoid any adverse effects to the migratory birds and their habitat.
- Should construction and vegetation clearing occur from March through August, active bird nest surveys during vegetation clearing will be conducted daily by a biologist before clearing begins. During construction active bird nest surveys will be conducted by a biologist no more than 5 days prior to planned construction.
- Ground-nesting species such as Killdeer have the potential to be found on-site. Construction personnel should be made aware of these species, their habits, and regulatory status, and biological monitors clearing areas for construction should take these species into account.
- In the event that migratory birds or their nests are present prior to or during construction, actions should be implemented to ensure migratory birds, their nests, eggs, and young will not be harmed. This can be achieved by establishing buffer distances from the nests in which clearing and construction should not occur until the nests are no longer active. These distances will be determined on a case-by-case basis as different birds require varying buffer distances (i.e., raptor or passerine). Consultation with a qualified biologist will be necessary to determine these buffer distances.

Migratory birds and their nests may be permanently affected in areas around the sediment pool due to the elimination of the pool.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alternative may temporarily affect migratory birds if construction activities occur between March 1 and August 31. In accordance with the MBTA the following measures will be implemented:

- Construction activities and vegetation clearing should be conducted outside peak-nesting seasons (March-August) to avoid any adverse effects to the migratory birds and their habitat.
- Should construction and vegetation clearing occur from March through August, active bird nest surveys during vegetation clearing will be conducted daily by a biologist before clearing begins. During construction active bird nest surveys will be conducted by a biologist no more than 5 days prior to planned construction.
- Ground-nesting species such as Killdeer have the potential to be found on-site. Construction personnel should be made aware of these species, their habits, and regulatory status, and biological monitors clearing areas for construction should take these species into account.
- In the event that migratory birds or their nests are present prior to or during construction, actions should be implemented to ensure migratory birds, their nests, eggs, and young will not be harmed. This can be achieved by establishing buffer distances from the nests in which clearing and construction should not occur until the nests are no longer active. These distances will be determined on a case-by-case basis as different birds require varying buffer distances (i.e., raptor or passerine). Consultation with a qualified biologist will be necessary to determine these buffer distances.

All areas would be expected to return to pre-existing conditions following rehabilitation activities.

Cumulative Effects
Temporary impacts to migratory birds have the potential to occur during construction associated with decommissioning or rehabilitation unless the required measured are taken. Temporary, but significant impacts to migratory birds would occur in the event of catastrophic breach. Potential negative long-term impacts to migratory birds could result from minor loss of habitat if the dam is removed either through catastrophic breach or decommissioning. These potential long-term effects would be incremental to other regional impacts to migratory birds resulting from future rehabilitation or breach of other flood retarding structures and development within the watershed.

5.3.13 Cultural Resources

Existing Conditions
One previously unrecorded archeological site, one previously unrecorded isolated find, and one previously unrecorded historic-age resource were documented within the APE.

Alternative 1 - No Action/FWOFI
Coordination was completed with the Texas State Historic Preservation Office and concurrence was received on July 30, 2021 that no historic properties are present, and the proposed project would have no adverse effect on historic properties Therefore cultural resources are not anticipated to be relevant to the proposed action. NRCS consultation with relevant Tribes was initiated on July 6, 2022.

Alternative 2 - Decommission (FWFI)
Coordination was completed with the Texas State Historic Preservation Office and concurrence was received on July 30, 2021 that no historic properties are present, and the proposed project would have no adverse effect on historic properties Therefore cultural resources are not anticipated to be relevant to the proposed action. NRCS consultation with relevant Tribes was initiated on July 6, 2022.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)
Coordination was completed with the Texas State Historic Preservation Office and concurrence was received on July 30, 2021 that no historic properties are present, and the proposed project would have no adverse effect on historic properties Therefore cultural resources are not anticipated to be relevant to the proposed action. NRCS consultation with relevant Tribes was initiated on July 6, 2022.

Cumulative Impacts
As no impacts are expected, cumulative impacts to cultural resources were not evaluated.

5.3.14 Local and Regional Economy

Existing Conditions
There are developed residential and commercial areas downstream of Upper Cibolo Creek FRS No. 2 project area in the City of Boerne, however the dam and impoundment are located on private property. The property owner utilizes the lake for recreational purposes, and access is not provided to the general public.

Alternative 1 - No Action/FWOFI
The No Action/FWOFI Alternative would have no effect on the existing conditions of local and regional economy while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a catastrophic breach does occur, it has the potential to cause significant impacts to the local economy as a result of the sudden discharge of fill/sediment and large flows. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. The local decommissioning would initially result in a temporary positive impact on the local economy during construction efforts, but there would be potentially long-term negative impacts to the economy through the loss of flood protection to downstream residential and commercial areas.

<u>Alternative 2 - Decommission (FWFI)</u>
Dam Decommissioning would initially result in a temporary positive impacts on the local economy during construction efforts, but there would be potentially long-term negative impacts to the economy through the loss of flood protection to downstream residential and commercial areas.

<u>Alternative 3 - High Hazard Potential Rehabilitation (FWFI)</u>
The High Hazard Potential Rehabilitation Alterative would result in a temporary positive impact on the local economy during construction and would continue to provide flood protection for downstream residential and commercial areas.

<u>Cumulative Impacts</u>
Temporary negative impacts to the local economy would occur in the event of catastrophic breach of the dam. Temporary positive impacts to the local economy would occur during construction in the event of local decommissioning or rehabilitation. Potential long-term impacts to the local economy would occur if the flood storage function of the dam is removed either through catastrophic breach or decommissioning. These long-term effects would be incremental to other regional impacts to the local economy resulting from future development and rehabilitation or breach of other flood retarding structures within the watershed.

5.3.15 Environmental Justice

<u>Existing Conditions</u>
The census tracts potentially affected by the project have a higher share of white residents and lower share of all other races compared to the entire state of Texas. Similarly, the affected census tracts, except Census Tract 9705 have a smaller share of residents identifying as Hispanic or Latino compared to the entire state of Texas. However, EJScreen, EPA's Environmental Justice Screening and Mapping Tool shows 28% and 19% people of color for the areas representing Census Tract 9703.01 and 9703.02, respectively. EJScreen also reports that the area representing Census Tract 9705 has 36% people of color. EJScreen's data suggest the area reported may contain a more racially diverse population than the Census estimates capture. The census tracts potentially affected by the project also have a lower share of all people living below the poverty level, residents aged 18 and over living below the poverty level, and families living below the poverty level than Texas does at large. However, American Community Survey data measures the poverty level by the percentage of families and people whose income in the past 12 months is below the poverty level. This is not a perfect method of capturing poverty, and it does not account for low-income people and families who live just above the poverty level and are vulnerable to shocks. According to EJScreen the area representing Census Tract 9705 is 30% low-income, while the areas representing Census Tracts 9703.01 and 9703.02 are 20% and 19%, respectively. This suggests that approximately almost a quarter of the population impacted by the Project are low-income.

<u>Alternative 1 - No Action/FWOFI</u>
The No Action/FWOFI Alternative would have no effect on the existing conditions of Environmental Justice while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a

catastrophic breach does occur, it has the potential to cause significant impacts to downstream minority and low-income populations as a result of damage to properties and injuries to individuals within the community. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. Following local decommissioning, this alternative would remove the flood protection benefits and increase development restrictions downstream which could negatively impact minority and low-income populations.

Alternative 2 - Decommission (FWFI)
The Decommission Alternative would remove the flood protection benefits and increase development restrictions downstream which could negatively impact minority and low-income populations. At risk structures would be acquired or floodproofed. The risk of breach would be removed.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alterative would allow flood protection benefits to continue for 100 years and would avoid potential impacts to downstream minority and low-income populations. The risk of breach would be removed.

Cumulative Impacts
Potential long-term impacts to downstream minority and low-income populations would occur in the event of a catastrophic breach. It is also anticipated that long-term impacts to downstream minority and low-income populations could occur if the flood storage function of the dam is removed through decommissioning. These long-term effects would be incremental to other regional impacts to downstream minority and low-income populations resulting from rehabilitation of other flood retarding structures within the watershed.

5.3.16 Land Use

Existing Conditions
The land use in the upstream watershed (64.9% shrub/scrub, 12.6% evergreen forest, 9.1% mixed forest, 4.2% deciduous forest, 2.9% developed – open space, 2.2% herbaceous, 2.1% developed – medium intensity, and 1.4% open water) has remained consistent for the life of the dam. The upstream drainage area consists of approximately 1646.8 acres. The existing area at the dam is a floodwater retarding structure with an impounded normal pool/sediment pool area. The area downstream of the dam receiving flood damage reduction benefits has experienced residential development since installation of the existing dam.

Alternative 1 - No Action/FWOFI
The No Action/FWOFI Alternative would have no effect on the existing conditions of land use while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a catastrophic breach does occur, it has the potential to cause impacts to 76 residences, 12 commercial buildings, 20 "Main Local Roads and Minor State Highways", 2 "Major State and Minor Federal Highways", 3 "Major Federal and Interstate Highways" and downstream agricultural lands as a result of the sudden discharge of fill/sediment and large flows. It is expected that if a breach does occur, that

a local decommission would be performed following the breach to stabilize the site. The local decommissioning would result in agricultural, residential, and road crossings downstream no longer being protected from flooding.

Alternative 2 - Decommission (FWFI)
The Decommission Alternative would affect current and future land use. Impacts to land use would result in agricultural, residential, and road crossings downstream no longer protected from flooding.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alterative will result in minimal changes to land use and vegetation cover adjacent to FRS No. 2 due to the widening of the existing auxiliary spillway crest. In addition, the dam crest will be raised by 2.3 feet, increasing the amount of area inundated by the structure when the WSE is at the crest elevation. The existing easement elevation is set at the current auxiliary spillway crest, so the area inundated between that elevation and the top of dam elevation would not be covered by the existing easement. This alternative may require the purchase of additional land rights as discussed in Section 7.4.2. This alternative would provide increased protection against breach to properties downstream of the dam.

Cumulative Impacts
Temporary impacts to the downstream land use would occur in the event of catastrophic breach of the dam. Potential long-term impacts to the downstream land use would occur if the flood storage function of the dam is removed either through catastrophic breach or decommissioning. These long-term effects would be incremental to other regional impacts to land use resulting from future development, conversion of agricultural lands to other land uses, and rehabilitation or breach of other flood retarding structures within the watershed.

5.3.17 Public Health and Safety

Existing Conditions
FRS No. 2 has provided flood protection benefits to downstream areas since it was constructed in 1980, but currently does not meet State and Federal criteria for a high hazard dam. The existing vegetated earth auxiliary spillway does not have the capacity necessary to safely pass the PMP event. Overtopping the dam could cause the dam to erode and collapse, resulting in a release of the water and sediment stored behind the dam. Approximately 372 people are at risk for loss of life. There are 76 homes and 12 commercial structures within the in the breach zone of this dam. There are also 25 roads that would be inundated by over 1 foot of water in the event of a breach, putting individuals in vehicles at risk.

Alternative 1 - No Action/FWOFI
The No Action/FWOFI Alternative would have no effect on the existing conditions of public health and safety while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a catastrophic breach does occur, it has the potential to cause significant impacts public health and safety. It is expected that following a breach, a local decommission would be performed to

stabilize the site. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. The Local Decommissioning would remove the risk associated with the potential for dam failure. Flows resulting from the 1% AEP storm event would safely pass the constricted breach, but the 1% AEP floodplain would be expanded. Increased development restrictions would be implemented to protect public health and safety within the enlarged floodplain area.

Alternative 2 - Decommission (FWFI)
The Decommission Alternative would remove the risk associated with the potential for dam failure. Flows resulting from the 1% AEP 24-hour storm event would safely pass the constricted breach, but the 1% AEP 24-hour floodplain would be expanded. Increased development restrictions would be implemented to protect public health and safety within the enlarged floodplain area.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)
Under the High Hazard Potential Rehabilitation Alternative, the dam would be rehabilitated using current design and safety criteria and performance standards to maintain flood protection benefits for 100 years after construction. The proposed top of dam, which is set by the FBH storm, will be 2.3 feet higher than the existing top of dam and the 1% AEP 24-hour flood pool will be 0.7 feet lower than the existing condition. No homes will be at risk of inundation from the backwater from the dam for either of these storm events. The downstream water surface elevation during the 1% AEP 24-hour storm event will be similar to the current condition. Immediately below the dam to approximately 350 feet upstream up the private driveway for 25 Ranger Creek Road, the water surface elevation will be reduced -0.13 feet to -0.8 feet from the existing condition. During the 0.2% AEP 24-hour flood, the change in WSEL for the same section will experience a minor increase of 0.16 feet from the existing conditions. From approximately 350 feet upstream up the private driveway for 25 Ranger Creek Road Downstream to the downstream extent of the model, the water surface elevation increases from 0.01 ft to 0.13 foot . During the 0.2% AEP 24-hour flood, there is an average decrease of 2. 7 feet and no increase in WSEL elevation above the last structure. The threat to loss of life from failure of the dam would be greatly reduced.

Cumulative Impacts
Temporary, but significant impacts to public health and safety would occur in the event of catastrophic breach of the dam. Potential long-term impacts to public safety would occur if the flood storage function of the dam is removed either through catastrophic breach or decommissioning. These long-term effects would be incremental to other regional impacts to public health and safety resulting from rehabilitation or breach of other flood retarding structures within the watershed.

5.3.18 Social Issues/Community Cohesion

Existing Conditions
FRS No. 2 has provided value to the community since 1980 by providing flood protection benefits that enhance the quality of life for downstream residents. The main concerns expressed by local citizens regarding changes to the dam include 1) the understanding of the need to

continue flood protection 2) the impact of the embankment extension due to the top of dam raise, downstream slope flattening, and secondary vegetated auxiliary spillway, and 3) the impact to property values upstream and downstream of the dam.

Alternative 1 - No Action/FWOFI
The No Action/FWOFI Alternative would have no effect on the existing conditions of community cohesion while the dam remains in place, prior to local decommissioning by the Sponsors. The risk of dam breach would remain until the dam is decommissioned and if a catastrophic breach does occur, it has the potential to cause significant impacts to downstream community cohesion as a result of damage to properties and injuries to individuals within the community. It is expected that if a breach does occur, that a local decommission would be performed following the breach to stabilize the site. Following local decommissioning, this alternative would remove the flood protection benefits and increase development restrictions downstream which could negatively impact community cohesion.

Alternative 2 - Decommission (FWFI)
The Decommission Alternative would remove the flood protection benefits and increase development restrictions downstream due to the expanded 1% AEP floodplain. In addition, this alternative would require the acquisition/removal of 39 residential and nonresidential structures, the floodproofing of 49 residential and nonresidential structures, and the addition of a flood warning system on one road. It is expected that this alternative could cause issues with community cohesion.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alterative will allow flood protection benefits to continue for 100 years and would avoid residential relocation and increased development restrictions downstream. Property values will be maintained for downstream residents who benefit from the flood protection provided by FRS No. 2.

Cumulative Impacts
Potential long-term impacts to community cohesion would occur in the event of a catastrophic breach. It is also anticipated that minor long-term impacts to community cohesion could occur if the flood storage function of the dam is removed through decommissioning. These long-term effects would be incremental to other regional impacts to social issues and community cohesion resulting from rehabilitation of other flood retarding structures within the watershed.

5.4 Cumulative Effects

NRCS has constructed 4 flood control dams in the Upper Cibolo Creek watershed. This system of small upstream impoundments provides a network of flood protection for the local residents.

Construction of FRS No. 2 has had long-term direct effects on the environment through the excavation of the site, filling of the structure, and development of permanent impoundment upstream from the dam that now provides flood control, incidental private recreational opportunities, fish and wildlife habitat, and other incidental benefits.

FRS No. 2 has indirectly affected the natural environment by creating a permanent upstream normal pool, by temporarily inundating the floodplain upstream of the dam during rain events, and by trapping sediment that would otherwise move downstream during rain events. FRS No. 2 has reduced downstream peak flows during storm events, and consequently protects property and people in otherwise flood-prone areas.

Rehabilitation of FRS No. 2 under the Alternative 3 would not significantly change the hydrology downstream, except for protecting the downstream area from catastrophic flooding that could occur if the dam was to fail. Rehabilitation of FRS No.2 would allow downstream areas within the floodplain to support residential development. The rehabilitation of FRS No. 2 will ensure that the structure continues to function as intended and provide benefits into the future. Rehabilitation of Upper Cibolo Creek Watershed FRS No. 4 is also currently being considered. No other sites in the Upper Cibolo Creek watershed are currently scheduled for rehabilitation.

5.5 Risk and Uncertainty

Environmental (Wetlands and Fish/Wildlife Habitat)
During the planning process, an evaluation was undertaken to determine what effects or consequences the selected alternatives would have on the environment. NRCS biologists, environmental coordinators and hydrologic/hydraulic engineers conducted multiple field reviews and determined that best professional judgment was appropriate to make fish and wildlife habitat determinations. While technically the Nominal Group method was used, there was no reason to rank the solutions (alternatives) because all planning team members were in agreement on the alternatives, the adverse impacts, and the benefits due to the minor, temporary nature of the impacts.

Cultural Resources
Based on the results of the background review and survey, there are no properties included in or eligible for inclusion in the NHRP within the APE of the alternative resulting in the rehabilitation of FRS No. 2. NRCS consultation with the SHPO/THC is complete and concurrence with a No Effect determination was received from SHPO/THC on July 30, 2021 (Appendix E).

The tribal search indicated that the Comanche Nation of Oklahoma, the Apache Tribe of Oklahoma, the Tonkawa Tribe of Indians of Oklahoma, the Wichita and Affiliated Tribes (Wichita, Keechi, Waco, and Tawakonie) of Oklahoma, and the Coushatta Tribe of Louisiana have indicated interest in ancestral lands and might attach religious or cultural significance to historic properties or have claims to land areas within Kendall County, Texas. NRCS initiated consultation with each of these tribes by letter on July 6, 2022 (Appendix E).

Economics
Risk and uncertainty were incorporated into the flood damage reduction analysis through Monte Carlo simulation incorporated in HEC-FDA. The uncertainty could be reduced for the economic analysis, but that would require more intensive primary and secondary data collection. Identification of the Economically Preferred alternative was not distorted by the level of

uncertainty. Thus, it was determined that increased investment in analysis was not necessary and any reduction in risk and uncertainty would not result in the identification of a different Economically Preferred alternative.

Hydrology and Hydraulics

Areas of risk and uncertainty associated with this project lie in the accuracy of estimating flood flows and flood elevations. The uncertainty of flood flows and water surface elevations has the potential for increased damages as new properties are converted from agricultural to residential or commercial use. It is possible these uncertainties could lead to increased risk to human life in the event of a dam breach. Hydrologic methods and computer modeling used in this analysis are consistent with the standards of practice at this time. However, the tributary is not gauged, and no verification of storm flows is possible. Potential impacts for each alternative are estimated using techniques that relate potential damage to lost opportunity. However, these methods are in part based on professional judgment, and actual experience could be different.

Engineering

Areas of risk and uncertainty associated with this project lie in the accuracy of estimating costs associated with each alternative. Cost estimates were developed from available historic and current data. Factors discovered during actual design, notably the bearing capacity of the existing structure and availability of suitable material for construction could affect these estimates. Potential impacts for each alternative are estimated using techniques that relate potential damage to lost opportunity. However, these methods are in part based on professional judgment, and actual experience could be different.

6.0 CONSULTATION, COORDINATION, AND PUBLIC PARTICIPATION

6.1 Dam Assessments Reports and Assistance Request

NRCS completed Rehabilitation Assessment Reports and estimated risk-based profiles of FRS No. 2 in August 2010. This evaluation indicated that the dam did not meet NRCS requirements with respect to the current hazard potential classification and recommended modifications to meet current design criteria.

The Sponsors submitted formal request for assistance to NRCS for FRS No. 2 on April 15, 2014.

6.2 Scoping and Public Meetings

The project sponsors are the Kendall County Soil and Water Conservation District (SWCD) #216, the Kendall County Commissioners Court, and the City of Boerne. Multiple meetings were held throughout the project with representatives of the Kendall County #216, the Kendall County Commissioners Court, and the City of Boerne, NRCS, and TSSWCB to provide updates on the planning process and gather input on the development of the Plan-EA. Due to the COVID-19 Pandemic, it was necessary to hold many of these meetings virtually, rather than in-person, as would have been preferred.

Public meetings were also held at key milestones throughout the planning process to solicitate public input related to issues and concerns associated with the project to be considered in development of the Plan-EA. Due to the COVID-19 Pandemic, it was necessary to hold one these meetings virtually, rather than in-person, as would have been preferred.

The client kickoff meeting for the project was held via Microsoft Teams on May 6, 2020. The overall project scope, personnel, schedule, and public participation plan were reviewed and discussed. Key assumptions were discussed, and additional data were requested by AECOM. Project impacts related to the COVID-19 Pandemic were also discussed. The meeting was attended by representatives AECOM, NRCS, and TSSWCB.

A sponsor kickoff/scoping meeting for the project was held via Microsoft Teams on June 10, 2020. The required sponsor commitment, overall project scope, schedule, and public participation plan were reviewed and discussed. An overview of FRS No. 2 and the contributing watershed were provided and information on site issues and concerns was provided by the sponsors. The meeting was attended by representatives AECOM, NRCS, TSSWCB, Kendall County SWCD #216, the Kendall County Commissioners Court, and the City of Boerne.

The first public meeting for FRS No. 2 was held virtually via Microsoft Teams on August 9, 2020 to discuss the Watershed Rehabilitation Program and potential alternative solutions to bring the dam into compliance with current dam safety and design criteria. In addition to providing the public information on the planning process, a primary purpose of the meeting was to discuss resource problems, issues, and concerns of local residents associated with the FRS No. 2 project area. A slide show was presented to help facilitate discussions. Notice for the public meeting was published in the Boerne Star.

Additional meetings were held via Microsoft Teams with the project sponsors, NRCS and TSSWCB on March 4, 2021, May 18, 2021, and September 1, 2021 to provide updates on the planning process and to gather additional input on the project. Specific input related to key analysis assumptions and potential rehabilitation alternative was gathered during these meetings.

A second public meeting for FRS No. 2 will be held at the beginning of the public review and comment period to discuss the planning process, development of the potential alternatives, evaluation of the alternatives, and selection of the preferred alternative to bring the dam into compliance with current dam safety and design criteria. Notice for the public meeting will be published in the Boerne Star. The rehabilitation alternatives included in the plan, the economic analysis, and the environmental assessment results will be presented at the meeting.

The Plan-EA will be distributed for interagency and public review after all internal NRCS reviews have been completed. Copies of the document will be made available to the public via the Kendall County SWCD Website. Comments will be solicited from the public during the comment period. After the interagency and public review period, comments received on the Plan-EA will be incorporated into the Final Plan. Letters of comment received on the Plan-EA and NRCS responses to the comments will be included in **Appendix A**.

6.3 Agency Consultation

Consultation with SHPO/THC was initiated in March 22, 2021 through the email submission of a Texas Antiquities Permit application to conduct a cultural resources survey of all areas of new disturbance associated with potential rehabilitation measures. Texas Antiquities Permit No. 30077 was issued by the THC on March 25, 2021. A pedestrian survey of the Area of Potential Effect (APE) was completed on April 13th, 14th, and 20th, 2021. NRCS consultation with the SHPO/THC was completed and concurrence was received on June 26, 2021 that no historic properties are present and that the proposed project would have no effect on historic properties (Appendix E).

Preliminary coordination with the USFWS was initiated..

A pre-application meeting was held with the USACE on January 10, 2023. Based on this meeting, it appears that a Nationwide Permit 3, Maintenance, with a Pre-Construction Notification would be required for the proposed project.

7.0 SELECTED ALTERNATIVE

Alternative 3, to rehabilitate the dam to high hazard potential standards, has been selected as the Preferred Alternative, the Alternative that best meets the purpose and need for the project, is preferred by the local community and their leadership. Of the two alternatives involving federal investment (2 and 3), Alternative 3 provides the most economic benefit with the fewest environmental and social impacts.

7.1 Rationale for Selected Alternative per PR&G

The preferred alternative is to rehabilitate FRS No. 2 to meet current NRCS performance standards for a high hazard dam. The preferred alternative meets the identified purposes and needs for the project and significantly reduces the potential risk to human life. The preferred alternative:

- Eliminates the threat to loss of life from catastrophic breach of FRS No. 2 to approximately 372 people by decommissioning the dam.
- Ensures continued flood protection downstream of FRS No. 2 for residents, by rehabilitating the dam to meet current performance standards for a high hazard dam.
- Eliminates the Sponsors' liability of operating a dam which does not meet state and federal requirements by rehabilitation of FRS No. 2 to meet current performance standards.
- Maintains existing stream habitat downstream of FRS No. 2.
- Retains the existing aquatic and terrestrial habitat in and around FRS No. 2.

Formulation of the alternatives considered four criteria: completeness, effectiveness, efficiency, and acceptability. All of the alternatives considered meet the completeness criteria, as they were developed in a way to provide and account for all necessary investments or other actions to ensure the realization of the planned effects, including any necessary actions by others. The No Action/FWFOI alternative ultimately removes the safety hazard of the dam failing, through local decommissioning, but it does not provide continued downstream flood protection. Alternative 3 reduces the risk of dam failure by overtopping and continues to provide downstream flood protection. Therefore, the two federally assisted alternatives meet the criteria for effectiveness, as they alleviate the specified problems and achieve the specified opportunities. Among the federally assisted alternatives (Alternatives 2 and 3), Alternative 3 has the highest net economic benefits and the lowest construction cost, so it has the highest benefit-cost ratio. Alternative 3 meets the criteria for efficiency, as it alleviates the specified problems and realizes the specified opportunities at least cost. Alternative 3 meets the criteria for acceptability as it has the fewest negative environmental and social impacts and therefore, demonstrates viability and appropriateness from the perspective of the general public and consistency with existing Federal laws, authorities, and public policies.

Alternative 3 is considered the Environmentally, Socially, Locally, and Economically preferred alternative. The preferred alternative (Alternative 3) allows the dam to meet safety and performance standards while continuing to provide downstream flood protection in a manner that takes into consideration economic, social, and environmental goals.

7.2 FRS No. 2 Measures to Be Installed

Measures considered for the high hazard potential rehabilitation of FRS No. 2 included different principal spillway sizes, the addition of a second auxiliary spillway, adding a RCC spillway, widening the existing auxiliary spillway, and varying crest heights for the principal spillway, Auxiliary Spillway, and Top Of Dam. The optimal configuration for Alternative 3 – High Hazard Potential Rehabilitation consists of the following components:

- Remove the existing principal spillway system;
- Install a new principal spillway system consisting of a standard inlet tower with a lower crest at elevation 1,585.75 feet and 36-inch RCP conduit discharging into a new impact basin;
- Regrade inlet and outlet channel of the existing vegetated auxiliary spillway, widen crest from 200 feet to 350 feet, adding a splitter dike (as specified for spillways over 200 feet wide, per section 628.5004 of the National Engineering Handbook) and lower crest to elevation of 1,611.30 feet (0.7 feet decrease);
- Protect downstream end of auxiliary spillway with rock riprap per stability evaluation;
- Add a concrete cutoff wall at the control section of the auxiliary spillway:
- Raise and grade top of dam level 2.3 feet from and elevation of 1,614.5 feet to 1,616.8 feet; and
- Replace rock blanket on 2.5:1 upstream embankment slope.

After the implementation of these planned works of improvement, FRS No. 2 will meet all current NRCS criteria and performance standards and will provide 100 years of future sediment storage. Detailed structural data for the proposed rehabilitated dam can be found in **Table 7-3**.

7.3 Emergency Action Plan

The Sponsors will provide leadership in developing an EAP for FRS No. 2 prior to the commencement of construction and will review and update the EAPs annually with local emergency response officials. As required by the National Engineering Manual, Part 520, Subpart C, Section 520.27 and the NOMM, Part 500, Subpart F, the NRCS State Conservationist is to determine that an EAP is prepared for FRS No. 2 prior to the execution of fund obligating documents for construction of the structures. NRCS will provide technical assistance in preparation and updating of the EAP. The breach inundation map of the final design will be the basis for potential areas to be affected and citizens to be notified. The purpose of the EAP is to identify areas at risk, outline appropriate actions, and to designate parties responsible for those actions in the event of a potential failure of FRS No. 2.

7.4 Real Property Rights

7.4.1 General

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 real property acquisition costs to be borne by the Sponsors and NRCS are as shown in the Cost-share table in **Section 7** 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 that will continue to maintain and operate the development in accordance with the Operation and Maintenance Agreement.

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. Section 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 sponsors are legally unable to comply with the real property acquisition requirements, they agree 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.

7.4.2 Easements

The Sponsors are responsible for obtaining any needed land rights, title, and easements associated with the rehabilitation projects and associated works of improvement. According to NRCS policy, for watershed rehabilitation projects the minimum land rights area upstream from the dam must be for all areas below the elevation of the top of dam, unless the plan allows a lower elevation (not be lower than the elevation of the 1% AEP storm or auxiliary spillway elevation, whichever is higher).

The Kendall County Commissioners Court currently hold an easement, which may cover a portion of the land required for the construction and/or related construction activities of the preferred alternatives. The original easement for FRS No. 2 indicates it encompasses 76 acres, more or less and covers an area surrounding the embankment and auxiliary spillway and the area within the backwater of the structure, below the elevation of 1613.55 feet (NAVD88).

For FRS No. 2, the existing flood pool has a surface area of 61.8 acres and the flood pool associated with the preferred alternative (i.e., auxiliary spillway elevation set at 1% AEP PSH) is 60.5 acres.

The recommended easement elevation for the reservoir flood pool is 1613.55 feet, which is the current easement elevation. Rationale for the choice of easement elevation, which is below top of dam is the following:

- The easement for the reservoir flood pool of FRS No. 2 that is associated with the original Upper Cibolo Creek Watershed Work, was for the backwater of the structure below elevation of 1613.55 (2 feet above the design AS crest elevation).
- The existing auxiliary spillway crest elevation is 1612.0 (0.45 foot higher than design elevation) and the proposed auxiliary spillway crest would be lowered to an elevation of 1611.3 feet. Although the auxiliary spillway crest will be lowered, maintaining the current easement elevation will ensure that the level of protection currently provided by preventing construction below elevation 1613.55 will be maintained or exceeded with the preferred alternative. Note that the easement elevation will not be below the elevation of the 1% AEP WSE in FRS No. 2)
- The existing top of dam elevation is 1614.5 and the proposed top-of-dam elevation is 1616.8 feet. There are currently no upstream structures built below the existing or proposed top of dam elevation.

The Sponsors will need to further investigate the extents of the preferred alternative within the existing easement area. Once this investigation is complete, the Sponsors can evaluate whether additional acreage is required outside of their existing easement. If additional area outside of the existing easement is required, the Sponsors will need to coordinate with local landowners for obtaining additional easements to meet the minimum NRCS requirements during final design. The cost of additional any land acquisition and or easements that may be required in association with the preferred alternative is not expected to be significant in relation to the other costs associated with the alternative.

It is anticipated that some temporary land rights will be needed for the staging areas during construction. No residential or commercial relocations will be necessary as a result of the project.

7.5 Mitigation

During construction, site mitigation measures will include erosion and sediment control, seeding of disturbed areas, dust control, and other practices identified during the design process. An erosion and sediment control plan will be developed as part of the permitting process. Vegetation will be established immediately following construction on all land disturbed by construction activities. Appropriate plants for erosion control and wildlife habitat will be selected based upon the installation season, soils, surrounding vegetation, and the Sponsors' preference. All tools, equipment, and vehicles will be cleaned before transporting materials and before entering and leaving the worksites to prevent the introduction and spread of invasive plant species.

All needed measures will be taken to mitigate (avoid, minimize, and compensate) any adverse impacts during construction and may include timing of the work, sediment controls such as seeding, mulching and silt fences, and wetting construction areas to reduce dust.

7.6 Permits and Compliance

Prior to construction, the Sponsors will be responsible for obtaining and complying with permits required by federal, state, and/or local regulatory agencies.

USACE guidelines indicate that any discharge of dredged or fill material into "Waters of the United States" require authorization under Section 404 of the Clean Water Act of 1972. A pre-application meeting with the USACE was held on January 10, 2023. Based on this meeting, it appears that a Nationwide Permit 3, Maintenance, with a Pre-Construction Notification would be required. U.S. Fish and Wildlife Service coordination will be completed by the USACE as part of the permit approval process. Separate U.S. Fish and Wildlife Service coordination is not required for the project. It will be the responsibility of the Sponsors to comply with the conditions of the general permit during design and construction.

For projects with disturbances equal to or greater than five acres, it is necessary to have a Storm Water Pollution Prevention Plan (SWPPP) in place prior to construction of the proposed project and filing a Notice of Intent with the TCEQ is required. A Notice of Termination (NOT) must be filed once the site has reached final stabilization. Construction activities associated with the rehabilitation of FRS No. 2 will require a Stormwater Pollution Prevention Plan.
If cultural resources are discovered during installation, work will cease and the State Historic Preservation Officer will be notified. Appropriate investigations procedures will be initiated.

As FRS No. 2 is located within the EPAs review area for the Edwards Aquifer Sole Source Aquifer and would receive Federal funding for rehabilitation, the project will need to be evaluated by the EPA Region 6 Source Water Protection Branch. If the evaluation indicates that the project does not have significant potential to contaminate the SSA, the project may continue as planned.

Kendall County is a Sponsor for FRS No. 2 and is aware of the planning efforts associated with the structure. Additional coordination with Kendall County on permitting and with the Kendall County Engineer/Floodplain Administrator will be required during the design phase.

Coordination with FEMA region 6 will be required during the design phase to ensure compliance with the National Flood Insurance Program.

7.7 Costs and Cost Sharing

Table 7-1 through **Table 7-6**, located at the end of Chapter 7 describe the project costs, project benefits, and structure data for the Preferred Alternatives. Estimated installation costs and cost sharing allocations for the Preferred Alternatives are shown in **Table 7-1** and **Table 7-2**. Structure data for the preferred alternatives are provided in **Table 7-3**. Total annualized costs are shown in **Table 7-4**. Costs shown in **Table 7-1**, **Table 7-2**, and **Table 7-4** and throughout the document are based on standard cost accounting practices required of federal watershed planning agencies, such as NRCS. The basis for cost sharing between NRCS and the Sponsors is based on the provisions of the dam rehabilitation amendments of the Watershed Protection and Flood Prevention program.

Table 7-5 displays the average annual benefits of the preferred alternatives, and **Table 7-6** provides a comparison of benefits and costs. The analysis used 2021 dollars, 2.5% discount rate, and a 103-year period of analysis (3 years of construction and 100-year evaluation period).

7.8 Installation and Financing

The project is planned for a phased installation totaling about 36 months including design and construction. The phasing priority is currently being considered by NRCS Texas. The actual installation period is contingent on the availability of funds for design and installation.

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.

NRCS will provide assistance to the Sponsors with the FRS No. 2 Rehabilitation projects. NRCS will be responsible for the following:

- Execute a new Operation and Maintenance Agreement with the Sponsors that extends the O&M responsibilities for another 100 years following construction. This agreement will be based on the NRCS National Operation and Maintenance Manual.
- Provide financial assistance equal to 65% of total eligible project costs, not to exceed 100% of actual construction costs.
- Verify that a current Emergency Action Plan is developed before construction is initiated.
- Provide engineering support, technical assistance, and approval during the design and construction of the project.
- Certify completion of all installed measures.

Kendall County Soil and Water Conservation District #216, Kendall County, and The City of Boerne will be responsible for the following:

- Secure all needed environmental permits, easements, and rights for installation, operation and maintenance of the rehabilitated structure.
- Prepare an updated Emergency Action Plan for FRS No. 2 prior to the initiation of construction.
- Execute an updated Operation and Maintenance Agreement with NRCS for FRS No. 2. This agreement will be based on the NRCS National Operation and Maintenance Manual.
- Provide engineering services for the design, construction, and certification of the project.
- Provide local administrative and contract services necessary for the installation of the project.
- Provide nonfederal funds for cost-sharing of the project at a rate equal to, or greater than, 35% of the total eligible project costs.

- Participate in and comply with applicable Federal floodplain management and flood insurance programs.
- Enforce all associated easements and rights-of-way for the safe operation of the dam.

The NRCS share of installation costs will be provided from funds appropriated under the Watershed Protection and Flood Prevention Act (Public Law 83-566), Watershed Rehabilitation. This is not a fund-obligating document, and federal assistance is subject to the availability of Congressional appropriations. The Sponsors have analyzed their financial requirements for carrying out the plan, including components that are not eligible for federal assistance as part of this plan. The Sponsors will arrange for funds to be available, when needed, from donations, non-federal grants, cash reserves, tax revenues and other non-federal sources. Credit for in-kind contributions will be as specified in the Memorandum of Understanding.

The cost, if any, of all water, mineral, and other resource rights and all required permits are not eligible for federal financial assistance. These costs shall be borne, in full, by the Sponsor. The Sponsors also understand that they will be fully responsible for costs incurred for the operation, maintenance, and replacement of installed measures.

7.9 Operation, Maintenance, and Replacement

Measures installed in 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. An updated O&M agreement will be developed, including FRS No. 2, utilizing the NRCS-National Operation and Maintenance Manual, and will be executed when the implementation agreements are executed. The term of the new O&M agreement will be for 100 years following the completion of rehabilitation. The O&M agreement will specify responsibilities of the Sponsors and include detailed provisions for retention, use, and disposal of property acquired or improved with Public Law 83-566 cost sharing. Provisions will be made for free access of Sponsors, state, and federal representatives to inspect all structural measures and their appurtenances at any time.

Table 7-1. Estimated Installation Costs

Cost Item	PL-83-566 Funds[1,2]	Other Funds[1]	Total
FRS No. 2	$5,525,000	$2,167,000	$7,692,000[1]

[1] Price Base: 2021 dollars
[2] Federal agency responsible for assisting in installation of works of improvement

Table 7-2. Estimated Cost Distribution – Structural Measures

Cost Item	Installation Costs: PL-83-566[1]				Installation Costs: Other Funds[1]						Total Project Cost
	Construction	Engineering	Project Administration	Total PL-83-566	Construction	Engineering	Real Property/ Easements	Permits	Project Administration	Total Other Funds	
FRS No. 2	$3,840,000	$1,107,000	$578,000	$5,525,000	$2,023,000	$0	$30,000	$99,000	$15,000	$2,167,000	$7,692,000

[1] Price Base: 2021 dollars

Table 7-3. Structural Data Upper Cibolo Creek FRS No. 2

Item	Unit	FRS No. 2 Planned Rehabilitation
Class of Structure		High
Seismic Zone		1
Uncontrolled Drainage Area	sq-mi	2.57
Controlled Drainage Area	sq-mi	N/A
Total Drainage Area	sq-mi	2.57
Runoff Curve Number (1-day) (Avg. AMC)		65
Time of Concentration (T_c)	hrs	1.18
Elevation Top of Dam[1]	ft	1,616.8
Elevation Crest of Vegetated Auxiliary Spillway	ft	1,611.3
Elevation Crest of Structural Auxiliary Spillway	ft	N/A
Elevation Crest Principal Spillway	ft	1585.75
Auxiliary Spillway Type (right bay)		Vegetated with splitter dike
Auxiliary Spillway Bottom Width (right bay)	ft	200
Auxiliary Exit Slope (right bay)	%	8.3
Auxiliary Spillway Type (left bay)		Vegetated
Auxiliary Spillway Bottom Width (left bay)	ft	150
Auxiliary Exit Slope (left bay)	%	20.0
Maximum Height of Dam	ft	52.3
Volume of Embankment Fill	yd^3	242,179[2]
Total Capacity (Auxiliary Spillway Crest)	ac-ft	1,041.7
Sediment Submerged	ac-ft	143.7
Sediment Aerated	ac-ft	25.4
Floodwater Retarding Capacity	ac-ft	871.8
Surface Area		
Sediment Pool	acres	17.2
Floodwater Retarding Pool	acres	60.5
Principal Spillway		
Rainfall Volume (1-day)	in	12.9
Rainfall Volume (10-day)	in	19.0
Runoff Volume (10-day)	in	9.33
Capacity (at Earthen Auxiliary Crest)	ft^3/s	185
Type of Conduit		RCP
Dimensions of Conduit	in	36
Frequency of Operation (Vegetated Auxiliary Spillway)	% chance	1.0
Frequency of Operation (Structural Auxiliary Spillway)	% chance	N/A
Auxiliary Spillway Hydrograph		
Rainfall Volume	in	14.37
Runoff Volume	in	9.46
Storm Duration	hrs	6

Item	Unit	FRS No. 2 Planned Rehabilitation
Velocity of Flow (V_e)	ft/s	7.1
Maximum Reservoir Water Surface Elevation	ft	1,613.03
Freeboard Hydrograph		
Rainfall Volume	in	28.8
Runoff Volume	in	23.21
Storm Duration	hrs	6
Maximum Reservoir Water Surface Elevation	ft	1,616.75
Storage Capacity Equivalents		
Sediment Volume	in	1.14
Floodwater Retarding Volume	in	7.58

1/ All elevations are recorded in North American Vertical Datum 1988 (NAVD88).
2/ Total volume of earthfill in FRS No. 2 = 242,179 CY (230,804 CY from Upper Cibolo Creek FRS 2 As-builts + 11,375 CY for proposed rehabilitation).

Table 7-4. Average Annual Costs

	Average Annual Construction Cost[1]	Average Annual Operation and Maintenance Cost[1]	Total Average Annual Cost
Alternative 3 – High Hazard Potential Rehabilitation (FWFI)	$218,000	$5,000	$223,000

[1] Price Base: 2021 dollars, 2.5% discount rate, and a 103-year period of analysis. Interest was added to the average annual construction cost to make the first year of benefits the base year of the analysis.

Table 7-5. Estimated Average Annual Benefits

Benefit Category	Alternative 3 - High Hazard Potential Rehabilitation (FWFI)
Structure, Content, and Automobiles, and Debris Removal	$106,000
Benefits to Roads and Bridges	$13,000
Benefits to Sediment and Erosion	$1,000
Total	$120,000

Table 7-6. Comparison of Benefits and Costs

Alternative	Average Annual Benefits[1]	Average Annual Costs[1]	Net Benefits	Benefit-Cost Ratio
Alternative 3 – High Hazard Potential Rehabilitation (FWFI)	$120,000	$223,000	-$103,000	0.5

[1] Price Base: 2021 dollars, 2.5% discount rate, and a 103-year period of analysis.

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9.0 LIST OF PREPARERS

Table 9-1. List of Preparers

Name / Title	Current Position (Years)	Education	Total Experience (Years)	Applicable Certifications
NRCS				
Mark Northcut, Natural Resource Manager	3	B.S. Ag. Engineering	34	
David Sullivan, Civil Engineer	2	B.S. Civil Engineering	12	
Rocky Ingram, Soil Conservationist	5	B.S. Ag. Education	12	
L. Rex McAliley, Wildlife Biologist	2	Ph.D. Biology	21	
Angela Moody, Archeologist	3	B.A. Anthropology M.A. Museum Sciences	15	
Ryan McCloud, Economist	2	B.S. Ag. Economics	6	
David Buland, Economist	1	B.A. Economics M.A. Theology M.A. Economics	40	
Texas State Soil and Water Conservation Board				
Steve Bednarz, Program Administrator/Engineer	8	B.S. Ag. Engineering	46	P.E.
Ronnie Skala, Engineer	3	B.S. Ag. Engineering	43	P.E.,CFM
Allen Nash, Engineer	2	B.S. Env. Engineering	12	P.E.,CFM
Engineering/Consulting Firm				
Jeff Irvin, Project Principal, AECOM	35	MSCE Water Resources Engineering, MSCE Geotechnical Engineering, BS	47	P.E.
Luis Alday, Project Manager, Hydrology/SITES, Rehab. Alt. Analysis, AECOM	3	B.S. Civil Engineering M.S. Civil Engineering	22	P.E.
Clifton Dorrance, Planning Lead, AECOM	13	B.S. Agricultural Engineering	13	P.E.
Travis Brand, H&H Modeling & Alternatives Analysis, AECOM				
Lily Cartwright, H&H Modeling & Alternatives Analysis, AECOM	1.7	B. S. Civil & Environmental Engineering	5	E.I.T.
Milena Spirova, Alternative Analysis CADD, Alternative Analysis Cost Estimates, AECOM	1	B.S. Civil Engineering,	4	E.I.T
Alyssa Ruiz, Risk Assessment Worksheets, Alternative Analysis Cost Estimates AECOM	4.5	M.S. Civil Engineering	5	E.I.T

Name / Title	Current Position (Years)	Education	Total Experience (Years)	Applicable Certifications
Lance Finnefrock, Geotechnical Analysis, AECOM	13	B.S. Civil & Environmental Engineering, M.S. Civil (Geotechnical) Engineering	14	P.E., G.E.
Mariana Conceição de Sá, Geotechnical Analysis, AECOM				P.E.
Jason Weiss, Economic Analysis, AECOM	21	B.S. Environmental Engineering	25	
Thomas Redstone, Economic Analysis, AECOM	3	B.S. Civil & Environmental Engineering, M.S. Civil (Geotechnical) Engineering	5	AICP, ENV SP
Frida Cruz, Economic Analysis, AECOM	2	MS, Resource Economics and Policy; BIE, Industrial Engineering,	2	ENV SP
Jennifer Oakley, Ecologist, AECOM	6	BA Economics & Environmental Studies; Masters in Planning, Policy, & Management	12	Wetland Training
Joseph Jandle, Ecologist, AECOM	5	B.S. Integrated Environmental Science; M.S. Agricultural and Applied Economics	6	Wetland Training
Amanda Hargrave, Ecologist, AECOM	5	B.S. Biology, B.S. Environmental Science, M.S. Wildlife Ecology	6	Wetland Training
Steve Ahr, Cultural Resources, AECOM	12	B.S. Wildlife Biology,	25	RPA
Beth Reed, Cultural Resources, AECOM	3.5	M.S. Wildlife Ecology	20	
Lucy Harrington, Cultural Resources, AECOM	4	B.S. Wildlife Biology,	7	RPA
Jonathan Stroik, Cultural Resources, AECOM	11	M.S. Wildlife Ecology	25	RPA
Helen Potter, GIS, AECOM	6	B.S. Geography	9	
Albert Fraley, GIS Specialist, AECOM	2	B.S. Environmental Geography - Sam Houston State University	2	GIS Certification - Sam Houston State Univ.

10.0 DISTRIBUTION LIST

Comments will be requested on the Supplemental Plan I – EA from the following agencies and organizations.

10.1 Federal Agencies

NRCS National Watershed Management Center, Little Rock, Arkansas.

U.S. Fish and Wildlife Service, Austin, TX

USACE District, Fort Worth, Texas

EPA Region 6, Dallas, Texas

10.2 Texas State Agencies

Texas State Soil & Water Conservation Board, Temple, Texas

Texas Parks and Wildlife Department, Austin, Texas

Texas Commission on Environmental Quality, Region 13, San Antonio, TX

Texas Historical Commission, Austin, Texas

10.3 Other

Kendall County Soil and Water Conservation District #216, Boerne, Texas

Kendall County, County Judges Office, Boerne, Texas

City of Boerne, Texas

11.0 INDEX

Appendix A Comments and Responses on Plan-EA

A-1 Tribal Consultation Correspondence

USDA United States Department of Agriculture

Farm Production and Conservation

Natural Resources Conservation Service

USDA NRCS
W.R. Poage Federal Building
101 South Main Street
Temple, TX 76501

July 6, 2022

Durell Cooper, Chairman
Apache Tribe of Oklahoma
Post Office Box 1330
Anadarko, Oklahoma 73005

Dear Chairman Cooper:

While the Natural Resource Conservation Service (NRCS) Texas works to build a relationship with your Tribe through establishing Tribal consultation protocols, I would like to invite your Tribe to consult over whether a proposed project on private lands might impact any of your Tribe's places of cultural or religious significance, National Historic Preservation Act (NHPA) historic properties, and other Tribal interests. I recognize your Tribal expertise and sovereignty, as well as the importance of your Tribe's interests on ancestral lands.

NRCS is providing technical and financial assistance in conjunction with the Texas State Soil and Water Conservation Board and local sponsors, including the Kendall County Soil and Water Conservation District, Kendall County, and the City of Boerne; to prepare a Supplemental Watershed Plan (SWP) to evaluate rehabilitation alternatives for the Upper Cibolo Creek Watershed Floodwater Retarding Structure No. 2 (FRS No. 2), located in Kendall County, Texas.

AECOM Technical Services, Inc. (AECOM) conducted a cultural resources survey of a 66-acre study area in support of the SWP April 13-14, and 20, 2021, under Texas Antiquities Permit No. 30077. The pedestrian survey was supplemented with the excavation of 76 shovel tests and resulted in the identification of one previously unrecorded prehistoric archeological site (41KE294), one prehistoric isolated find (IF-1), and one historic age (ca. 1950) concrete dam (Resource 001). Site 41KE294 consists of a large scatter of prehistoric lithic materials and early twentieth century historic artifacts situated atop a Pleistocene terrace. IF-1 contains two chert flakes in an eroded, upland setting. Based on the results of the investigations, the site and IF are not likely to yield information important to history or prehistory. AECOM recommended the portions of the site within the study area are not eligible for listing in the National Register of Historic Places (NRHP). Furthermore, the site does not merit designation as State Antiquities Landmarks (SALs). The survey also documented the historic-age resource, FRS No. 2 (Resource 001). Based on a review by an architectural historian, this resource does not meet the NRHP criteria of eligibility and is therefore recommended as not eligible for listing in the NRHP.

A geomorphic assessment determined that the study area exhibits variable potential for containing buried and intact archeological deposits. Four geomorphic surfaces (T-2, T-1, T-

0a, and T-0b) were identified within the study area, which are underlain by four alluvial stratigraphic units, designated from oldest to youngest as Units 1 through 4. The greatest potential for deep artifact burial and preservation exists within T-1 (Unit 2) and T-0a (Unit 3). Based on correlations with other alluvial chronologies in central Texas, Unit 2 could contain Paleoindian through Middle Archaic archeological materials in stratified context. Unit 3 could contain Late Archaic through Late Prehistoric and possibly historic archeological materials in a stratified context. T-2 (Unit 1) and T-0b (Unit 4) were found to be too old and too young, respectively, to exhibit archeological relevance.

Based on the results of the survey, AECOM recommended future rehabilitation efforts within the FRS No. 2 study area should have No Effect on properties included in, or eligible for inclusion in, the NRHP, or that merit designation as SALs, and that construction can proceed without further investigations. This recommendation was made on the assumption that deep impacts will not occur within any previously undisturbed areas that were assessed as having potential for containing buried and preserved archeological deposits. In other words, no deep impacts are anticipated to occur within undisturbed T-1 (Unit 2) or T-0a (Unit 3) deposits. Should the scope of the project change such that deep impacts to T-1 (Unit 2) or T-0a (Unit 3) would occur, then additional archeological investigations such as exploratory backhoe trenching may be warranted. Enclosed is a map of the proposed project study area, as well as the letter of concurrence on the cultural resources investigations from the Texas Historical Commission, also known as the State Historic Preservation Office (SHPO).

Please reply with whether you are interested in participating in consultation regarding this project and assist us in identifying whether there are any culturally or religiously significant places, or other Tribal interests, we should be aware of that might be affected by this project.

In responding, please refer to Cultural Resource Review Request: 20_0303_ 259 _FRS _ UpperCibolo2. The point of contact for reply or further information is Angela Moody, Archaeologist/Cultural Resource Specialist angela.moody@usda.gov, 830-719-5750 or by mail to the address above within our planned review period of 30 days of receiving this letter. Thank you in advance for your assistance and timely reply to this request.

Sincerely,

Kristy Oates

KRISTY OATES
State Conservationist

Enclosure

USDA United States Department of Agriculture

Farm Production and Conservation

Natural Resources Conservation Service

USDA NRCS
W.R. Poage Federal Building
101 South Main Street
Temple, TX 76501

July 6, 2022

Russell Martin, President
Tonkawa Tribe of Indians of Oklahoma
Historical Preservation Office
1 Rush Buffalo Road
Tonkawa, Oklahoma 74653-4449

Dear Mr. Martin:

While the Natural Resource Conservation Service (NRCS) Texas works to build a relationship with your Tribe through establishing Tribal consultation protocols, I would like to invite your Tribe to consult over whether a proposed project on private lands might impact any of your Tribe's places of cultural or religious significance, National Historic Preservation Act (NHPA) historic properties, and other Tribal interests. I recognize your Tribal expertise and sovereignty, as well as the importance of your Tribe's interests on ancestral lands.

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Sincerely,

Kristy Oates
KRISTY OATES
State Conservationist

Enclosure

USDA United States Department of Agriculture | Farm Production and Conservation | Natural Resources Conservation Service | USDA NRCS
W.R. Poage Federal Building
101 South Main Street
Temple, TX 76501

July 6, 2022

Martina Minthorn, THPO
Comanche Nation of Oklahoma
Post Office Box 908
Lawton, Oklahoma 73502

Dear Ms. Minthorn:

While the Natural Resource Conservation Service (NRCS) Texas works to build a relationship with your Tribe through establishing Tribal consultation protocols, I would like to invite your Tribe to consult over whether a proposed project on private lands might impact any of your Tribe's places of cultural or religious significance, National Historic Preservation Act (NHPA) historic properties, and other Tribal interests. I recognize your Tribal expertise and sovereignty, as well as the importance of your Tribe's interests on ancestral lands.

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State Conservationist

Enclosure

USDA United States Department of Agriculture | Farm Production and Conservation | Natural Resources Conservation Service | USDA NRCS
W.R. Poage Federal Building
101 South Main Street
Temple, TX 76501

July 6, 2022

William Nelson, Sr., Chairman
Comanche Nation of Oklahoma
Post Office Box 908
Lawton, Oklahoma 73502

Dear Mr. Nelson:

While the Natural Resource Conservation Service (NRCS) Texas works to build a relationship with your Tribe through establishing Tribal consultation protocols, I would like to invite your Tribe to consult over whether a proposed project on private lands might impact any of your Tribe's places of cultural or religious significance, National Historic Preservation Act (NHPA) historic properties, and other Tribal interests. I recognize your Tribal expertise and sovereignty, as well as the importance of your Tribe's interests on ancestral lands.

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State Conservationist

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W.R. Poage Federal Building
101 South Main Street
Temple, TX 76501

July 6, 2022

Lauren Norman-Brown, THPO
Tonkawa Tribe of Indians of Oklahoma
Historical Preservation Office
1 Rush Buffalo Road
Tonkawa, Oklahoma 74653-4449

Dear Ms. Norman-Brown:

While the Natural Resource Conservation Service (NRCS) Texas works to build a relationship with your Tribe through establishing Tribal consultation protocols, I would like to invite your Tribe to consult over whether a proposed project on private lands might impact any of your Tribe's places of cultural or religious significance, National Historic Preservation Act (NHPA) historic properties, and other Tribal interests. I recognize your Tribal expertise and sovereignty, as well as the importance of your Tribe's interests on ancestral lands.

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Enclosure

USDA United States Department of Agriculture

Farm Production and Conservation

Natural Resources Conservation Service

USDA NRCS
W.R. Poage Federal Building
101 South Main Street
Temple, TX 76501

July 6, 2022

Terri Parton, President
Wichita and Affiliated Tribes
Post Office Box 729
Anadarko, Oklahoma 73005

Dear Ms. Parton:

While the Natural Resource Conservation Service (NRCS) Texas works to build a relationship with your Tribe through establishing Tribal consultation protocols, I would like to invite your Tribe to consult over whether a proposed project on private lands might impact any of your Tribe's places of cultural or religious significance, National Historic Preservation Act (NHPA) historic properties, and other Tribal interests. I recognize your Tribal expertise and sovereignty, as well as the importance of your Tribe's interests on ancestral lands.

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Kristy Oates
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State Conservationist

Enclosure

USDA United States Department of Agriculture | Farm Production and Conservation | Natural Resources Conservation Service | USDA NRCS
W.R. Poage Federal Building
101 South Main Street
Temple, TX 76501

July 6, 2022

Ted Vilicana
c/o Historic Preservation Office
Comanche Nation of Oklahoma
6 SW D Avenue, Suite C
Lawton, Oklahoma 73501

Dear Mr. Vilicana:

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State Conservationist

Enclosure

USDA United States Department of Agriculture

Farm Production and Conservation

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USDA NRCS
W.R. Poage Federal Building
101 South Main Street
Temple, TX 76501

July 6, 2022

Robin Williams, THPO
Wichita and Affiliated Tribes
c/o Mary Boton
Post Office Box 729
Anadarko, Oklahoma 73005

Dear Ms. Williams:

While the Natural Resource Conservation Service (NRCS) Texas works to build a relationship with your Tribe through establishing Tribal consultation protocols, I would like to invite your Tribe to consult over whether a proposed project on private lands might impact any of your Tribe's places of cultural or religious significance, National Historic Preservation Act (NHPA) historic properties, and other Tribal interests. I recognize your Tribal expertise and sovereignty, as well as the importance of your Tribe's interests on ancestral lands.

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In responding, please refer to Cultural Resource Review Request: 20_0303_ 259 _FRS _ UpperCibolo2. The point of contact for reply or further information is Angela Moody, Archaeologist/Cultural Resource Specialist angela.moody@usda.gov, 830-719-5750 or by mail to the address above within our planned review period of 30 days of receiving this letter. Thank you in advance for your assistance and timely reply to this request.

Sincerely,

Kristy Oates

KRISTY OATES
State Conservationist

Enclosure

USDA United States Department of Agriculture

Farm Production and Conservation

Natural Resources Conservation Service

USDA NRCS
W.R. Poage Federal Building
101 South Main Street
Temple, TX 76501

July 6, 2022

Darrin Cisco, Cultural Coordinator
Apache Tribe of Oklahoma
Post Office Box 1330
Anadarko, Oklahoma 73005

Dear Mr. Cisco:

While the Natural Resource Conservation Service (NRCS) Texas works to build a relationship with your Tribe through establishing Tribal consultation protocols, I would like to invite your Tribe to consult over whether a proposed project on private lands might impact any of your Tribe's places of cultural or religious significance, National Historic Preservation Act (NHPA) historic properties, and other Tribal interests. I recognize your Tribal expertise and sovereignty, as well as the importance of your Tribe's interests on ancestral lands.

NRCS is providing technical and financial assistance in conjunction with the Texas State Soil and Water Conservation Board and local sponsors, including the Kendall County Soil and Water Conservation District, Kendall County, and the City of Boerne; to prepare a Supplemental Watershed Plan (SWP) to evaluate rehabilitation alternatives for the Upper Cibolo Creek Watershed Floodwater Retarding Structure No. 2 (FRS No. 2), located in Kendall County, Texas.

AECOM Technical Services, Inc. (AECOM) conducted a cultural resources survey of a 66-acre study area in support of the SWP April 13-14, and 20, 2021, under Texas Antiquities Permit No. 30077. The pedestrian survey was supplemented with the excavation of 76 shovel tests and resulted in the identification of one previously unrecorded prehistoric archeological site (41KE294), one prehistoric isolated find (IF-1), and one historic age (ca. 1950) concrete dam (Resource 001). Site 41KE294 consists of a large scatter of prehistoric lithic materials and early twentieth century historic artifacts situated atop a Pleistocene terrace. IF-1 contains two chert flakes in an eroded, upland setting. Based on the results of the investigations, the site and IF are not likely to yield information important to history or prehistory. AECOM recommended the portions of the site within the study area are not eligible for listing in the National Register of Historic Places (NRHP). Furthermore, the site does not merit designation as State Antiquities Landmarks (SALs). The survey also documented the historic-age resource, FRS No. 2 (Resource 001). Based on a review by an architectural historian, this resource does not meet the NRHP criteria of eligibility and is therefore recommended as not eligible for listing in the NRHP.

A geomorphic assessment determined that the study area exhibits variable potential for containing buried and intact archeological deposits. Four geomorphic surfaces (T-2, T-1, T-

0a, and T-0b) were identified within the study area, which are underlain by four alluvial stratigraphic units, designated from oldest to youngest as Units 1 through 4. The greatest potential for deep artifact burial and preservation exists within T-1 (Unit 2) and T-0a (Unit 3). Based on correlations with other alluvial chronologies in central Texas, Unit 2 could contain Paleoindian through Middle Archaic archeological materials in stratified context. Unit 3 could contain Late Archaic through Late Prehistoric and possibly historic archeological materials in a stratified context. T-2 (Unit 1) and T-0b (Unit 4) were found to be too old and too young, respectively, to exhibit archeological relevance.

Based on the results of the survey, AECOM recommended future rehabilitation efforts within the FRS No. 2 study area should have No Effect on properties included in, or eligible for inclusion in, the NRHP, or that merit designation as SALs, and that construction can proceed without further investigations. This recommendation was made on the assumption that deep impacts will not occur within any previously undisturbed areas that were assessed as having potential for containing buried and preserved archeological deposits. In other words, no deep impacts are anticipated to occur within undisturbed T-1 (Unit 2) or T-0a (Unit 3) deposits. Should the scope of the project change such that deep impacts to T-1 (Unit 2) or T-0a (Unit 3) would occur, then additional archeological investigations such as exploratory backhoe trenching may be warranted. Enclosed is a map of the proposed project study area, as well as the letter of concurrence on the cultural resources investigations from the Texas Historical Commission, also known as the State Historic Preservation Office (SHPO).

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Sincerely,

Kristy Oates

KRISTY OATES
State Conservationist

Enclosure

Study Area

Project Location Map

Upper Cibolo Creek Watershed FRS No. 2
Kendall County, Texas

N W E S

0 200 400
Meters

Data Sources: Roads - TxDOT 2018; County Boundaries - TIGER 2015
Basemap: USGS 7.5-minute Topographic Maps: Ranger Creek Quadrangle

AECOM

June 2022

Ahr, Steve

From: noreply@thc.state.tx.us
Sent: Friday, July 30, 2021 11:27 AM
To: Ahr, Steve; reviews@thc.state.tx.us
Subject: [EXTERNAL] Section 106 Submission

TEXAS HISTORICAL COMMISSION
real places telling real stories

Re: Project Review under Section 106 of the National Historic Preservation Act
THC Tracking #202113387
Date: 07/30/2021
Upper Cibolo Creek FRS No. 2 Survey
Kendall County
Boerne,TX 78640

Description: Archeological survey in support of a Supplemental Watershed Plan for the rehabilitation of the Upper Cibolo Creek Floodwater Retarding Structure No. 2, in Kendall Co.

Dear Steven Ahr:
Thank you for your submittal regarding the above-referenced project. This response represents the comments of the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission (THC), pursuant to review under Section 106 of the National Historic Preservation Act.

The review staff, led by Tiffany Osburn, Caitlin Brashear, has completed its review and has made the following determinations based on the information submitted for review:

Above-Ground Resources

- No historic properties are present or affected by the project as proposed. However, if historic properties are discovered or unanticipated effects on historic properties are found, work should cease in the immediate area; work can continue where no historic properties are present. Please contact the THC's History Programs Division at 512-463-5853 to consult on further actions that may be necessary to protect historic properties.

Archeology Comments

- No identified historic properties, archeological sites, or other cultural resources are present or affected. However, if cultural materials are encountered during project activities, work should cease in the immediate area; work can continue where no cultural materials are present. Please contact the THC’s Archeology Division at 512-463-6096 to consult on further actions that may be necessary to protect the cultural remains.
- THC/SHPO concurs with information provided.
- This draft report is acceptable. Please submit a final report: one restricted version with any site location information (if applicable), and one public version with all site location information redacted. To facilitate review and make project information and final reports available through the Texas Archeological Sites Atlas, we appreciate submitting abstracts online at http://xapps.thc.state.tx.us/Abstract and e-mailing survey area

shapefiles to archeological_projects@thc.texas.gov if this has not already occurred. Please note that these steps are required for projects conducted under a Texas Antiquities Permit.

We have the following comments: Thank you for your thorough survey and analysis of the project area. As recommended, if the scope of the Project changes such that deep impacts to T-1 (Unit 2) or T-0a (Unit 3) are anticipated, additional archeological investigations such as exploratory backhoe trenching will be necessary.

We look forward to further consultation with your office and hope to maintain a partnership that will foster effective historic preservation. Thank you for your cooperation in this review process, and for your efforts to preserve the irreplaceable heritage of Texas. If the project changes, or if new historic properties are found, please contact the review staff. If you have any questions concerning our review or if we can be of further assistance, please email the following reviewers: tiffany.osburn@thc.texas.gov, caitlin.brashear@thc.texas.gov.

This response has been sent through the electronic THC review and compliance system (eTRAC). Submitting your project via eTRAC eliminates mailing delays and allows you to check the status of the review, receive an electronic response, and generate reports on your submissions. For more information, visit http://thc.texas.gov/etrac-system.

Sincerely,

for Mark Wolfe, State Historic Preservation Officer
Executive Director, Texas Historical Commission

Please do not respond to this email.

A-2 Texas Historical Commission Correspondence

Ahr, Steve

From: noreply@thc.state.tx.us
Sent: Friday, July 30, 2021 11:27 AM
To: Ahr, Steve; reviews@thc.state.tx.us
Subject: [EXTERNAL] Section 106 Submission

TEXAS HISTORICAL COMMISSION
real places telling real stories

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Boerne,TX 78640

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- THC/SHPO concurs with information provided.
- This draft report is acceptable. Please submit a final report: one restricted version with any site location information (if applicable), and one public version with all site location information redacted. To facilitate review and make project information and final reports available through the Texas Archeological Sites Atlas, we appreciate submitting abstracts online at http://xapps.thc.state.tx.us/Abstract and e-mailing survey area

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This response has been sent through the electronic THC review and compliance system (eTRAC). Submitting your project via eTRAC eliminates mailing delays and allows you to check the status of the review, receive an electronic response, and generate reports on your submissions. For more information, visit http://thc.texas.gov/etrac-system.

Sincerely,

for Mark Wolfe, State Historic Preservation Officer
Executive Director, Texas Historical Commission

Please do not respond to this email.

A-3 United States Army Corps of Engineers Pre-App Meeting Summary

Upper Cibolo Creek FRS No. 2 Rehabilitation Project Pre-Application Meeting (SWF-2022-00566)

January 10, 2023, 10:30 am to 11 am

ATTENDEES

- Clifton Dorrance (AECOM)
- Jennifer Oakley (AECOM)
- Brian Bartels (USACE)

ACTION ITEMS

- AECOM to determine potential impacts to water features.

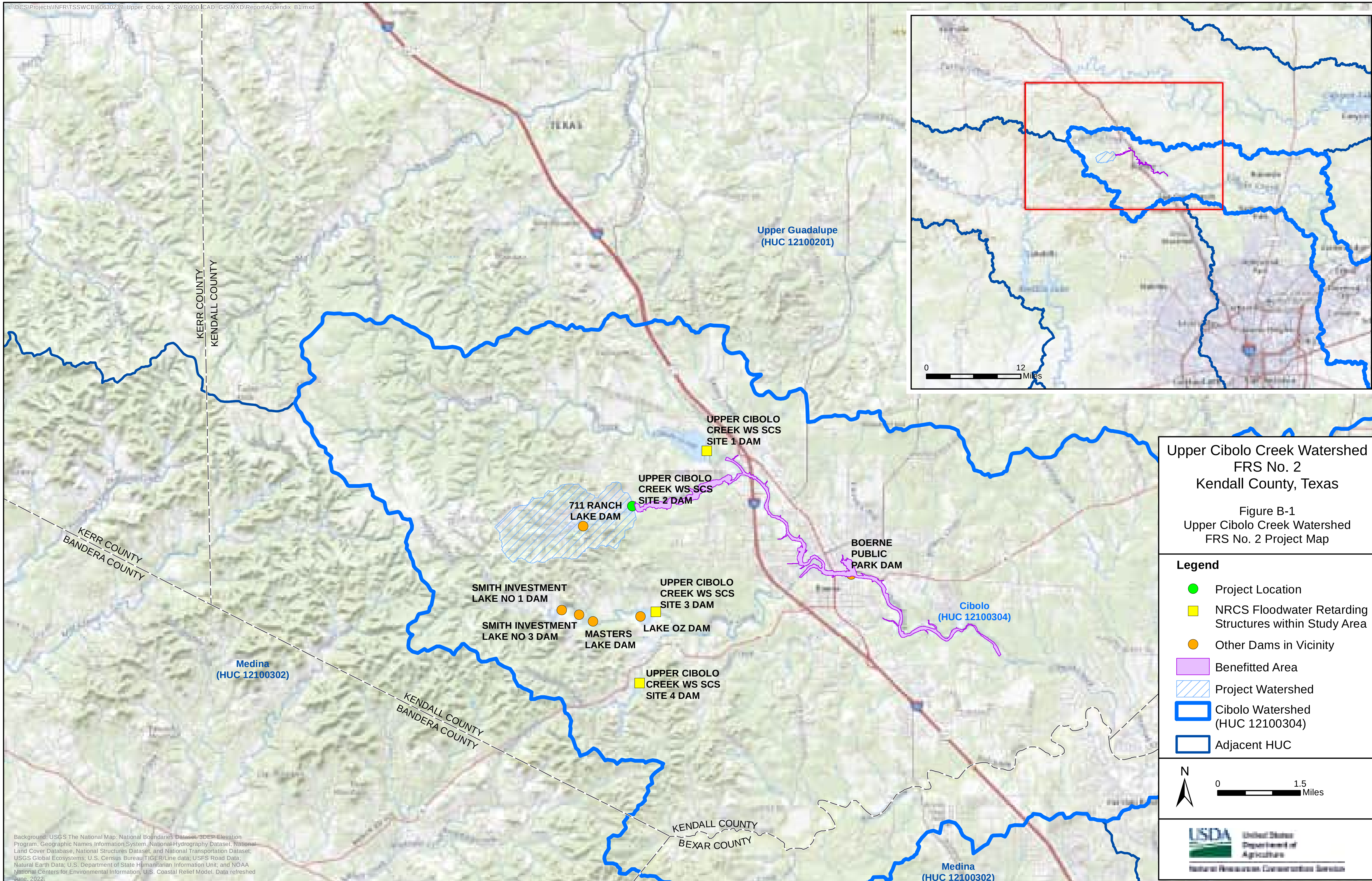
GENERAL DISCUSSION

This document serves as a general summary of the USACE Pre-Application Meeting Teleconference Call at 10:30 am on January 10, 2023 for the Upper Cibolo Creek FRS No. 2 Rehabilitation Project.

- A brief summary of the proposed project was presented.
    - Current dam structure does not meet Natural Resources Conservation Service (NRCS) criteria for the assigned high hazard classification; therefore, will be rehabilitated.
- The NRCS would be the lead federal agency.
- USACE stated that the main issue is the potential for additional impoundment of water that would result in the change of a water feature classification from stream/wetland to impoundment.
- The proposed project would not change the normal pool capacity of FRS No. 2, as the principal spillway crest would be lowered to the current elevation of the low-level ports on the spillway riser. The auxiliary spillway crest would be lowered by 0.7 foot and any change to the amount of inundation of water caused by lowering the crest elevation would be temporary (no more than 10 days). The dam crest would be raised by 2.3 feet to prevent overtopping during the required NRCS design storm.
- Once additional design/impacts are known, set up another call with the USACE.
- Project appears to comply with coverage under a Nationwide Permit 3, Maintenance.

Prepared by: Jennifer Oakley AECOM, January 10, 2023.
Reviewed by Brian Bartels, January 12, 2023

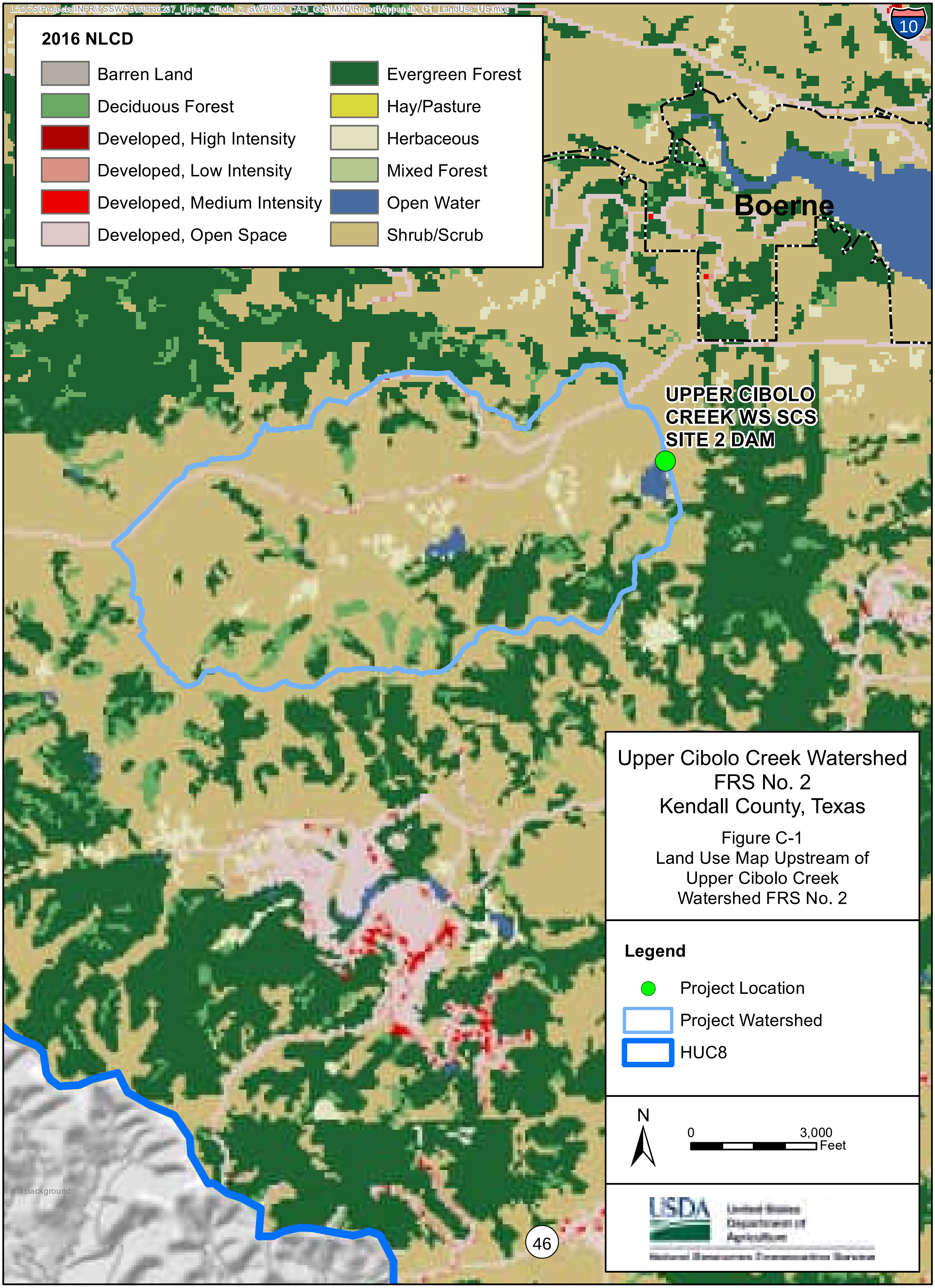
Appendix B Project Map



Upper Cibolo Creek Watershed FRS No. 2
Kendall County, Texas

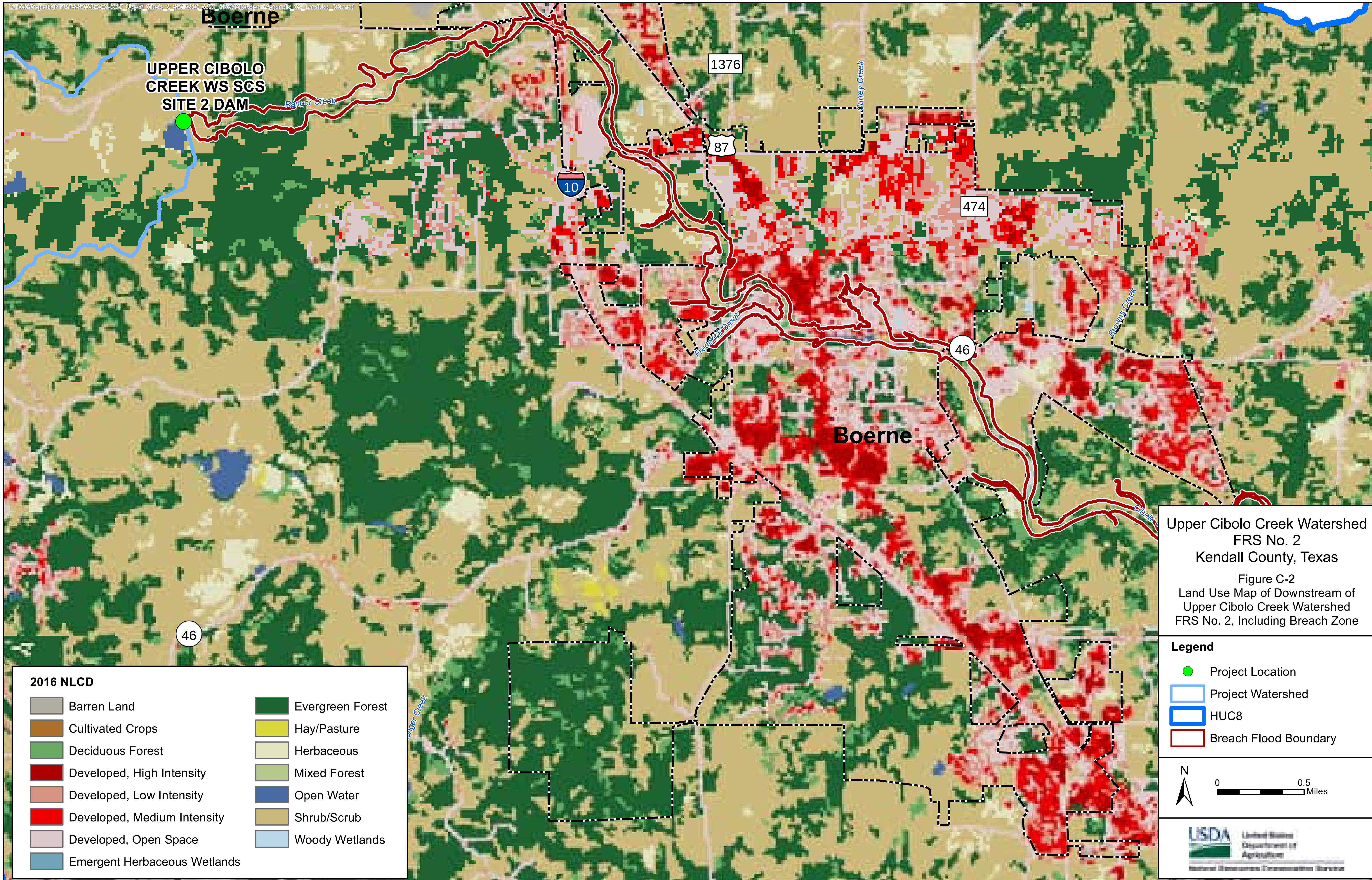
Figure B-1
Upper Cibolo Creek Watershed FRS No. 2 Project Map

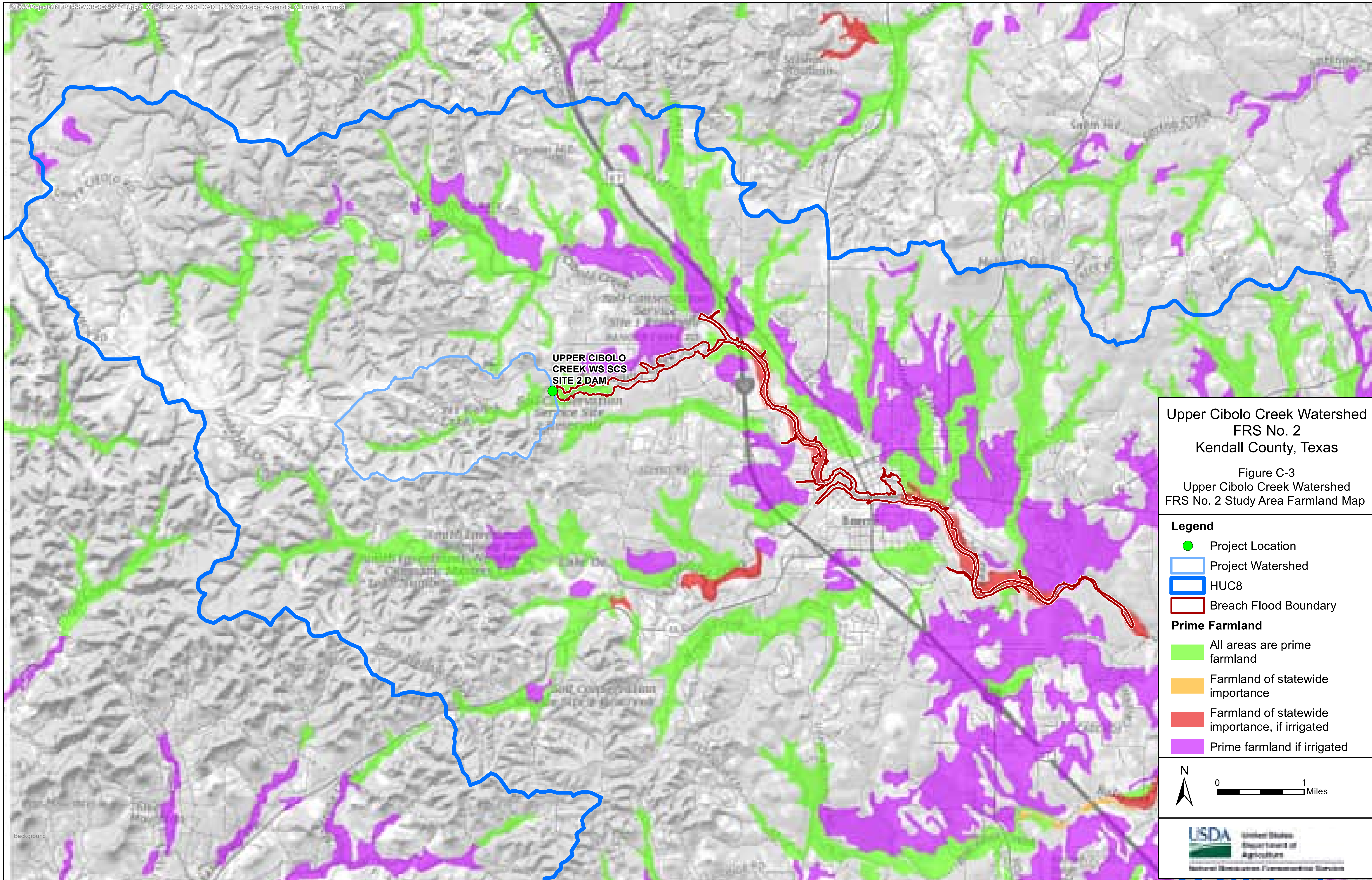
Appendix C Support Maps

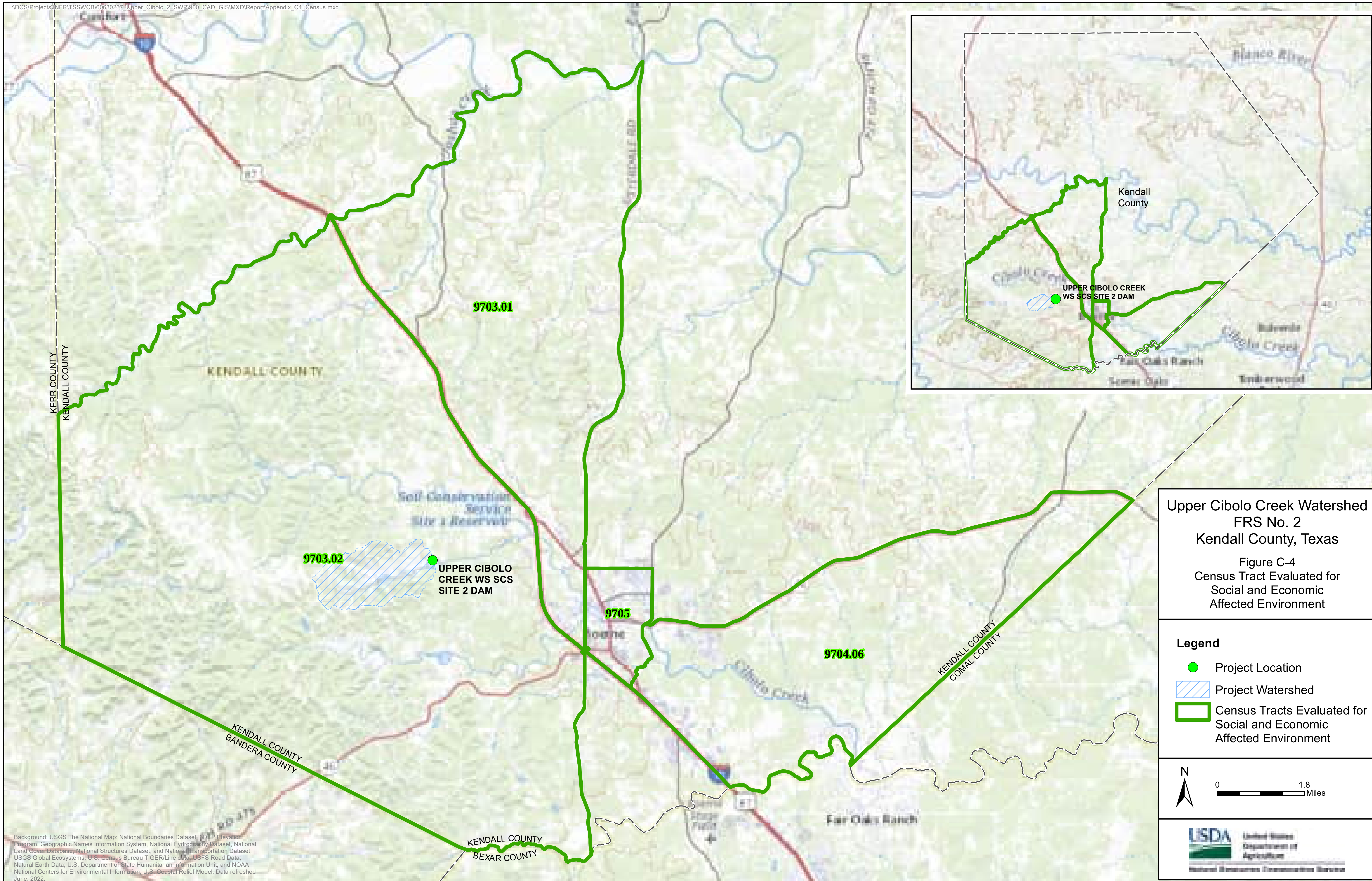


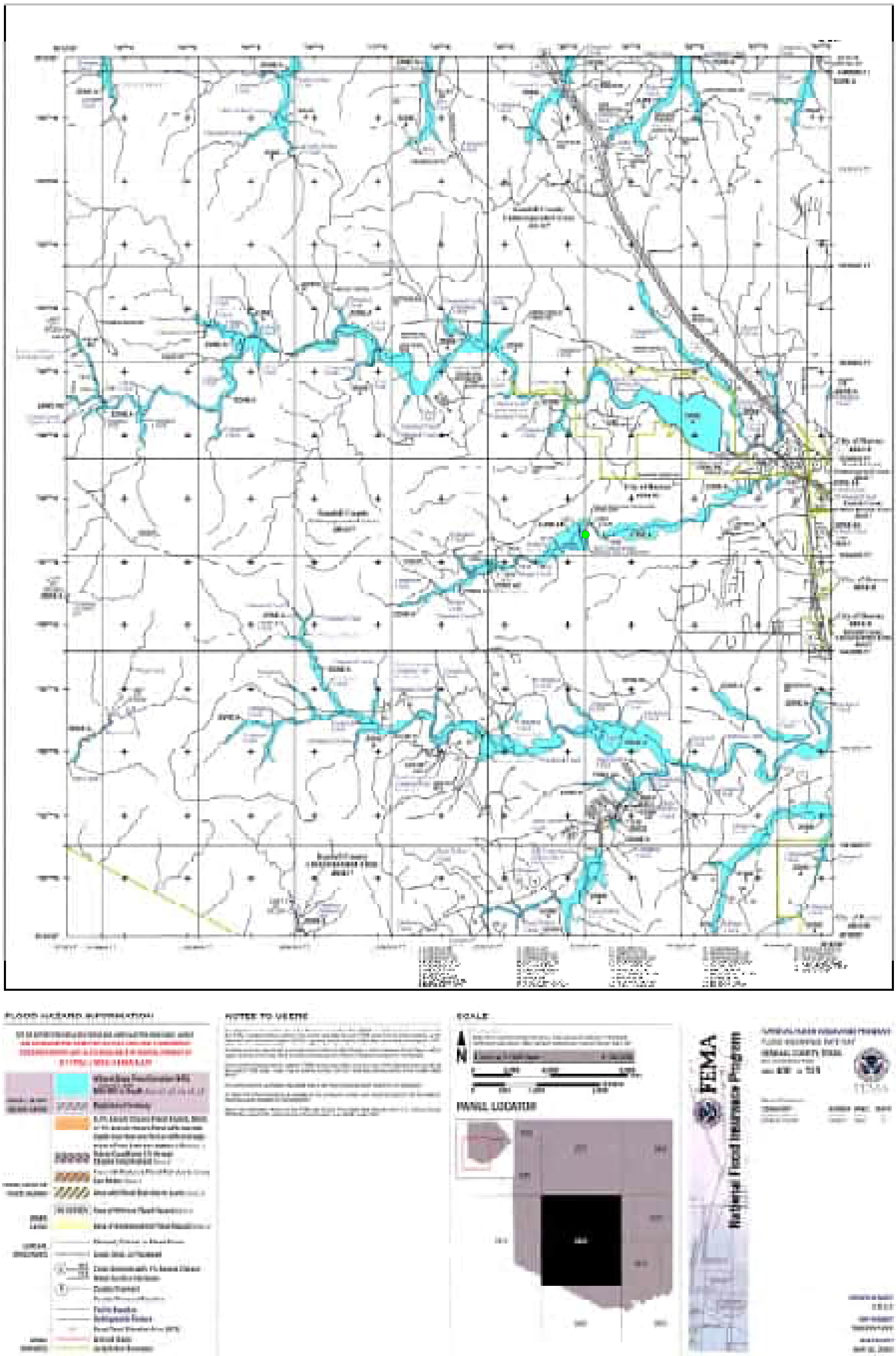
Upper Cibolo Creek Watershed
FRS No. 2
Kendall County, Texas

Figure C-1
Land Use Map Upstream of
Upper Cibolo Creek
Watershed FRS No. 2


Boerne
UPPER CIBOLO CREEK WS SCS SITE 2 DAM
Ranger Creek
1376
Currey Creek
87
10
474
Browns Creek
Frederick Creek
46
Boerne
Cibolo
46
Ranger Creek
2016 NLCD
Barren Land
Cultivated Crops
Deciduous Forest
Developed, High Intensity
Developed, Low Intensity
Developed, Medium Intensity
Developed, Open Space
Emergent Herbaceous Wetlands
Evergreen Forest
Hay/Pasture
Herbaceous
Mixed Forest
Open Water
Shrub/Scrub
Woody Wetlands
Upper Cibolo Creek Watershed
FRS No. 2
Kendall County, Texas
Figure C-2
Land Use Map of Downstream of Upper Cibolo Creek Watershed FRS No. 2, Including Breach Zone
Legend
Project Location
Project Watershed
HUC8
Breach Flood Boundary
N
0
0.5
Miles
USDA


UPPER CIBOLO CREEK WS SCS SITE 2 DAM
Upper Cibolo Creek Watershed FRS No. 2
Kendall County, Texas
Figure C-3
Upper Cibolo Creek Watershed FRS No. 2 Study Area Farmland Map
Legend
Project Location
Project Watershed
HUC8
Breach Flood Boundary
Prime Farmland
All areas are prime farmland
Farmland of statewide importance
Farmland of statewide importance, if irrigated
Prime farmland if irrigated
N
0
1
Miles
USDA


Upper Cibolo Creek Watershed
FRS No. 2
Kendall County, Texas
Figure C-4
Census Tract Evaluated for
Social and Economic
Affected Environment
Legend
Project Location
Project Watershed
Census Tracts Evaluated for
Social and Economic
Affected Environment
N
0
1.8
Miles
9703.01
9703.02
9705
9704.06
UPPER CIBOLO
CREEK WS SCS
SITE 2 DAM
KENDALL COUNTY
KERR COUNTY
KENDALL COUNTY
KENDALL COUNTY
BANDERA COUNTY
KENDALL COUNTY
BEXAR COUNTY
KENDALL COUNTY
COMAL COUNTY
Soil Conservation
Service
Site 1 Reservoir
Cibolo Creek
Fair Oaks Ranch
Kendall
County
UPPER CIBOLO CREEK
WS SCS SITE 2 DAM
Blanco River
Fair Oaks Ranch
USDA



United States Department of Agriculture
Natural Resources Conservation Service

Legend

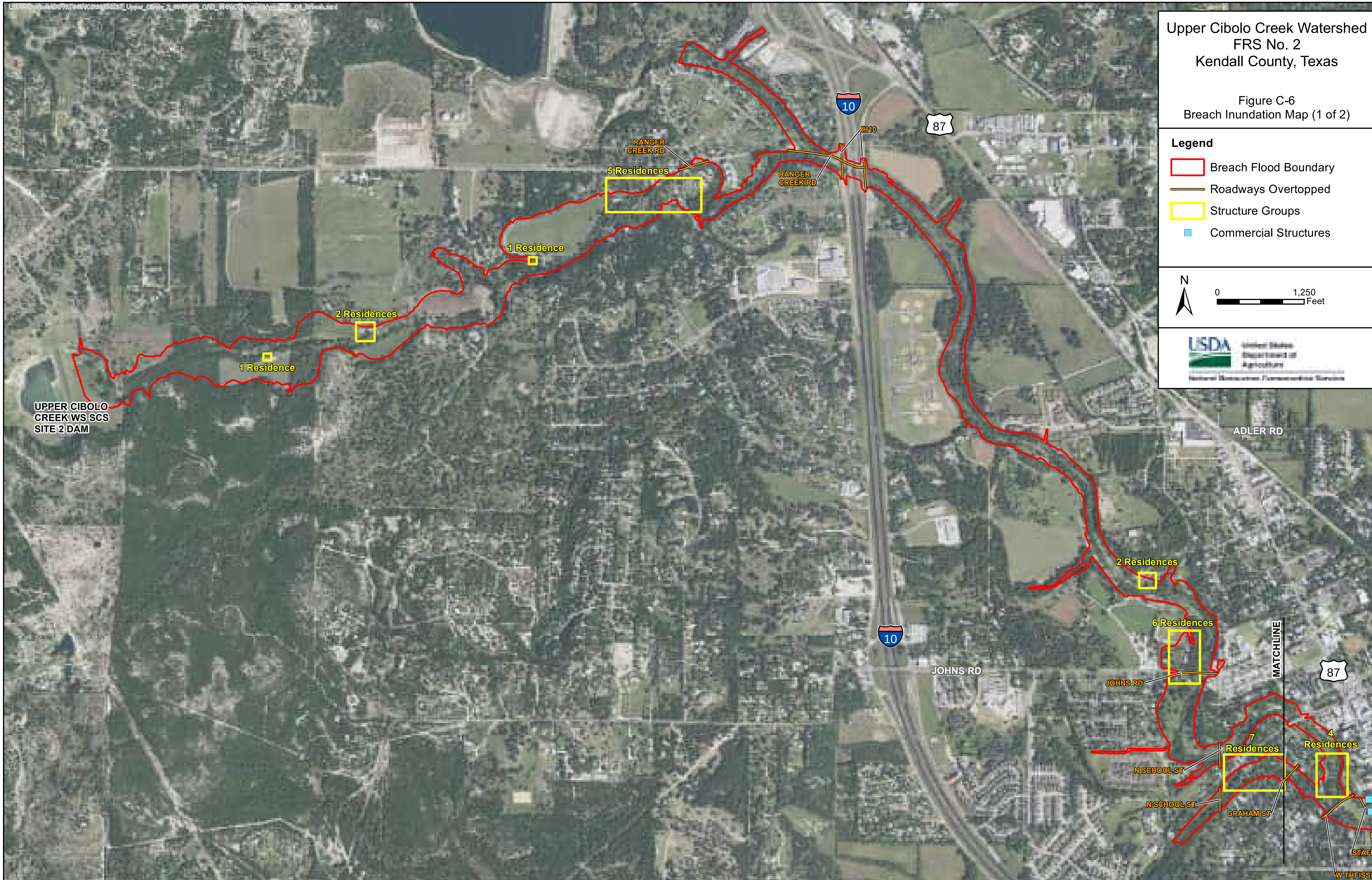
Project Location

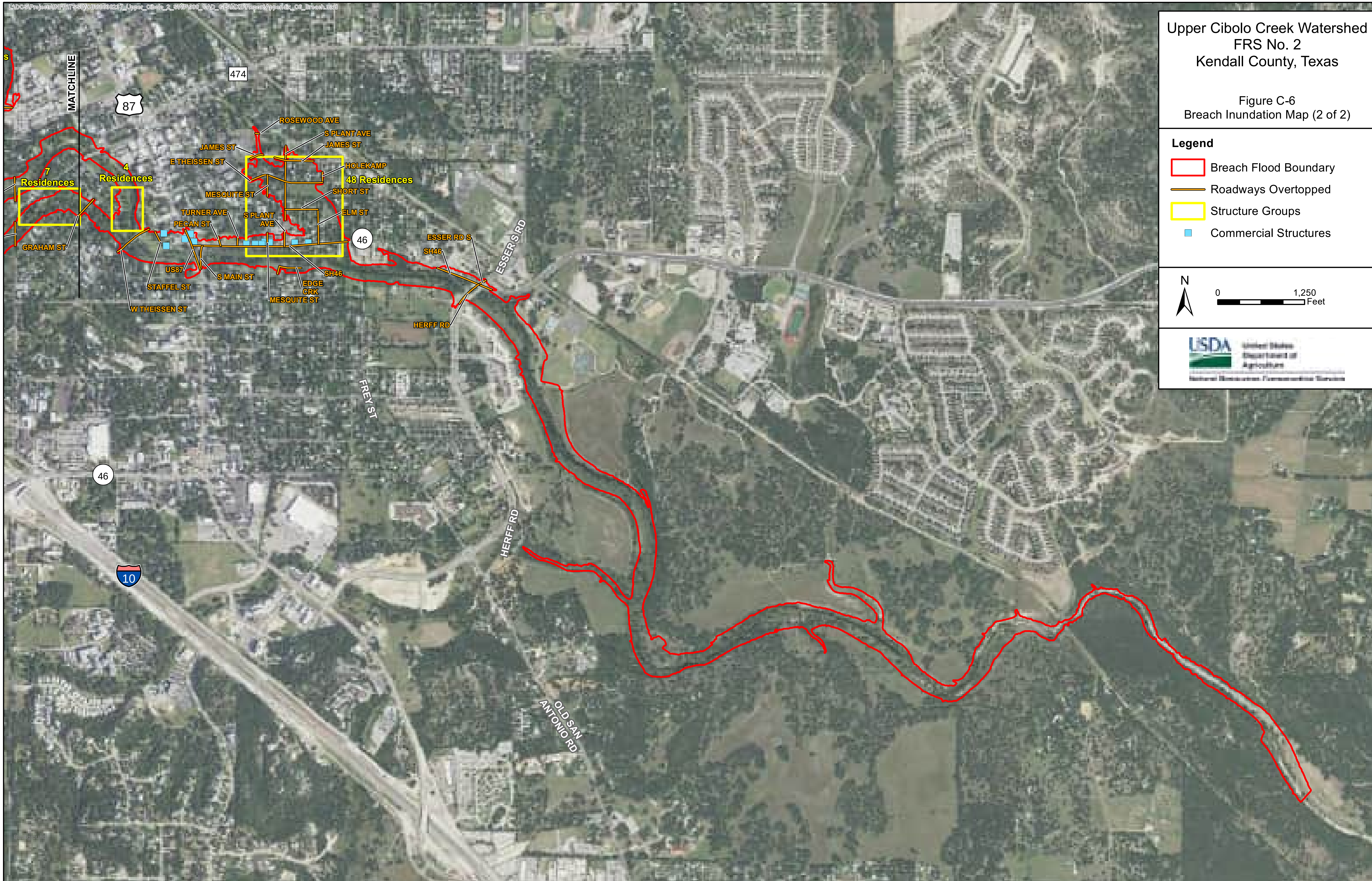
N

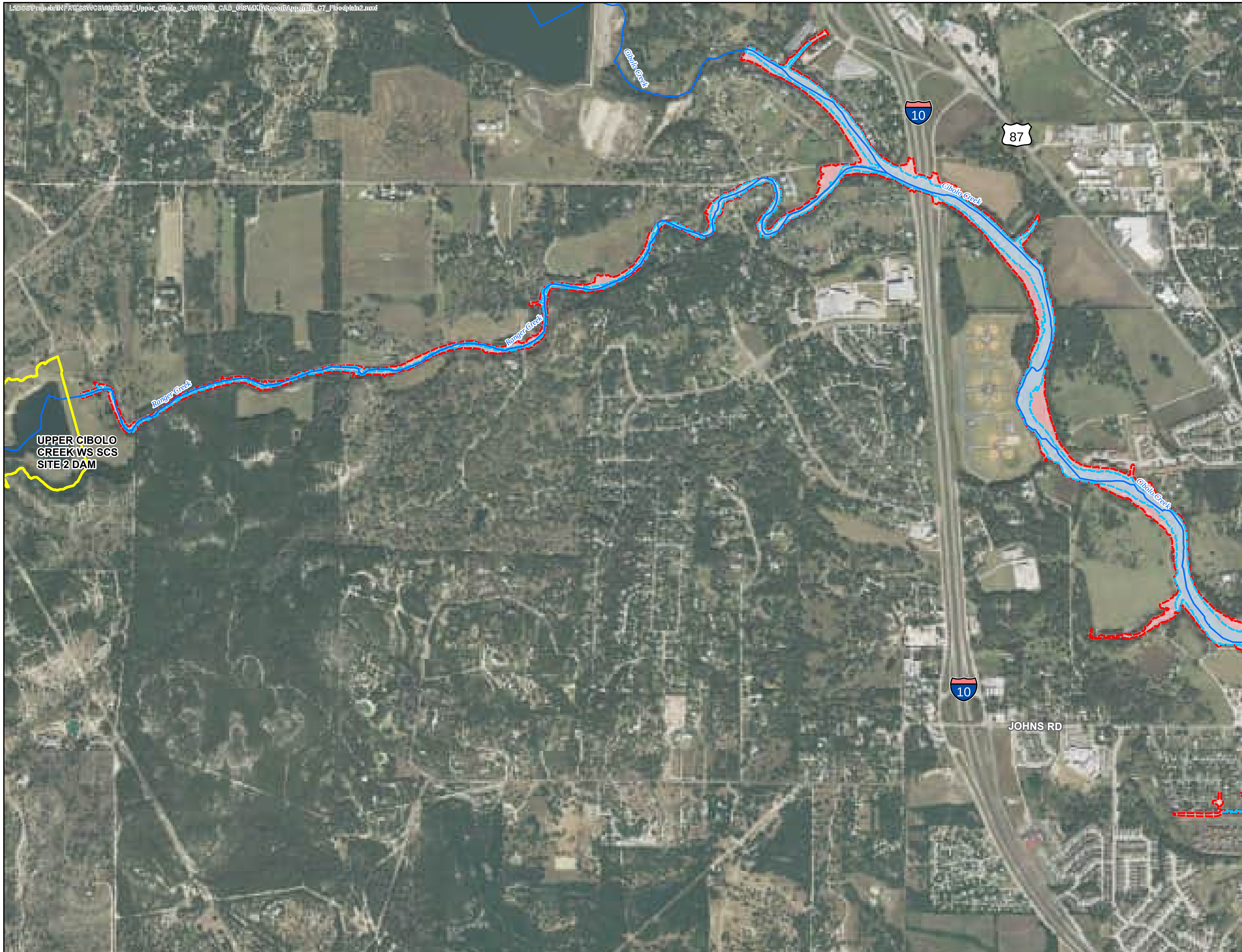
0 5,000 Feet

Upper Cibolo Creek Watershed
FRS No. 2
Kendall County, Texas

Figure C-5
Flood Insurance Rate Map


Upper Cibolo Creek Watershed
FRS No. 2
Kendall County, Texas
Figure C-6
Breach Inundation Map (1 of 2)
Legend
Breach Flood Boundary
Roadways Overtopped
Structure Groups
Commercial Structures
N
0
1,250
Feet
USDA
UPPER CIBOLO CREEK WS SCS SITE 2 DAM
1 Residence
2 Residences
1 Residence
5 Residences
RANGER CREEK RD
RANGER CREEK RD
IH10
10
87
ADLER RD
2 Residences
6 Residences
MATCHLINE
JOHNS RD
JOHNS RD
10
87
7 Residences
4 Residences
N SCHOOL ST
N SCHOOL ST
GRAHAM ST
STAFFEL
W THEISSEN


Upper Cibolo Creek Watershed
FRS No. 2
Kendall County, Texas
Figure C-6
Breach Inundation Map (2 of 2)
Legend
Breach Flood Boundary
Roadways Overtopped
Structure Groups
Commercial Structures
N
0
1,250
Feet
USDA
MATCHLINE
474
87
46
10
7 Residences
4 Residences
48 Residences
ROSEWOOD AVE
S PLANT AVE
JAMES ST
JAMES ST
HOLEKAMP
E THEISSEN ST
MESQUITE ST
SHORT ST
TURNER AVE
PECAN ST
S PLANT AVE
ELM ST
GRAHAM ST
US87
S MAIN ST
SH46
STAFFEL ST
EDGE CRK
MESQUITE ST
W THEISSEN ST
ESSER RD S
SH46
ESSER S RD
HERFF RD
FREY ST
HERFF RD
OLD SAN ANTONIO RD



Upper Cibolo Creek Watershed
FRS No. 2
Kendall County, Texas

Figure C-7
Floodplain Map (1 of 2)

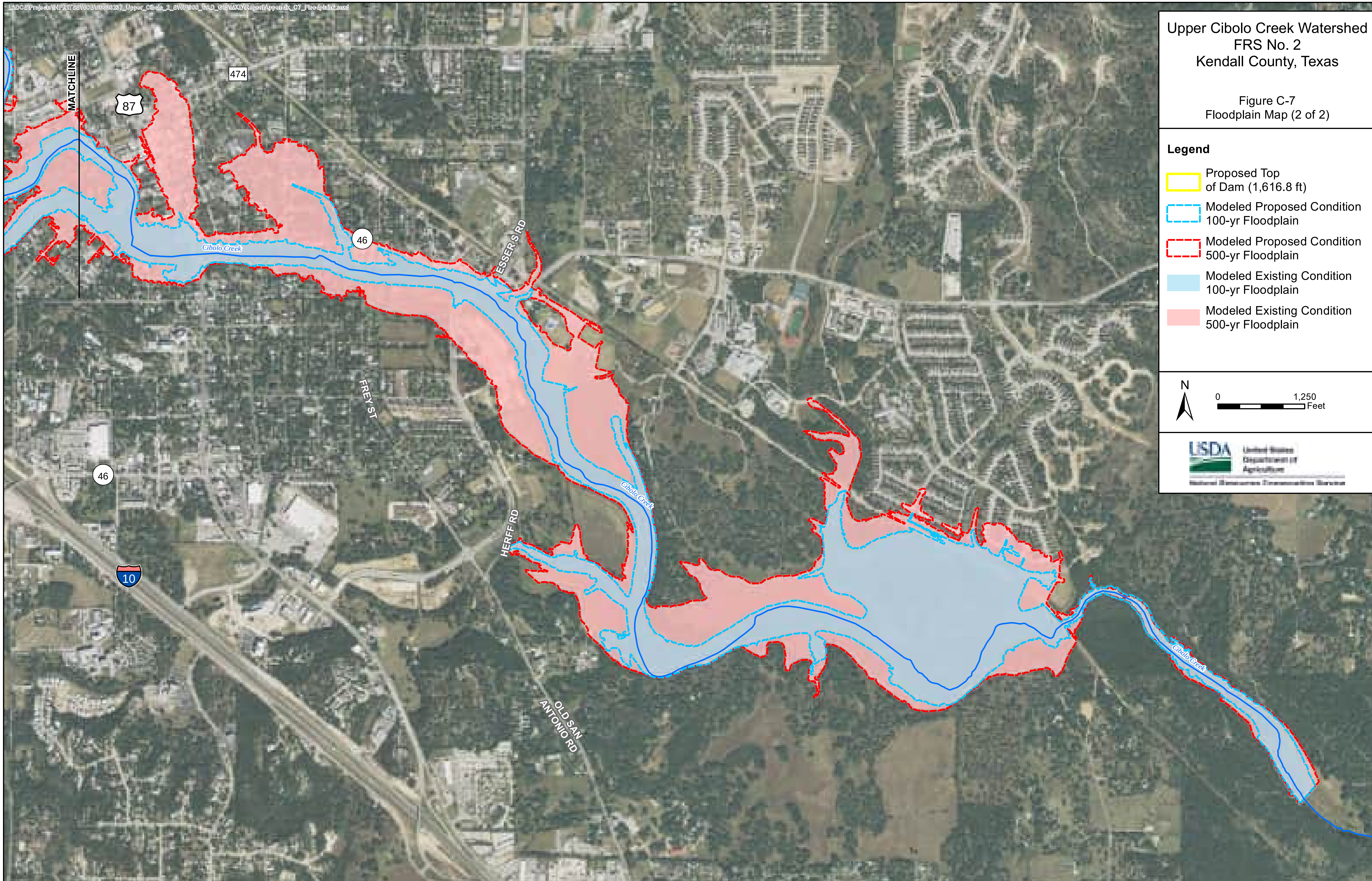
Legend

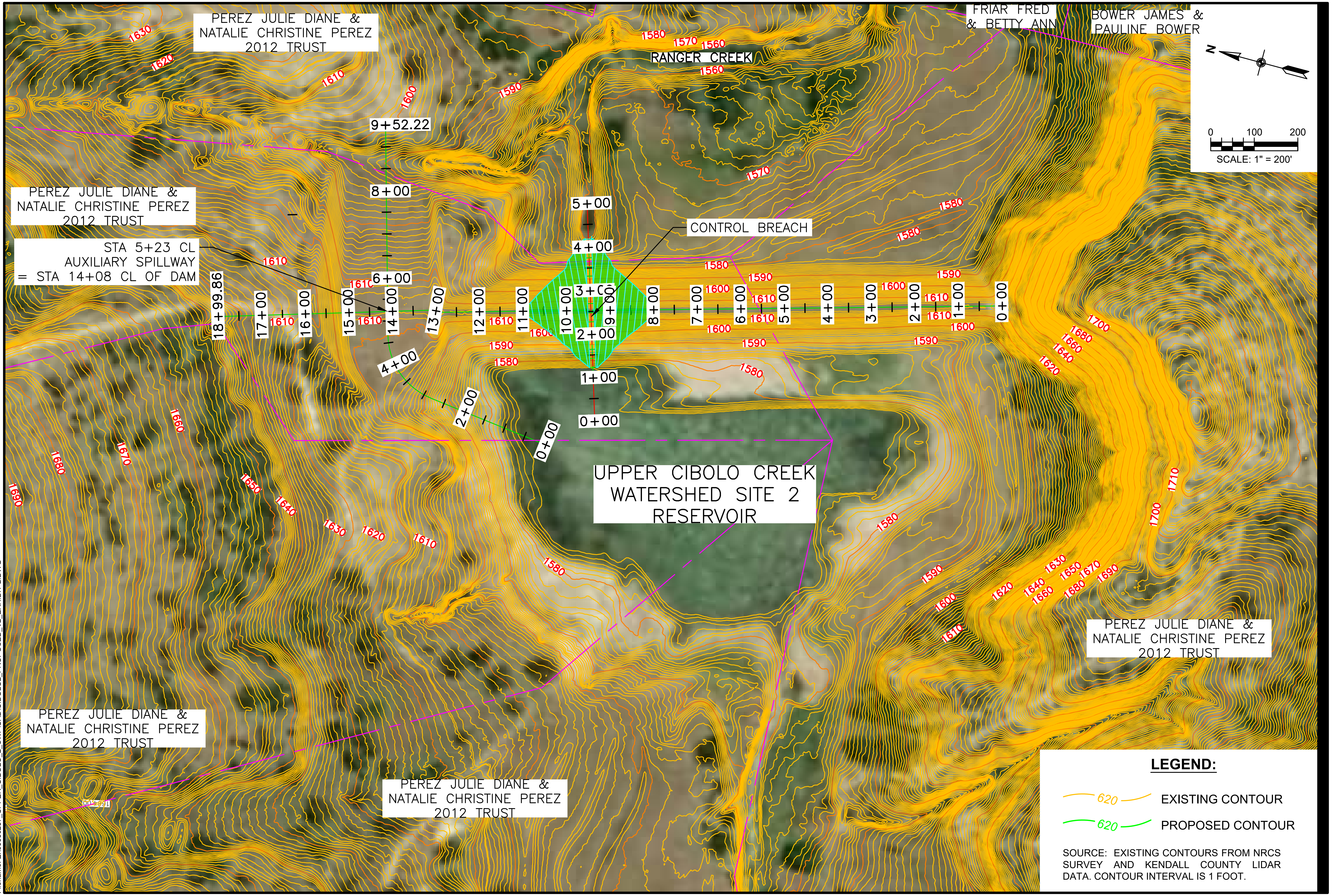
- Proposed Top of Dam (1,616.8 ft)
- Modeled Proposed Condition 100-yr Floodplain
- Modeled Proposed Condition 500-yr Floodplain
- Modeled Existing Condition 100-yr Floodplain
- Modeled Existing Condition 500-yr Floodplain

N

0 1,250 Feet

USDA United States Department of Agriculture
Natural Resources Conservation Service


Upper Cibolo Creek Watershed
FRS No. 2
Kendall County, Texas
Figure C-7
Floodplain Map (2 of 2)
Legend
Proposed Top of Dam (1,616.8 ft)
Modeled Proposed Condition 100-yr Floodplain
Modeled Proposed Condition 500-yr Floodplain
Modeled Existing Condition 100-yr Floodplain
Modeled Existing Condition 500-yr Floodplain
N
0
1,250
Feet
USDA
MATCHLINE
87
474
46
Cibolo Creek
ESSER'S RD
FREY ST
46
HERFF RD
10
OLD SAN ANTONIO RD
Cibolo Creek
Cibolo Creek



AECOM

Figure: C-8

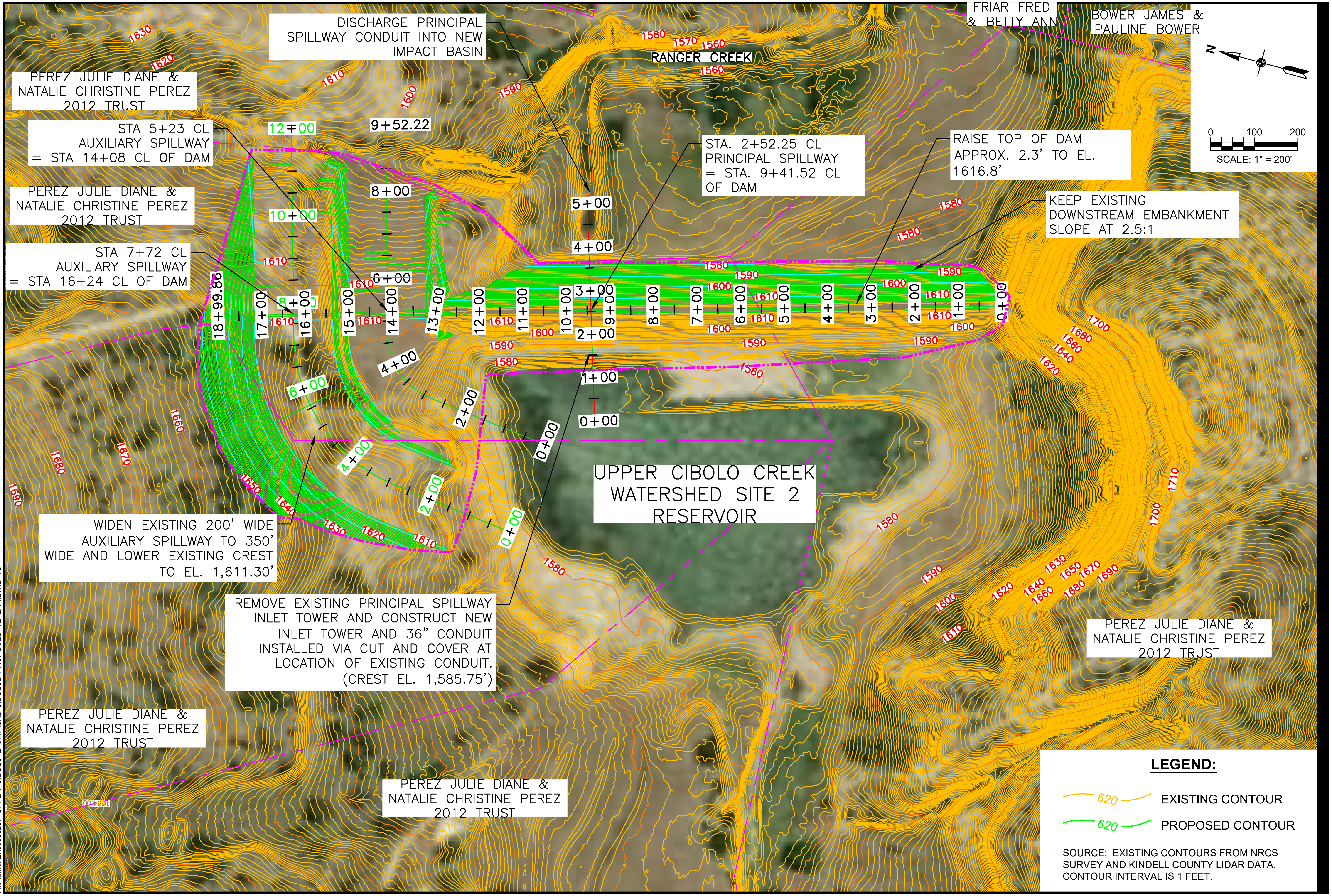
DAM 2 DECOMMISSIONING PLAN MODIFICATIONS

Floodwater Retarding Structure Site No. 2
Upper Cibolo Creek Watershed

Supplemental Watershed Rehabilitation Plan
Rehabilitation Alternatives
Texas State Soil and Water Conservation Board
Project No.: 60630237 Date: 6/25/2021

Project Management Initials: ____ Designer: MJL Checked: ____ Approved: ____ ANSI B 11" x 17"

Last saved by: BILL.CHAPMAN(2021-09-10) Last Plotted: 2021-09-10
Filename: E:\60630237_UPPER_CIBOLO_2_SWP\CAD\CIBOLO2_PROPOSED_V2_EXHIBIT-2.DWG



AECOM

Figure: C-9

DAM 2 ALTERNATIVE 3, HIGH HAZARD P LAN MODIFICATIONS

Floodwater Retarding Structure Site No. 2
Upper Cibolo Creek Watershed

Supplemental Watershed Rehabilitation Plan
Rehabilitation Alternatives
Texas State Soil and Water Conservation Board
Project No.: 60630237 Date: 6/25/2021

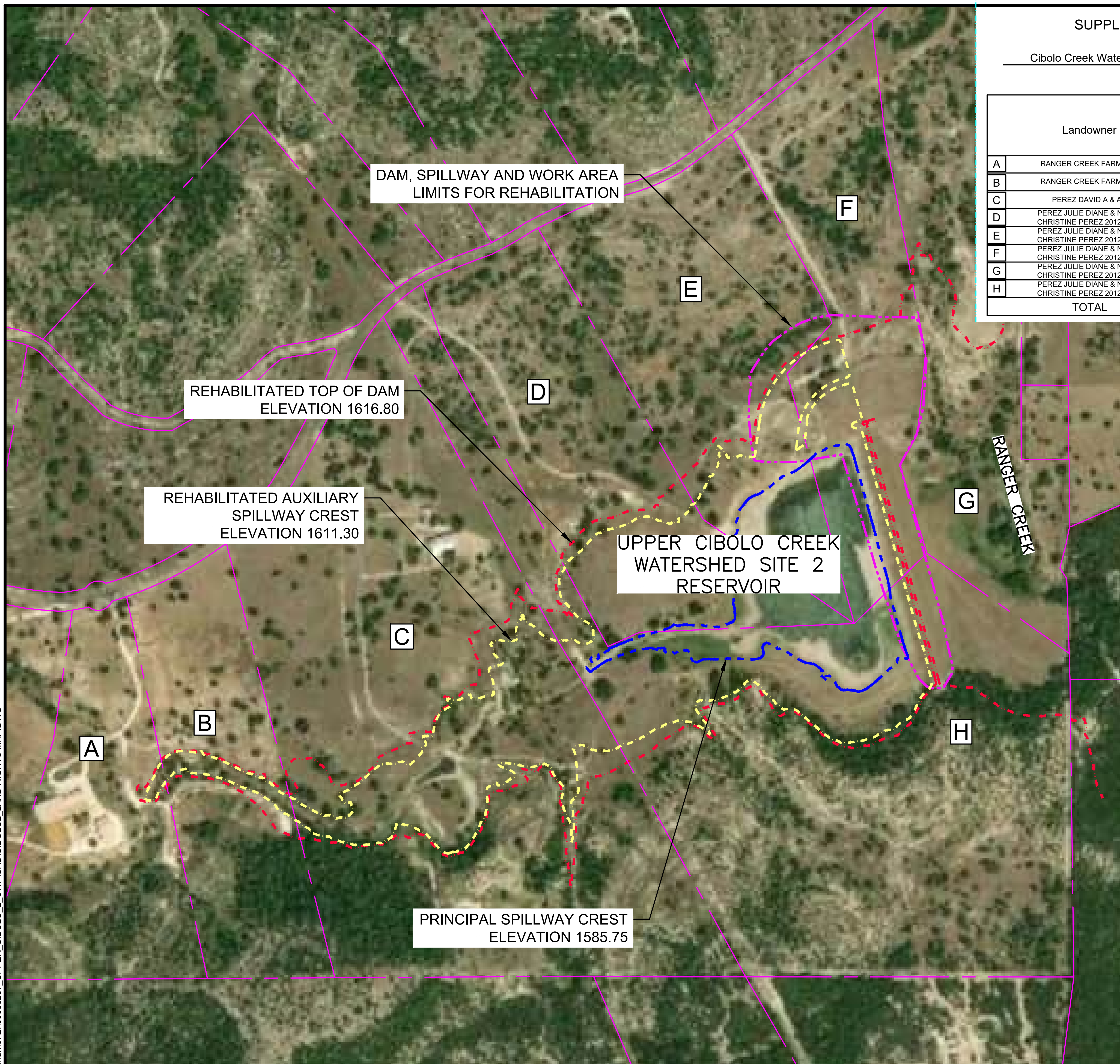
ANSI B 11" x 17"
Approved: ____
Checked: ____
Designer: MJL
Project Management Initials: ____
Last saved by: BILL.CHAPMAN(2021-09-10) Last Plotted: 2021-09-10
Filename: E:\60630237_UPPER_CIBOLO_2_SWP\CAD\CIBOLO2_PROPOSED_V2_EXHIBIT.DWG

SUPPLEMENTAL LAND RIGHTS WORK MAP FOR REHABILITATION

Cibolo Creek Watershed — SITE 2

Surface Acres

	Landowner	Embankment and Spillways Permanent Easement	Temporary Construction Campsite & Work Area	Borrow Areas	Total Acres Needed
A	RANGER CREEK FARMS, LLC	0.31	0	0	0.31
B	RANGER CREEK FARMS, LLC	2.01	0	0	2.01
C	PEREZ DAVID A & AMY	20.08	0	0	20.08
D	PEREZ JULIE DIANE & NATALIE CHRISTINE PEREZ 2012 TRUST	12.59	0	0	12.59
E	PEREZ JULIE DIANE & NATALIE CHRISTINE PEREZ 2012 TRUST	7.73	3.35	0	11.08
F	PEREZ JULIE DIANE & NATALIE CHRISTINE PEREZ 2012 TRUST	2.84	11.81	0	14.65
G	PEREZ JULIE DIANE & NATALIE CHRISTINE PEREZ 2012 TRUST	0	0.08	0	0.08
H	PEREZ JULIE DIANE & NATALIE CHRISTINE PEREZ 2012 TRUST	18.38	2.65	0	21.03
	TOTAL	63.94	17.89	0	81.83



N

0 250 500

SCALE: 1" = 500'

AECOM

Figure: C-10

Floodwater Retarding Structure Site No. 2
Upper Cibolo Creek Watershed

CIBOLO 2 - LAND RIGHTS MAP

Supplemental Watershed Rehabilitation Plan
Rehabilitation Alternatives
Texas State Soil and Water Conservation Board
Project No.: 60630237 Date: 6/25/2021

Project Management Initials: Designer: MJL Checked: Approved: ANSI B 11" x 17"

Last saved by: BILL.CHAPMAN(2021-09-10) Last Plotted: 2021-09-10
Filename: E:\60630237_UPPER_CIBOLO_2_SWP\CAD\CIBOLO2_LAND RIGHTS MAP.DWG

Appendix D Investigation and Analysis Report

Supplemental Watershed Plan No. I and EA for Upper Cibolo Creek Floodwater Retarding Structure No. 2 Investigation and Analysis Report

D.1 INTRODUCTION

D.1.1 Overview

Appendix D provides supplementary information regarding the investigations and analyses conducted for the Supplemental Watershed Planning efforts for Upper Cibolo Creek Floodwater Retarding Structure (FRS) No. 2 located in Kendall County, Texas. The dam is located on Ranger Creek, a tributary to Upper Cibolo Creek. There are three NRCS dams upstream of the confluence between Upper Cibolo Creek and Menger Creek (FRS No. 1, FRS No. 3, and FRS No. 4) that were within the modeled extents. Analyses were completed for three project alternatives. Discussion on the following topics is presented in **Section D.2** through **Section D.4**:

- Alternative selection;
- Economics evaluation procedures, assumptions, and analysis methods;
- Economic analysis befits, costs, and results; and
- Hydrology and hydraulics.

D.1.2 Background

The original purpose of the Upper Cibolo Creek Watershed Plan was for watershed protection, flood protection, and municipal and industrial water supply. Upper Cibolo Creek FRS No. 2 was constructed as a single-purpose, low hazard potential FRS. Due to downstream development, FRS No. 2 has been reclassified as a high hazard potential dam, yet it does not meet the current safety and performance standards for the high hazard potential classification. While there is a need for action to reduce safety risks and meet current safety standards, there is also a need for continued flood protection in the Upper Cibolo Creek Watershed.

The NRCS studied the feasibility of project alternatives that result in FRS No. 2 meeting safety and performance standards while continuing to provide downstream flood protection in a manner that takes into consideration economic, social, and environmental goals. This report provides information on the methods and details of the analyses that were conducted for the *Supplemental Watershed Plan No. I and Environmental Assessment for Upper Cibolo Creek FRS No.2*.

Historically, the land in the study area was relatively undeveloped, minimizing potential flood impacts from a dam breach. However, potential damages from a dam breach are larger today than when the dam was constructed, necessitating increased safety standards to accommodate the increased hazard rating of the dam. As part of the basin-wide study, four alternatives underwent a preliminary evaluation for the rehabilitation study of FRS No. 2. The alternatives are summarized in the ensuing sections.

D.2 ALTERNATIVES CONSIDERED

As described in Section 4.1 of the *Supplemental Watershed Plan No. I and EA*, the alternatives that were considered for FRS No. 2 in the development and identification of the selected alternative were:

- No Action/Future without Federal Investment (FWOFI);
- Dam Decommissioning (Future with Federal Investment [FWFI]);
- Low Hazard Potential Rehabilitation (FWFI) - rehabilitate dam to meet current low hazard potential criteria and perform non-structural measures to reduce risk in the breach zone, i.e., relocating structures; and
- High Hazard Potential Rehabilitation (FWFI) - rehabilitate and upgrade dam to meet current high hazard potential criteria.

A summary of each of the alternatives considered for FRS No. 2 is shown in **Table D-1**. Complete descriptions of the alternatives considered are provided in the *Supplemental Watershed Plan No. I and EA for Upper Cibolo Creek FRS No. 2*, Section 4.2 through Section 4.3. Cells shaded blue in **Table D-1** were not considered in the economic analysis for the reasons provided in the table.

Table D-1. Alternatives Summary

Alternative Title	Description	Plan-EA Alternative & Rationale
No Action/ Future Without Federal Investment (FWOFI)	• Initial period of no action • Sponsors accepts risk of breach during period of no action • Controlled breach of FRS No. 2 by Sponsors once funds are allocated or after catastrophic breach (whichever occurs first) • No mitigation for induced flooding	**Alternative 1** in Plan-EA for FRS No. 2.
Dam Decommissioning (Future With Federal Investment [FWFI])	• Controlled breach of FRS No. 2 with federal investment • Riparian vegetation would be established • Mitigation would be provided for induced flooding in the form of structure acquisition, floodproofing, and flood warning system/barricades for roadways • No mitigation for increased flooding on roads that would be impassable in existing condition.	**Alternative 2** in Plan-EA for FRS No. 2.
Low Hazard Potential Rehabilitation (FWFI)	• Keep existing PS system • Provide 100 years of sediment storage • Add rock blanket on upstream slope • Lower existing AS crest to elevation 1611.10 feet (NAVD 88)	Eliminated from detailed evaluation in Plan-EA due to obvious high cost relative to other alternatives, per Section 4.2.1. The high cost is primarily associated with

Alternative Title	Description	Plan-EA Alternative & Rationale
	• Protect downstream end of AS with rock rip rap • Add concrete cutoff wall at the control section of the AS • Remove Population At Risk (PAR) from breach zone	removal of the PAR from the breach zone, which would also cause significant community disruption. Therefore, this was considered but eliminated from detailed evaluation.
High Hazard Potential Rehabilitation (FWFI)	• Remove existing PS system • Install new PS system with crest at elevation 1,585.75 feet (NAVD88) and 36-inch RCP conduit discharging into new impact basin • Regrade inlet and outlet channel of the existing AS, widen crest from 200 feet to 350 feet, add splitter dike and lower crest to elevation of 1,611.30 feet (NAVD88) • Protect downstream end of AS with rock riprap • Add a concrete cutoff wall at the control section of the AS • Raise and grade top of dam level 2.3 feet from an elevation of 1,614.5 feet to 1,616.8 feet • Provide 100-years of sediment storage • Add rock blanket on upstream slope	**Alternative 3** in Plan-EA for FRS No. 2

Cells shaded blue were eliminated from detailed evaluation in Plan-EA.

D.3 ECONOMIC ANALYSIS

D.3.1 Economic Framework

In general, the national economic benefits presented in this supplemental plan were developed based on guidance contained in *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&G)[1] and the *Principles, Requirements and Guidelines for Federal Investments in Water Resources*[2]. The benefits of the project would occur in the rural community of Boerne, Texas, resulting in benefits being agricultural.

Costs and benefits are reported in 2021 dollars and a 2.5% discount rate. The benefits and costs were evaluated over a 103-year period of analysis (36 months of construction and 100-year evaluation period). Inputs or assumptions provided in a year prior to 2021 were adjusted using U.S. Gross Domestic Product (GDP) deflators.

The analyses of Alternative 1 - No Action/FWOFI and FWFI alternatives (Alternative 2 and Alternative 3) include damage or cost reduction incurred for a range of benefit categories. Benefit categories evaluated in the economic analysis were:

[1] U.S. Water Resources Council, Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, March 1983.

[2] Principles, Requirements and Guidelines for Federal Investments in Water Resources, 2014.

- Damage reductions to residential and nonresidential structures and their contents;
- Debris removal costs avoided;
- Damage reductions to automobiles; and
- Damage reductions to roads and bridges.

Damage to structures and contents typically form the majority of damages that result from a flood event, and therefore, form the foundation of the economic analysis when assessing alternatives. Damages to structures, contents, and automobiles were estimated through the Hydrologic Engineering Center's Flood Damage Analysis (HEC-FDA) program, and the results generated by the program were output in average annual terms based on damage estimates at each recurrence interval evaluated. Debris removal costs were assigned for every structure that incurred flood damages, based on the HEC-FDA results. Damages to roads and bridges were estimated using engineering analysis from each annual exceedance probability (AEP) storm event evaluated.

The benefit categories represent damage reduction from future flooding and are evaluated in average annual terms. To estimate average annual damages (AAD) from future flooding, eight storm recurrence intervals were modeled (50%, 20%, 10%, 4%, 2%, 1%, 0.5%, and 0.2% AEP storm events). The methods used to perform the economic analysis are described in the following sections.

D.3.2 Benefit Analysis

The following describe the analyses used to evaluate the benefits of the FWFI alternatives.

D.3.2.1 Structure Inventory

Knowledge of existing residential and nonresidential development located in a floodplain is essential when evaluating a flood-risk-management measure. A structure inventory was undertaken to identify the residential and nonresidential structures located in the study area, which serves as the base data for the economic analysis. The structure inventory comprises residential and nonresidential structures that are within the area of inundation based on the hydrologic and hydraulic (H&H) models. Data from the Kendall County Appraisal District were utilized to determine the characteristics of the structures in the inventory.

HEC-FDA was then used to estimate annual damages to residential and nonresidential structures for each alternative. The structure inventory imported into HEC-FDA included the following information for each structure:

- A unique identifier;
- The name of the river;
- Structure improvement value;
- Stream station number (based on H&H modeling cross sections);

- Finished-floor elevation (FFE); and
- Damage category and occupancy types assigned to the structure based on type and use.

LiDAR data were used to determine ground surface elevation (GSE) at each structure, which was added to the foundation height to estimate the FFE. Structure types and their respective foundation heights are listed in **Table D-2**.

Table D-2. Structure Type in Study Area

Structure Type	Structure Description	Structure Use	Foundation Height (FFE feet above GSE)
1ST-B	Single Family 1 Story with Basement	Residential	1
1ST-NB	Single Family 1 Story with no Basement	Residential	0.5
2ST-B	Single Family 2 Story with Basement	Residential	1
2ST-NB	Single Family 2 Story with no Basement	Residential	0.5
APT_P	Apartment	Commercial	0.5
CLOTH_P	Clothing Store	Commercial	0.5
CONV_P	Convenience Store	Commercial	0.5
FFR_P	Fast-Food Restaurant	Commercial	0.5
FURN_P	Furniture Store	Commercial	0.5
GROC_P	Grocery Store	Commercial	0.5
HTL_P	Hotel	Commercial	0.5
M_H	Mobile Home	Residential	2.5
MED_P	Medical Facility	Commercial	0.5
OFF_P	Office	Commercial	0.5
REC_P	Recreational	Commercial	0.5
REST_P	Restaurant	Commercial	0.5
RF_P	Religious Facility	Commercial	0.5
SCH_P	School	Commercial	0.5
SERV_P	Service-related Facility	Commercial	0.5
WH_P	Warehouse	Commercial	0.5
A1	Automobile	Automobile	0

Note: Single family homes identified with crawl-space foundation were assigned a foundation height of 1 or 1.5 feet above GSE, based on visual inspection.

Local tax appraisal data from the Kendall County Appraisal District was reviewed and used to assign structure type and valuation to the structures. The tax assessor data provided multiple valuation components (e.g., land, improvement) for each parcel. The value listed under the improvement component in the tax assessor data was used as a proxy to estimate the depreciated replacement value of structures.

To make sure that all potentially impacted structures were incorporated into the analysis, the study area was based on the floodplain from a breach scenario. The structure inventory collected information on 915 residential and nonresidential structures (**Table D-3)**. The inventory also included 720 automobiles, which were associated with the residential structures.

Table D-3. Summary of Structure Inventory

Structure Type	Number of Structures	Total Value of Structures
1ST-B	2	$802,000
1ST-NB	424	$56,981,000
2ST-B	1	$333,000
2ST-NB	292	$73,092,000
APT_P	39	$26,877,000
CLOTH_P	16	$3,105,000
CONV_P	32	$10,497,000
FFR_P	4	$854,000
FURN_P	2	$1,312,000
GROC_P	1	$275,000
HTL_P	1	$161,000
M_H	1	$7,000
MED_P	13	$2,824,000
OFF_P	39	$16,360,000
REC_P	6	$2,278,000
REST_P	18	$6,091,000
RF_P	4	$9,399,000
SCH_P	3	$27,642,000
SERV_P	1	$302,000
WH_P	16	$1,431,000

Each structure was assigned a depth-damage function (DDF) based on the structure type that estimates an economic loss as a percentage of the value of the structure based on the building class and depth of flooding. DDFs were sourced from the U.S. Army Corps of Engineers' (USACE's) Economic Guidance Memorandum (EGM) 04-01, *Generic Depth-Damage Relationships for Residential Buildings with Basements*.[3] DDFs for nonresidential buildings were sourced from FEMA's Benefit-Cost Analysis Toolkit.[4] The structure and content DDFs for the structure types are provided in **Attachment D-1**.

[3] USACE, 2003. *Generic Depth-Damage Relationships for Residential Buildings with Basements*, EGM 04-01. October 10. https://planning.erdc.dren.mil/toolbox/guidance.cfm?Option=BL&BL=OnlyInlandFlood&Type=None&Sort=Default.

[4] FEMA, 2019. *Benefit-Cost Analysis Toolkit, Version 6.0*. https://www.fema.gov/media-library/assets/documents/179903.

The station number for each structure was assigned using GIS and based on the structure location and cross section shapefiles from the H&H analysis.

D.3.2.2 Automobiles

The damages to automobiles were determined using the U.S. Army Corps of Engineers' (USACE) Economic Guidance Memorandum, 09-04, *Generic Depth-Damage Relationships for Vehicles*. In accordance with the guidance, the elevation of each automobile was assumed to be the ground surface elevation of the adjacent residential structure, which was provided in the structure inventory. The damages to vehicles at residences is dependent on the average number of vehicles per household and the percentage of vehicles that are likely to be at the residence at the time the flood waters reach the property and the availability of safe evacuation routes.

In 2019, the median number of vehicles per household in Kendall County[5], Texas was 1.8 (U.S. Census Bureau).[6] Suggested by the guidance, the average vehicle value was obtained from Edmunds. According to the Edmunds *Used Vehicle Market Report* (2019), the average retail value for used vehicles was $20,600 in 2019[7] ($21,200 in 2021 dollars).

The length of potential warning time and the access to a safe evacuation route to a flood-free location were considered to estimate the percentage of vehicles that would likely remain in the flood-prone location. For Kendall County, it is assumed that the warning time would be less than 6 hours; therefore, 50.5% of the vehicles in the flood area would be evacuated according to USACE guidance and 49.5% would remain.

Since only those vehicles not used for evacuation can be included in the damage calculations, an adjusted average vehicle value of $18,900 ($21,200 x 1.8 x 0.495) was assigned to each individual residential structure on record in the structure inventory and imported into HEC-FDA to calculate the damages.

D.3.2.3 Structure and Automobile Benefits

Data on structures, automobiles and H&H data were imported into HEC-FDA to estimate the average annual damages and benefits. The following sections describe the structure and automobile damage estimate for each alternative and the resulting benefits. HEC-FDA conducts a Monte Carlo simulation to estimate the impacts of uncertainty on the results. Uncertainty parameters are incorporated into both the H&H analysis and the structure data. The results provided in this section account for uncertainty.

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[5] U.S. Census Bureau data for the San Antonio-New Braunfels Metropolitan statistical area, which includes Boerne, Texas, was used.

[6] U.S. Census Bureau, 2019 5-Year Estimates; Selected Housing Characteristics https://data.census.gov.

[7] Edmonds, Used Car Report, CY 2019, https://static.ed.edmunds-media.com/unversioned/img/industry-center/insights/2019-used-vehicle-report.pdf.

Because of the potential for Alternative 2 to induce flooding in relation to the existing conditions, the results of the initial HEC-FDA runs were compared for the existing conditions and Alternative 2. Any structure that received flooding above the FFE for the 1% AEP storm event was mitigated for induced flooding. If a structure was inundated by 1 foot or more of flooding at the 1% AEP storm event the property would be acquired, and the structure demolished. If a structure was inundated by less than 1 foot of flooding at the 1% AEP storm event, the structure was dry floodproofed to a height of 3 feet above the FFE. In total, 39 structures were identified for acquisition and 49 structures for dry floodproofing. HEC-FDA was re-run for Alternative 2 using a modified structure inventory to account for the mitigation of induced structures.

Table D-4 provides the average annual damage for each alternative, by structure category, while **Table D-5** presents the number of structures flooded above the FFE for each recurrence interval.

Table D-4. Average Annual Damage by Structure Category

Project Alternative	AUTO	COM	RES	Total
Alternative 1 – No Action/FWOFI	$20,000	$124,000	$146,000	$290,000
Alternative 2 – Federal Decommissioning (FWFI)	$12,000	$44,000	$57,000	$113,000
Alternative 3 – High Hazard Potential Rehabilitation (FWFI)	$13,000	$86,000	$89,000	$187,000

Table D-5. Number of Structures Flooded Above the Finished-Floor Elevation

Alternative	50% AEP	20% AEP	10% AEP	4% AEP	2% AEP	1% AEP	0.5% AEP	0.2% AEP
Alternative 1 - No Action/ FWOFI								
1ST-B	0	0	0	0	0	0	0	0
1ST-NB	0	0	0	2	6	19	28	99
2ST-B	0	0	0	0	0	0	0	0
2ST-NB	0	0	1	1	6	9	21	54
APT_P	0	0	0	0	1	1	3	17
CLOTH_P	0	0	0	0	2	3	3	8
CONV_P	0	0	0	0	0	3	6	14
FFR_P	0	0	0	0	2	3	3	4
FURN_P	0	0	0	0	0	0	0	1
GROC_P	0	0	0	0	0	0	0	1
HTL_P	0	0	0	0	0	0	0	1
M_H	0	0	0	0	0	0	0	0
MED_P	0	0	0	0	0	3	4	6
OFF_P	0	0	0	0	3	11	13	19
REC_P	0	0	0	0	0	0	0	0
REST_P	0	0	0	0	2	6	6	10
RF_P	0	0	0	0	0	0	0	0

Alternative	50% AEP	20% AEP	10% AEP	4% AEP	2% AEP	1% AEP	0.5% AEP	0.2% AEP
SCH_P	0	0	0	0	0	0	0	0
SERV_P	0	0	0	0	0	0	0	0
WH_P	0	1	1	1	3	4	4	6
Total	**0**	**1**	**2**	**4**	**25**	**62**	**91**	**240**
Alternative 2 – Federal Decommissioning (FWFI) *								
1ST-B	0	0	0	0	0	0	0	0
1ST-NB	0	0	0	0	0	5	14	85
2ST-B	0	0	0	0	0	0	0	0
2ST-NB	0	0	0	0	0	3	15	48
APT_P	0	0	0	0	0	0	2	16
CLOTH_P	0	0	0	0	0	1	1	6
CONV_P	0	0	0	0	0	2	5	13
FFR_P	0	0	0	0	0	1	1	2
FURN_P	0	0	0	0	0	0	0	1
GROC_P	0	0	0	0	0	0	0	1
HTL_P	0	0	0	0	0	0	0	1
M_H	0	0	0	0	0	0	0	0
MED_P	0	0	0	0	0	3	4	6
OFF_P	0	0	0	0	0	5	7	13
REC_P	0	0	0	0	0	0	0	0
REST_P	0	0	0	0	0	3	3	7
RF_P	0	0	0	0	0	0	0	0
SCH_P	0	0	0	0	0	0	0	0
SERV_P	0	0	0	0	0	0	0	0
WH_P	0	0	0	0	0	0	0	2
Total	**0**	**0**	**0**	**0**	**0**	**23**	**52**	**201**
Alternative 3 – High Hazard Potential Rehabilitation (FWFI)								
1ST-B	0	0	0	0	0	0	0	0
1ST-NB	0	0	0	1	2	8	22	90
2ST-B	0	0	0	0	0	0	0	0
2ST-NB	0	0	0	1	1	6	14	47
APT_P	0	0	0	0	0	1	1	17
CLOTH_P	0	0	0	0	0	2	4	8
CONV_P	0	0	0	0	0	1	3	13
FFR_P	0	0	0	0	1	2	3	4
FURN_P	0	0	0	0	0	0	1	1
GROC_P	0	0	0	0	0	0	0	1
HTL_P	0	0	0	0	0	0	0	1

Alternative	50% AEP	20% AEP	10% AEP	4% AEP	2% AEP	1% AEP	0.5% AEP	0.2% AEP
M_H	0	0	0	0	0	0	0	0
MED_P	0	0	0	0	0	0	3	5
OFF_P	0	0	0	0	0	5	13	20
REC_P	0	0	0	0	0	0	0	0
REST_P	0	0	0	0	1	3	6	10
RF_P	0	0	0	0	0	0	0	0
SCH_P	0	0	0	0	0	0	0	0
SERV_P	0	0	0	0	0	0	0	0
WH_P	0	0	1	1	1	3	4	6
Total	**0**	**0**	**1**	**3**	**6**	**31**	**74**	**223**

*Notes: Structures acquired to mitigate for induced flooding were removed from the inventory and were not included as having inundation above the FFE, however structures that were floodproofed were still counted as having inundation above the FFE (although any damages would not be incurred until floodwater reached three feet above the FFE).

Table D-6 provides the average annual benefits for structures and automobiles.

Table D-6. Average Annual Benefits

Project Alternative	Damages	Benefits
Alternative 1 – No Action/FWOFI	$290,000	N/A
Alternative 2 – Federal Decommissioning (FWFI)	$113,000	$177,000
Alternative 3 – High Hazard Potential Rehabilitation (FWFI)	$187,000	$103,000

D.3.2.4 <u>Debris Removal</u>

When flooding occurs, debris can accumulate from flood damage, requiring effort to bring debris to the street for pickup and removal. The costs associated with debris removal were estimated based on guidance from the Federal Emergency Management Agency (FEMA) and were grouped with Structure Damages for the purposes of this analysis.

Debris costs were estimated for structures located in the reaches evaluated. Debris costs were assumed to be incurred for every structure that incurred flood damages, based on the HEC-FDA results. The debris cost per structure includes the hauling cost, tipping fee, and labor to remove debris and break it into pieces that could be hauled to the street for pickup.

FEMA has estimated there would be 25 to 30 cubic yards of debris for a structure without a basement and 45 to 50 cubic for structures with a basement. The cost to load and haul away debris was estimated using the average cost per cubic yard of $21 from the Homewyse Debris Removal

Cost Calculator (August, 2021); in addition, the disposal cost of $18 per cubic yard gives a total load and haul away cost of $39 per cubic yard.

Using the Homewyse Debris Removal Cost Calculator (August 2021), the number of labor hours to break down debris and move it from the structure to the street was estimated to be 1.03 hours for every cubic yard of debris. Because homeowners are forgoing other activities to clean up debris, including work and leisure, the opportunity cost was used to value this time. The value of time was estimated using the 2019 median household income for Kendall County from the Census and updating to 2021 dollars and dividing by 2,080 hours to get $42, representing the hourly opportunity cost of work per household. For leisure time, an opportunity cost of $28 was assigned based on the common practice used in economics literature to value recreation time as a fraction of the wage. In literature, this fraction ranges from one-third the wage to the full wage; therefore, a fraction of two-thirds was used to estimate the opportunity cost of leisure. During the flood aftermath, owners were assumed to forego recreation time two-thirds of the time and forego work one-third of the time, for an average value of time of $32.63. Finally, the average household size in Kendall County, 3.1 people (U.S. Census Bureau), was applied for an average opportunity cost of time (per person-hour) of $17.31. **Table D-7** presents the average cost of debris removal from a flooded structure with and without a basement.

Table D-7. Summary of Residential Debris Costs by Structure Type

Structure Description	Cubic Yards of Debris	Debris Removal Labor and Disposal Costs	Owner Opportunity Cost of Time	Total Debris Cost
With Basement	45 to 50	$1,900	$800	$2,700
Without Basement	25 to 30	$1,100	$500	$1,600

Notes: 2021 price level

Average annual damage debris removal costs and benefits by project alternative are summarized in **Table D-8**.

Table D-8. Debris Removal Damages

Project Alternative	Debris Removal Damages	Debris Removal Benefits
Alternative 1 – No Action/FWOFI	$7,000	N/A
Alternative 2 – Federal Decommissioning (FWFI)	$2,000	$5,000
Alternative 3 – High Hazard Potential Rehabilitation (FWFI)	$4,000	$3,000

Notes: 2021 price level

D.3.2.5 Roads and Bridges

Damages

There are 15 roads that would be flooded downstream of FRS No. 2 in the 50% to 0.2 % AEP storm events. Using repair costs of $15.00 per square yard of inundated asphalt (resurfacing, 12-inch sub base, 2-inch wearing surface), $30 per cubic yard for compacted earthfill, and $18.00 per linear foot of impacted guardrail (replacement), floodwater damages were calculated for each alternative and various recurrence intervals as shown in **Table D-9**. It should be noted that information was requested from the Sponsors and from TxDOT regarding the frequency of flooding of these roads and historic repair costs, but no information was available for verification of the damages shown in **Table D-9**. While some roads were designed to be overtopped and would not receive actual damages during frequent storm events, there would be a cost to clean-up the roads to remove debris and sediment accumulation.

Table D-9. Road Damages

Alternative	Total Damages per Annual Exceedance Probability							
	0.2%	**0.4%**	**1%**	**2%**	**4%**	**10%**	**20%**	**50%**
81 Ranger Cr.								
Alt. 1	$6,300	$5,400	$5,000	$4,600	$4,300	$3,800	$3,600	$3,200
Alt. 2	$6,300	$5,400	$5,000	$4,600	$4,300	$3,800	$3,600	$3,200
Alt. 3	$4,200	$3,300	$0	$0	$0	$0	$0	$0
103 Ranger Cr.								
Alt. 1	$22,000	$19,400	$18,300	$17,100	$15,200	$12,300	$11,400	$10,100
Alt. 2	$22,000	$19,400	$18,300	$17,100	$15,200	$12,300	$11,400	$10,100
Alt. 3	$14,900	$10,800	$3,800	$3,500	$3,300	$3,100	$2,900	$2,700
25 Ranger Cr.								
Alt. 1	$6,800	$6,200	$5,900	$5,600	$5,300	$4,900	$4,600	$4,300
Alt. 2	$6,800	$6,200	$5,900	$5,600	$5,300	$4,900	$4,600	$4,300
Alt. 3	$5,400	$4,700	$4,600	$4,400	$4,300	$4,100	$4,000	$3,800
23 Ranger Cr.								
Alt. 1	$7,000	$6,700	$6,500	$6,300	$6,000	$5,600	$5,200	$4,700
Alt. 2	$7,000	$6,700	$6,500	$6,300	$6,000	$5,600	$5,200	$4,700
Alt. 3	$6,100	$5,300	$5,200	$5,000	$4,800	$4,400	$4,100	$3,800
21 Ranger Cr.								
Alt. 1	$5,500	$5,300	$4,900	$4,700	$4,400	$4,100	$3,800	$3,300
Alt. 2	$5,500	$5,300	$4,900	$4,700	$4,400	$4,100	$3,800	$3,300
Alt. 3	$4,500	$3,900	$3,700	$3,500	$3,400	$3,000	$2,700	$1,000
I-10 (FR-EB)								
Alt. 1	$26,149	$19,188	$16,525	$0	$0	$0	$0	$0
Alt. 2	$26,149	$19,188	$16,525	$0	$0	$0	$0	$0
Alt. 3	$26,214	$19,184	$0	$0	$0	$0	$0	$0
I-10 (FR-WB)								
Alt. 1	$26,100	$19,200	$16,500	$0	$0	$0	$0	$0
Alt. 2	$26,100	$19,200	$16,500	$0	$0	$0	$0	$0
Alt. 3	$26,200	$19,200	$0	$0	$0	$0	$0	$0
Johns Rd.								
Alt. 1	$44,800	$38,300	$28,900	$20,200	$0	$0	$0	$0
Alt. 2	$44,800	$38,300	$28,900	$20,200	$0	$0	$0	$0
Alt. 3	$45,500	$26,200	$20,200	$0	$0	$0	$0	$0
School St.								
Alt. 1	$21,700	$19,800	$19,000	$17,600	$14,800	$13,500	$12,500	$11,100
Alt. 2	$21,700	$19,800	$19,000	$17,600	$14,800	$13,500	$12,500	$11,100
Alt. 3	$21,900	$19,000	$17,700	$15,100	$14,000	$12,800	$11,900	$10,600
San Antonio Ave.								
Alt. 1	$44,100	$40,000	$38,800	$28,400	$0	$0	$0	$0
Alt. 2	$44,100	$40,000	$38,800	$28,400	$0	$0	$0	$0
Alt. 3	$44,400	$39,400	$32,300	$0	$0	$0	$0	$0

Theissen St.								
Alt. 1	$70,800	$67,900	$65,000	$53,800	$46,000	$42,100	$40,400	$38,100
Alt. 2	$70,800	$67,900	$65,000	$53,800	$46,000	$42,100	$40,400	$38,100
Alt. 3	$71,000	$66,500	$55,800	$47,500	$43,400	$41,200	$39,600	$37,600
US 87 & Main St								
Alt. 1	$101,800	$90,700	$86,600	$67,000	$29,100	$0	$0	$0
Alt. 2	$101,800	$90,700	$86,600	$67,000	$29,100	$0	$0	$0
Alt. 3	$102,500	$88,900	$73,500	$29,900	$27,200	$0	$0	$0
US 87 and Main St. (Right Turn)								
Alt. 1	$28,700	$27,600	$24,300	$20,100	$18,600	$17,000	$0	$0
Alt. 2	$28,700	$27,600	$24,300	$20,100	$18,600	$17,000	$0	$0
Alt. 3	$28,700	$25,000	$22,800	$19,000	$17,700	$16,200	$0	$0
Herff Rd. (Southbound)								
Alt. 1	$102,400	$85,800	$61,000	$52,500	$45,600	$35,800	$28,700	$25,200
Alt. 2	$101,800	$64,900	$55,100	$48,400	$42,000	$31,400	$27,900	$23,900
Alt. 3	$101,800	$64,900	$55,100	$48,400	$42,000	$31,400	$27,900	$23,900
Herff Rd. (Northbound)								
Alt. 1	$92,200	$68,100	$45,900	$41,000	$38,600	$31,000	$27,400	$25,200
Alt. 2	$92,200	$68,100	$45,900	$41,000	$38,600	$31,000	$27,400	$25,200
Alt. 3	$92,100	$51,800	$42,500	$39,700	$37,200	$28,800	$26,900	$21,200
Total								
Alt. 1	$611,900	$500,400	$426,600	$338,700	$228,000	$170,100	$137,600	$125,000
Alt. 2	$611,900	$500,400	$426,600	$338,700	$228,000	$170,100	$137,600	$125,000
Alt. 3	$601,100	$429,000	$337,100	$216,200	$197,300	$145,100	$120,000	$104,600

Alternative 1 – No Action/FWOFI
Alternative 2 – Federal Decommission (FWFI)
Alternative 3 – High Hazard Potential Rehabilitation (FWFI)

Potential detours associated with closed and flooded roads were not estimated as part of the analysis.

Roadway Mitigation

To continue providing downstream flood protection as required to meet the Purpose and Need of the project, mitigation for additional flood impacts would be included in Alternative 2 – Federal Decommissioning (FWFI). Alternative 2 would cause increased flooding on 14 roads in the 1% AEP, 24-hour flood. Of the 14 roads with increased flooding, only the I-10 W frontage road would have barricades with flood warning lights installed on warn motorists of the flooding. The depth of flooding on this frontage road would increase from -1.1 feet in the existing condition to 1.5 feet in Alternative 2. All of the other road crossings with increased flooding have flooding depths between 1.1 feet and 17.6 feet in the existing condition and would not be passable. No barricades or flood warning lights would be installed on private driveways. The cost estimate for the flood warning system with automatic roadway barriers is $120,000[8]. The system includes an ALERT2 Master Gauging Station, 2 Advance Warning Systems with automatic barrier gates, installation, monitoring software and subscription service, and training for a single crossing location.

[8] Estimated based on quote received from High Sierra Electronics on November 11, 2021

The analysis estimated the benefits to roads and bridges from the evaluated alternatives (**Table D-10**).

Table D-10. Summary of Roads and Bridges Average Annual Benefits

Project Alternative	Total Roads and Bridges Benefits
Alternative 1 – No Action/FWOFI	N/A
Alternative 2 – Federal Decommissioning (FWFI)	$0
Alternative 3 – High Hazard Potential Rehabilitation (FWFI)	$13,000

[1] 2021 price level, 2.5% discount rate, 103-year period of analysis

D.3.2.6 Sediment and Erosion

Sediment and erosion damages included in the analysis (**Table D-11**) were based on the 1986 Upper Cibolo Creek Watershed Work Plan and updating benefits to 2021 dollars. The 1966 Work Plan included the analysis of four structures for flood mitigation. For this analysis, only one-fourth of the benefits in the Work Plan were included. The floodwater detention of Alternative 3 would provide approximately $1,000 in annual average sediment and erosion control benefits.

Table D-11. Sediment and Erosion Damage Reduction

Benefit Item	Average Annual Damage Reduction (1968$)	Average Annual Damage Reduction (2021$)
Sediment - Overbank Deposition	$70	$430
Erosion - Flood Plain Scour	$30	$160

D.3.2.7 Recreation

The existing reservoir behind FRS No. 2 provides recreation opportunities to the owners of the property. While recreation benefits were considered, there is no public access to the reservoir, limiting public benefit. Resultantly, recreation benefits associated with the reservoirs were not quantified.

D.3.2.8 Agricultural Land Damages

While there are some agricultural cropland and pasture located downstream of FRS No. 2 along Ranger Creek and Cibolo Creek, there is very little of it that would be impacted by flooding in the existing condition or by any of the proposed alternatives. The decommissioning alternatives (Alternative 1 and Alternative 2), would only result in approximately 6.3 acres of agricultural land being impacted in the 0.2% AEP storm event. Alternative 3 (High Hazard) would result in approximately 5.5 areas of agricultural land being impacted in the 0.2% AEP event. As a result of the small impacts to agricultural land, agricultural land damages and benefits were excluded from the analysis.

D.3.2.9 Benefit Summary

The following summarizes the benefits quantified for each project alternative. The benefits were evaluated over the 103-year period of analysis using the fiscal year (FY) 2022 Federal water resources discount rate of 2.5%. A summary of economic benefits is provided in **Table D-12**.

Table D-12. Summary of FWFI Economic Benefits

Project Alternative	Structure-Related Benefits	Debris Removal Damages Avoided	Road/ Bridge Damages Avoided	Sediment and Erosion Damages Avoided	Total Benefits
Alternative 2 – Federal Decommissioning (FWFI)	$177,000	$5,000	$0	$0	$181,000
Alternative 3 – High Hazard Potential Rehabilitation (FWFI)	$103,000	$3,000	$13,000	$1,000	$120,000

Notes: 2021 price level, 2.5% discount rate, 103-year period of analysis. Rounding may impact total values.

D.3.3 Cost Analysis

The costs of implementation for the selected alternative are summarized in **Table D-13**. Note that the costs presented in this table are not annualized.

Table D-13. Design and Construction Cost of Alternative Implementation

Item	Alternative 1 – No Action/FWOFI	Alternative 2 – Federal Decommissioning (FWFI)	Alternative 3 – High Hazard Potential Rehabilitation (FWFI)
Construction Cost	$428,000	$535,000	$4,944,000
Design and Engineering	$43,000	$53,000	$494,000
Permitting and Legal	$9,000	$11,000	$99,000
Contract Administration	$51,000	$64,000	$593,000
Design, Permitting, Contingency Cost	$133,000	$167,000	$1,562,000
Total	**$664,000**	**$830,000**	**$7,692,000**

Notes: 2021 price level

As discussed in previous sections, mitigation measures were included for Alternative 2 to account for induced flooding. Any structure that received flooding above the FFE for the 1% AEP storm event was mitigated for induced flooding. If a structure was inundated by 1 foot or more of flooding at the 1% AEP storm event the property would be acquired, and the structure demolished. If a structure was inundated by less than 1 foot of flooding at the 1% AEP storm event, the structure was dry floodproofed to a height of 3 feet above the FFE. In total, 39 structures were identified for acquisition and 49 structures for dry floodproofing. For structures that would be acquired, the cost of acquisition was based on the value of the property and general costs related to the process (**Table D-14**). The cost to acquire and floodproof the 88 structures is estimated at approximately $23 million. For structure being floodproofed, the costs were based on general costs for the process. For roads and bridges, $120,000 was included for a flood warning system at one road.

Table D-14. Costs for Acquisition and Dry Floodproofing

Item	Cost
Structure Acquisition	
Property value	Appraised Value
Relocation assistance (per structure)	$50,000
Real estate/administration fees (per structure)	$10,000
Demolition (per structure)	$50,000
Structure Dry Floodproofing	
Average cost of dry floodproofing (per structure)	$12,000
Floodproof entry door (per door)	$4,000
Entry doors per structure	2
Incidentals	20%

Average annual costs associated with the options include costs for design and construction, operation and maintenance (O&M), property acquisition and floodproofing, and mitigation of bridges and roads are shown in **Table D-15**.

Table D-15. Total Project Costs

Project Alternative	Construction Costs	Bridge/ Road Costs	Acquisition/ DFP Costs	Total Capital Cost	Annual O&M Costs	Average Annual Costs
Alternative 1 – No Action/ FWOFI	$664,000	$0	$0	$664,000	$0	$18,000
Alternative 2 – Federal Decommis-sioning (FWFI)	$830,000	$120,000	$22,708,000	$23,658,000	$0	$647,000
Alternative 3 – High Hazard Potential Rehabilitation (FWFI)	$7,692,000	$0	$0	$7,692,000	$5,000	$223,000

Note: 2021 price level, 2.5% discount rate, 103-year period of analysis. Average annual cost includes interest during construction applied to the construction costs.

D.3.4 Results of National Economic Analysis

Average annual net benefits and benefit-cost ratios (BCR) for the FWFI alternatives are shown in **Table D-16.** The FWFI alternative with the greatest annual net benefit as well as the highest BCR is Alternative 3.

Table D-16. Evaluation of FWFI Alternatives

Project Alternative	Average Annual Benefits	Average Annual Costs	BCR	Annual Net Benefits
Alternative 2 – Federal Decommissioning (FWFI)	$181,000	$647,000	0.3	-$466,000
Alternative 3 – High Hazard Potential Rehabilitation (FWFI)	$120,000	$223,000	0.5	-$103,000

Notes: 2021 price level, 2.5% discount rate, 103-year period of analysis

Upstream of the FRS No. 2, there are no homes below the existing or proposed top of dam elevation for Alternative 3. There are also no known public utilities, water sources, or public roads that would experience induced flooding with implementation of the preferred alternative. While large-scale develop of the watershed is not anticipated, low-density residential development is expected to continue both upstream and downstream of FRS No. 2. This development is not anticipated to have an impact on the functioning of the dam or change the flooding conditions.

Downstream of FRS No. 2, preliminary modeling indicated that Alternative 3 for FRS No. 2 with a principal spillway conduit diameter of 36 inches would cause minimal increases in flood depth at 41 residential and nonresidential structures downstream of FRS No. 2 during the 50% AEP through 1% AEP events. The maximum increase for the 1% AEP event is 0.07 foot and the average increase is 0.05 foot. Thus, no significant induced flooding of residential structures or transportation infrastructure is estimated to occur.

D.3.5 Regional Economic Analysis

A regional economic analysis was conducted to estimate the regional impacts of the construction activities for the FWFI alternatives, and the value-added flood damage reduction benefits. Since most of the local cost-share dollars would be funded by a Texas State Government agency, not the county, the entire state was used as the economic impacted area. The IMPLAN model was used to conduct the analysis following standard NRCS procedures. The analysis was conducted for Alternative 3 (Recommended Plan), while the calculated multipliers were used to estimate the impacts of Alternative 2. The detailed results for Alternative 3 are provided below and a summary of the results for both Alternative 2 and Alternative 3 are provided in the main narrative.

For the analysis:

- Reduced flood damages were modeled as increased household income.
- Reduced crop damages were modeled as increased farm income.
- Reduced infrastructure damages would reduce local expenditures and were modeled as increased household income from reduced taxes.

Table D-17 provides the results of the regional economic analysis for Alternative 3 during both the construction period and the operational period.

Table D-17. Regional Economic Impacts for Alternative 3

Impact Type	Employment	Labor Income	Value Added	Output
Construction Period *(Total Impacts during Construction)*				
Direct Effect	35.9	$2,984,000	$3,967,000	$7,692,000
Indirect Effect	19.1	$1,349,000	$2,216,000	$4,387,000
Induced Effect	24.6	$1,304,000	$2,260,000	$4,029,000
Total Effect	**79.6**	**$5,636,000**	**$8,444,000**	**$16,108,000**
Operational Period *(Annual Impacts)*				
Direct Effect	0	$120,000	$120,000	$120,000
Indirect Effect	0	$0	$0	$0
Induced Effect	0.8	$43,000	$75,000	$133,000
Total Effect	**0.8**	**$163,000**	**$194,000**	**$253,000**

D.4 HYDROLOGY AND HYDRAULICS

D.4.1 Project Setting and Data Sources

FRS No. 2 is located on Ranger Creek, tributary to Upper Cibolo Creek, in the south-west portion of Kendall County. The dam is approximately 4 miles west of Boerne and approximately 31 driving miles from San Antonio. New hydrologic (HEC-HMS, SITES) models were created for the area upstream of FRS No. 2 and the area contributing to Upper Cibolo Creek from the upstream extent to a location approximately 2.8 miles upstream of the point where it crosses the Kendall County line, with watershed breaks at dams and at stream crossings that were considered in hydraulic modeling.

The following data sources were used in the development of these models:

- Texas Natural Resource Information System (TNRIS). StratMap Program 50-cm resolution Light Detection and Ranging (LiDAR) for Bexar County. Data collected by TerraPoint May- August 2010 with third-party quality assurance/quality control by Dewberry. Published January 28, 2011.
- Texas Natural Resource Information System (TNRIS). StratMap Program 50-cm resolution Light Detection and Ranging (LiDAR) for Blanco, Caldwell, Gonzales, Kendall, & Kerr Counties. Data collected by Merrick & Company January - March 2011 with third party quality assurance/quality control by URS. Published May 09, 2011.
- Texas Natural Resource Information System (TNRIS). StratMap Program 50-cm resolution Light Detection and Ranging (LiDAR) for Bandera and Lampasas Counties. Data collected by Fugro December 2013 - January 2014 with third party quality assurance/quality control by URS. Published August 13, 2014.
- National Land Cover Dataset (NLCD) 2019.
- SSURGO Soils Shapefile for Kendall County.

- Field measurements of culverts and bridges associated with the HEC-RAS modeling area collected December 2020.
- As-Built plans for Upper Cibolo Creek FRS Nos. 1, 2, 3, and 4.

D.4.2 Summary of Modeling Procedures and Results

D.4.2.1 SITES Modeling

The dam hydraulic and hydrologic site computer analysis program SITES was used to:

- Develop design inflow hydrographs;
- Develop storage-discharge relationships;
- Model the PSH to size the principal spillway conduit and set the crest of the auxiliary spillway channel;
- Model the Stability Design Hydrograph (SDH) and the Freeboard Hydrograph (FBH) events;
- Evaluate integrity of the existing and proposed auxiliary spillway; and
- Set top of dam elevation.

The 100-year PSH event was evaluated to select the new size of the principal spillway and set the crest of the auxiliary spillway. The rainfall values are provided in **Table D-18.**

The main goals in sizing this principal spillway system include:

- Meet the minimum NRCS size requirements for the principal spillway conduit.
- Safely pass the 1% AEP peak flow with minimal increase to the existing condition peak flow.
- Select a crest elevation of the principal spillway riser tower that provides 100 years of future submerged sediment storage.
- Select a crest elevation of the principal spillway riser tower that allows for proper hydraulics of the tower (i.e. minimum riser height equal to or greater than three times the pipe diameter).
- Select an auxiliary spillway crest elevation and width that minimizes the raise to the dam crest.

Two rainfall events evaluated for estimating the peak water surface elevation and setting the top-of-dam crest elevation, including the 6-hour PMP storm with a rainfall depth of 28.8 inches and the 24-hour PMP storm with a rainfall depth of 45.14 inches. The 6-hour PMP storm proved to be the most conservative design storm in setting the top of dam elevation for the high hazard rehabilitation option.

Table D-18. Upper Cibolo FRS No. 2 Rainfall Values

Storm Event	Source	Rainfall Depth (inches)
100-yr, 6-hour	NOAA Atlas 14, Volume 11, Version 2	9.3
100-yr, 24-hour		12.9
100-yr, 10-day		19.0
PMP 6-hr / (FBH)	TCEQ PMP GIS Tool	28.8
PMP 12-hr		37.2
PMP 24-hr / (FBH)		45.14
SDH 6-hr	TR-210-60 Figure 2-2	14.37

The results of the existing conditions SITES analysis are shown in **Table D-19**.

Table D-19. Upper Cibolo FRS No. 2 Existing Conditions SITES Results

Storm	Storm Duration (hrs)	Peak Reservoir Inflow (cfs)	Peak Reservoir Outflow (cfs)	Peak Reservoir Storage (ac-ft)	Peak WSE (ft)	Depth Flow Over Dam (ft)
PSH	24	6499	291	1146	1613.0	N/A
ASH	6	7194	1780	1228	1614.3	0.3
FBH	6	18129	11411	1552	1619.0	5.0
FBH	24	7732	7706	1440	1617.5	3.5

D.4.2.2 SITES Integrity Analysis Parameters

Geotechnical soil borings were not collected as subsurface investigation was not part of the project scope of work. Therefore, existing geotechnical and geologic data were used to estimate the stratigraphy and the subsurface material parameters. The available data sources and methodology used to develop estimates of SITES parameters to be used in the integrity analysis are described below. The results of the integrity analysis for Alternative 3 indicate that the proposed spillway does not breach during the 24-hour FBH using the estimated SITES parameters. The headcut extends to within 340 feet of the crest of the left bay of the auxiliary spillway and within 50 feet of the crest of the right bay of the auxiliary spillway.

The SITES integrity parameters were selected based on review of historical boring logs reported in the Detailed Geologic Investigation (GI) (McClelland, 1978a) and of laboratory testing results included in the Interpretation of Soil Test Data and Recommendations report (McClelland, 1978b). According to historical boring logs (McClelland, 1978a), the auxiliary spillway at FRS No. 2 is primarily underlain by limestone of the Upper Glen Rose formation. Lean clays (CL) were also identified in historical boreholes 201, located upstream of the control section, and 208, located near the exit channel. Because the plans contained in the original GI (McClelland, 1978a) do not clearly indicate whether the clayey stratum was fully excavated during construction of the present auxiliary spillway, this stratum was conservatively included in the selection of SITES parameters as these may be highly erodible in the event of spillway activation. A summary of the historical laboratory test data is provided in **Table D-20**.

Historical laboratory test results indicate the CL soils have average plasticity index (PI) of 18, average liquid limit of 37, average fines content of 48%, average clay fraction of 19%, and dispersion potential of less than 20% (generally non-dispersive). Unconfined compressive strength test results were not available; thus, unconfined strengths of 13.8 MPa and 27.6 MPa were conservatively estimated based on available published literature. Additionally, rock quality designation (RQD) of 12 to 35%, corresponding to the 33rd and 67th percentiles of the RQD data available (McClelland, 1978a), were employed in analyses. Headcut erodibility index (Kh) was computed considering both favorable and unfavorable soil index properties and bedrock strength to allow for comparison between the two scenarios and subsequent selection of SITES parameters that are representative of the conditions at the project site. As such, favorable and unfavorable Kh values of 0.11 and 0.22, respectively, were estimated for the lean clay (CL) stratum. Similarly, favorable and unfavorable Kh values of 44 and 256, respectively, were estimated for the limestone stratum. A summary of the recommended SITES integrity analysis input parameters is provided in **Table D-21**.

D.4.2.3 Stability Analysis

The existing Upper Cibolo Creek FRS No. 2 Auxiliary Spillway was constructed in rock that meets the criteria for in-situ rock auxiliary spillway requirements (TR-60 Page 7.7). The proposed modifications to the auxiliary spillway for Alternative 3 will also be constructed in rock that meets the criteria for the in-situ rock auxiliary spillway requirements, so a stability analysis was not required for the proposed spillway.

It should be noted that the proposed modifications will include an earthen cap over the in-situ rock auxiliary spillway. An earthen cap over in-situ rock auxiliary spillway has been allowed on other dam sites and has been allowed to erode under very large storm events. A concrete cutoff wall at the control section has been included in the proposed modifications to minimize erosion to the earthen cap.

D.4.2.4 Dam Breach and Population at Risk

Technical Release No. 210- 60 (TR-210-60) *Earth Dams and Reservoirs* (USDA NRCS, 2005) and TR-66 *Simplified Dam-Breach Routing Procedure* (NRCS SCS, 1985) breach criteria and procedures were used to estimate a breach discharge hydrograph as described in Section 3.19 of the *Supplemental Watershed Plan No. I and EA*. Fair weather conditions were assumed for the breach analyses. The initial reservoir pool elevation assumed for the breach scenario was static at top of dam with non-storm conditions downstream.

The population at risk (PAR) was estimated for the existing condition (i.e., with existing dam in place). It should be noted that estimating the PAR is based on professional judgment coupled with empirical data. PAR estimates were provided for motorists, residents, and other people located downstream that could be affected by flooding from a catastrophic failure of FRS dam.

Table D-20. Summary of Historical Laboratory Test Data by Stratum (1)

Stratum Description (USCS)	Thickness (ft)	USCS	N_{60} (bpf)	Undrained Shear Strength, S_u (psf)	Unconfined Compressive Strength, UCS (psf)	Unconfined Compressive Strength, UCS (kPa)	Dry Unit Weight (pcf)	LL	PI	Fines (%)	CF (%)	D_{75} (mm)	D_{50} (mm)	Dispersion Potential (%)
CL	0 - 10	CL	-	-	-	-	97.2 [2]	29 – 48 (37) [2]	12 – 28 (18) [2]	45 – 53 (48) [2]	12 - 26 (19) [2]	0.33 - 0.80 (0.54) [2]	0.035 - 0.16 (0.10) [2]	9 -16 (14) [2]
Limestone	5 - 15	Limestone	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

Format of reported values is Minimum – Maximum (Average). Average value not reported when two of fewer results are available.
Historical test results for CL soils reported in the Detailed Geologic Investigation (McClelland, 1978a).
"-" indicates no data available at the time of this report.

Table D-21. Recommended Material Parameters for SITES Analysis of Existing Auxiliary Spillway

Stratum Description (USCS)	Thickness (ft)	USCS	Bounding Case	Dry Unit Weight (pcf)	N_{60} (bpf)	UCS (psi)	LL	PI	Clay Fraction [1] (%)	D_{75} (mm)	D_{50} (mm)	Derived Headcut Erodibility Index Parameters: Ms	Kb	Kd	Js	Kh
CL	0 - 10	CL	Unfavorable Values	95 [2]	-	25 [5]	40 [3]	21 [3]	22 [3]	0.38 [3]	0.06 [3]	0.11	1.0	1.0	1.0	**0.11**
			Favorable Values	105 [2]	-	45 [5]	31 [3]	14 [3]	15 [3]	0.70 [3]	0.15 [3]	0.22	1.0	1.0	1.0	**0.22**
Limestone	5 - 15	Limestone	Unfavorable Values	130 [4]	-	2,000 [4]	-	-	-	-	-	13.8	4.9	0.5	1.3	**44**
			Favorable Values	140 [4]	-	4,000 [4]	-	-	-	-	-	27.6	14.3	0.5	1.3	**256**

Notes:

"-" indicates no data available at the time of this report.
Estimated based on typical properties of CL soils per NAVFAC Design Manual 7.02 dated 1 September 1986.
Historical test results for CL soils reported in the Detailed Geologic Investigation (McClelland, 1978a).
Results reported are conservatively estimated based on literature available for moderately weak to moderately strong limestone.
Conservative estimate selected for analysis purposes only.

Guidance for Completion of "Evaluation of Potential Rehabilitation Projects" December 10, 2001, Updated July 5, 2013 was utilized to estimate PAR for residences and motorists downstream of the dam. According to the guidance, three people per residence are estimated to be at risk where floodwaters are greater or equal to 1.0 foot above natural ground elevation. For paved roads with predominantly local traffic, one vehicle per road with two people per vehicle are estimated to be at risk where floodwaters overtop the road deck at a depth of greater or equal to 1.0 foot.

The PAR for FRS No. 2 was estimated to be 372. All considered options would eliminate or greatly reduce the risk of catastrophic breach to the population downstream.

D.4.2.5 Statistical Storm Event Modeling

The effective FEMA Flood Zone for the reach of Ranger Creek upstream of FRS No. 2, through the auxiliary spillway, and into the downstream channel was developed in 1995 using detailed methods and is classified as zone AE. The reach downstream of FRS No. 2 was developed in 1995 using approximate methods and is classified as Zone A. The models were re-validated in May of 2020.

As the FEMA Flood Zone for the reach downstream of FRS No. 2 was not developed using detailed methods, new hydrologic and hydraulic models were developed for this study. The hydraulic model cross sections were developed from the current FEMA effective model cross sections and were modified as needed, and additional cross-sections were added.

HEC-HMS Hydrologic and HEC-RAS 1D Hydraulic Models

Hydrologic modeling was performed for the contributing drainage area upstream of FRS No. 2 and the Ranger Creek and Upper Cibolo Creek contributing watersheds downstream of FRS No. 2. A 1-D hydraulic (HEC-RAS) model was developed for the reach starting from the FRS No. 2 outlet on Ranger Creek to the confluence with Cibolo Creek, and for Cibolo Creek to the confluence with an unnamed tributary that is 1.9 miles downstream of Menger Creek. The spatial extent of the hydrologic model and major features are shown in **Figure D-1**. The locations of the hydraulic model cross sections are shown on **Figure D-2**. The modeling tasks performed are summarized as follows:

- Delineation of watersheds, including uncontrolled watersheds as well as watersheds controlled by FRS Nos. 1, 3, and 4;
- Estimation of rainfall depths for the 24-hour duration events with 50%, 20%, 10%, 4%, 2%, 1%, 0.5% and 0.2% AEP storm events using Atlas 14 rainfall data;
- Estimation of watershed time of concentration (Tc) by applying the NRCS Velocity Method for the FRS No. 2 upstream watershed and the NRCS Watershed lag time method for the remaining watersheds contributing to Upper Cibolo Creek;
- Estimation of watershed runoff curve numbers using 2019 NLCD and SSURGO soils data;
- Estimation of reach routing parameters using Muskingum-Cunge for the modeled reaches and Modified-Puls method where backwater effects were expected;

- Use of SITES program to develop rating curves for FRS Nos. 1, 3, and 4;
- Use of SITES program to evaluate rehabilitation alternatives for FRS No. 2 and develop rating curves associated with each alternative;
- Where needed, additional hydraulic model cross-sections were cut from a terrain based on the most recent elevation data available;
- Manning's n values were assigned based on land use, imagery and "Manning's n Values for Various Land Covers To Use for Dam Breach Analyses by NRCS in Kansas" table; and
- Cross culverts and bridge geometry entered based up field measurements, notes, and photos.

Table D-22. Upper Cibolo Creek FRS No. 2 Summary of HEC-HMS Hydrologic Parameters

Subbasin Name	Area (sq-mi)	CN	Lag (min)
CBC-001	19.56163	63.49	124.66
CBC-002	0.28725	60.51	35.37
UNT-001	1.900907	62.41	80.22
CBC-003	2.305288	60.66	94.45
RGC-001	2.571513	64.58	42.64
RGC-002	1.19145	59.63	70.87
CBC-004	2.027594	60.25	82.73
ESC-001	0.364701	64.1	37.97
CBC-005	0.149944	50.82	44.26
UNT-002	2.33204	63.39	78.57
CBC-006	0.681588	52.93	63.74
FRC-001	8.442929	63.83	85.21
FRC-002	0.258297	57.53	32.46
DHC-001	3.013697	64.67	38.18
DHC-002	1.325705	61.61	37.17
FRC-003	1.508996	56.55	79.44
UNT-FRC	1.516419	63.83	45.13
FRC-004	1.016893	60.97	65.92
CBC-007	0.38535	64.96	37.93
UNT-003	1.837436	61.95	101.53
CBC-008	0.220201	55.94	36.99
CYC-001	2.949956	64.53	109.62
CBC-009	0.354803	46.97	64.64
MGC-001	6.753868	64.06	99.42
CBC-010	0.900887	62.97	65.00
UNT-004	4.229144	62.9	110.59
CBC-011	1.599798	62.94	77.57
UNT-005	2.639962	66.21	102.67

Water surface elevations for the 4%, 2%, 1%, 0.2% AEP event at each HEC-RAS 1D cross section are shown in **Table D-23** to **Table D-26** for the existing conditions, Alternative 1 - No Action/FWOFI, Alternative 2 - Decommission Alternative, and Alternative 3 – High Hazard Rehabilitation (the preferred alternative) for FRS No. 2.

Table D-23. 4% AEP Event HEC-RAS 1D Water Surface Elevation Comparison

Cross Section	4% AEP Event WSE (ft)		
	Existing Conditions	Alternative 1 - No Action/FWOFI And Alternative 2 - Decommission	Alternative 3 – High Hazard Rehabilitation
56270	1560.63	1567.03	1561.34
55983	1559.66	1564.97	1560.18
55401	1552.4	1559.03	1553.1
55000	1547.44	1551.75	1548.08
53943	1537.87	1543.71	1538.54
53409	1532.98	1540.31	1533.72
53232	1532.33	1538.48	1533.03
53200	81 Ranger Creek Rd (Private)		
53112	1530.1	1535.87	1530.54
52884	1526.09	1530.72	1526.57
52367	1522.32	1527.85	1522.99
51976	1522.03	1527.94	1522.75
51900	103 Ranger Creek Rd (Private)		
51799	1517.27	1524.15	1518.03
51228	1513.59	1519.93	1514.39
50353	1505.54	1513.01	1506.36
49695	1500.9	1511.26	1501.88
49670	51 Ranger Creek Rd (Private)		
49392	1497.9	1504.08	1498.62
49075	1495.53	1500.08	1496.04
48496	1491.42	1496.78	1491.92
47625	1483.11	1489.33	1483.64
46573	1473.31	1475.83	1473.5
45782	1467.75	1471.58	1467.88
45492	1466.23	1469.5	1466.38
45430	25 Ranger Creek Rd (Private)		
45384	1466	1469.28	1466.13
45375	1465.88	1468.72	1466.01
45322	23 Ranger Creek Rd (Private)		

Cross Section	4% AEP Event WSE (ft)		
	Existing Conditions	Alternative 1 - No Action/FWOFI And Alternative 2 - Decommission	Alternative 3 – High Hazard Rehabilitation
45254	1465.15	1468.06	1465.29
45246	1465.19	1468.28	1465.33
45202	21 Ranger Creek Rd (Private)		
45117	1463.06	1466.04	1463.18
44653	1457.01	1458.95	1457.12
44066	1453.81	1457.39	1453.96
43107	1446.68	1450.24	1446.8
42208	1441.03	1443.04	1441.12
41967	1440.51	1442.41	1440.6
41800	I-10 Frontage Road (Eastbound)		
41665	1439.78	1441.62	1439.86
41646	1439.46	1441.31	1439.54
41572	I-10		
41524	1438.15	1440.05	1438.23
41499	1438.11	1440.01	1438.19
41350	I-10 Frontage Road (Westbound)		
41307	1437.33	1439.13	1437.42
40965	1436.44	1437.96	1436.51
40377	1434.91	1436.54	1434.97
39299	1428.78	1429.91	1428.83
38280	1425.8	1427.26	1425.86
37659	1423.07	1424.61	1423.14
36958	1420.91	1422.55	1420.98
36603	1419.03	1420.5	1419.09
36086	1417.46	1419.06	1417.52
35621	1416.4	1418.1	1416.46
35203	1415.49	1417.11	1415.55
34727	1414.33	1415.55	1414.38
33834	1412.51	1413.83	1412.56
33381	1411.6	1412.91	1414.18
32962	1410.09	1411.37	1412.67
31966	1407.13	1408.48	1410.17
31550	1405.99	1407.39	1409.34
31312	1405.67	1407.13	1409.23
30968	1404.83	1406.2	1408.57

Cross Section	**4% AEP Event WSE (ft)**		
	Existing Conditions	**Alternative 1 - No Action/FWOFI And Alternative 2 - Decommission**	**Alternative 3 – High Hazard Rehabilitation**
30920	Johns Road		
30778	1403.35	1404.62	1405.87
30352	1401.49	1402.38	1403.94
29835	1400.69	1401.86	1403.94
29403	1399.02	1400.14	1402.94
29121	1398.32	1399.48	1402.71
29010	School Street		
28937	1397.05	1398.68	1402.3
28349	1396.32	1397.99	1402.02
27990	1396.07	1397.87	1402.02
27678	1395.19	1397.11	1401.64
27551	1394.84	1396.76	1401.45
27457	San Antonio Ave		
27363	1394.07	1396.17	1400.81
27009	1393.69	1395.94	1400.79
26650	1393.28	1395.56	1400.79
26205	1392.92	1395.6	1400.76
25986	Theissen Street		
25879	1392.93	1395.59	1400.72
25572	1392.38	1395.22	1400.5
25053	1390.98	1394.53	1400.23
25017	US 87		
24938	1390.22	1392.75	1397.47
24916	1390.36	1392.83	1397.47
24850	US 87 River Road Turn		
24816	1389.13	1390.59	1392.61
24566	1388.55	1389.96	1391.89
24110	1387.94	1389.27	1391.19
23675	1387.41	1388.58	1390.44
23330	1385.99	1386.92	1388.56
23263	Inline Structure – River Road Park		
23185	1383.6	1384.74	1387.15
22814	1383.55	1384.71	1387.15
22448	1382.58	1383.55	1385.53
22066	1381.74	1382.68	1384.6

Cross Section	4% AEP Event WSE (ft)		
	Existing Conditions	Alternative 1 - No Action/FWOFI And Alternative 2 - Decommission	Alternative 3 – High Hazard Rehabilitation
21373	1378.61	1379.31	1381.83
20984	1379.02	1379.85	1381.83
20925	Herff Road (Southbound)		
20906	1378.53	1379.33	1381.33
20895	1378.58	1379.38	1381.33
20800	Herff Road (Northbound)		
20729	1377.71	1378.49	1380.51
20428	1377.3	1378.08	1380.06
19759	1375.61	1376.37	1378.38
19290	1374.83	1375.59	1377.64
18831	1374.05	1374.87	1377.14
18093	1371.67	1372.49	1374.69
17015	1368.72	1369.5	1371.72
16568	1367.74	1368.48	1370.8
15821	1366.03	1366.73	1369.39
14915	1363	1363.71	1366.43
13989	1361.96	1362.77	1365.82
13077	1358.94	1359.57	1362.12
11884	1357.61	1358.29	1361.14
11218	1355.73	1356.22	1358.8
10687	1353.54	1354.06	1356.72
9522	1349.64	1350.41	1354.04
8861	1347.86	1348.84	1353.28
8195	1346.26	1347.61	1352.63
7413	1343.35	1345.73	1351.22
6544	1343.59	1345.7	1350.87
6490	Old Railroad		
6414	1328.1	1329.35	1335.18
5265	1322.26	1323.04	1322.3
4097	1319.42	1320.11	1323.3
3239	1312.84	1313.47	1316.45
2107	1311.59	1312.18	1315.12
1261	1308.96	1309.48	1312.16

Table D-24. 2% AEP Event HEC-RAS 1D Water Surface Elevation Comparison

Cross Section	2% AEP Event WSE (ft)		
	Existing Conditions	Alternative 1 - No Action/FWOFI And Alternative 2 - Decommission	Alternative 3 – High Hazard Rehabilitation
56270	1560.66	1567.84	1561.39
55983	1559.68	1565.83	1560.23
55401	1552.43	1560.14	1553.16
55000	1547.47	1552.33	1548.13
53943	1537.9	1544.66	1538.59
53409	1533.02	1541.25	1533.78
53232	1532.34	1539.39	1533.14
53200	81 Ranger Creek Rd (Private)		
53112	1530.12	1536.85	1530.58
52884	1526.12	1531.65	1526.61
52367	1522.35	1528.41	1523.05
51976	1522.08	1528.71	1522.81
51900	103 Ranger Creek Rd (Private)		
51799	1517.3	1525.15	1518.09
51228	1513.62	1520.69	1514.45
50353	1505.58	1514	1506.43
49695	1500.94	1510.94	1501.96
49670	51 Ranger Creek Rd (Private)		
49392	1497.93	1505.71	1498.67
49075	1495.55	1500.4	1496.08
48496	1491.44	1497.71	1491.95
47625	1483.13	1490.39	1483.68
46573	1473.38	1476.21	1473.57
45782	1468.22	1472.73	1468.35
45492	1466.74	1470.12	1466.82
45430	25 Ranger Creek Rd (Private)		
45384	1466.43	1469.89	1466.49
45375	1466.32	1469.6	1466.35
45322	23 Ranger Creek Rd (Private)		
45254	1465.58	1468.61	1465.7
45246	1465.64	1468.93	1465.76
45202	21 Ranger Creek Rd (Private)		
45117	1463.48	1466.83	1463.6

Cross Section	2% AEP Event WSE (ft)		
	Existing Conditions	**Alternative 1 - No Action/FWOFI And Alternative 2 - Decommission**	**Alternative 3 – High Hazard Rehabilitation**
44653	1457.4	1459.51	1457.51
44066	1454.28	1458.37	1454.4
43107	1447.14	1451.23	1447.28
42208	1442.28	1444.5	1442.35
41967	1441.7	1443.75	1441.77
41800	I-10 Frontage Road (Eastbound)		
41665	1440.93	1442.93	1441
41646	1440.62	1442.6	1440.69
41572	I-10		
41524	1439.31	1441.45	1439.39
41499	1439.28	1441.4	1439.35
41350	I-10 Frontage Road (Westbound)		
41307	1438.46	1440.36	1438.53
40965	1437.4	1438.97	1437.46
40377	1435.96	1437.63	1436.02
39299	1429.3	1430.87	1429.34
38280	1426.91	1428.53	1426.97
37659	1424.29	1425.94	1424.34
36958	1422.19	1424.01	1422.25
36603	1420.18	1421.82	1420.23
36086	1418.75	1420.51	1418.81
35621	1417.8	1419.61	1417.86
35203	1416.87	1418.66	1416.93
34727	1415.5	1416.87	1415.54
33834	1413.79	1415.32	1413.83
33381	1412.86	1414.38	1414.18
32962	1411.32	1412.87	1412.67
31966	1408.44	1410.42	1410.17
31550	1407.35	1409.62	1409.34
31312	1407.09	1409.52	1409.23
30968	1406.17	1408.88	1408.57
30920	Johns Road		
30778	1404.64	1405.96	1405.87
30352	1402.39	1403.9	1403.94
29835	1401.89	1403.93	1403.94

Cross Section	2% AEP Event WSE (ft)		
	Existing Conditions	**Alternative 1 - No Action/FWOFI And Alternative 2 - Decommission**	**Alternative 3 – High Hazard Rehabilitation**
29403	1400.23	1402.84	1402.94
29121	1399.61	1402.58	1402.71
29010	School Street		
28937	1398.99	1402.15	1402.3
28349	1398.41	1401.77	1402.02
27990	1398.34	1401.83	1402.02
27678	1397.72	1401.41	1401.64
27551	1397.43	1401.2	1401.45
27457	San Antonio Ave		
27363	1397.01	1400.43	1400.81
27009	1396.86	1400.38	1400.79
26650	1396.57	1400.16	1400.79
26205	1396.63	1400.26	1400.76
25986	Theissen Street		
25879	1396.65	1400.23	1400.72
25572	1396.32	1400.02	1400.5
25053	1395.74	1399.72	1400.23
25017	US 87		
24938	1393.64	1396.57	1397.47
24916	1393.71	1396.6	1397.47
24850	US 87 River Road Turn		
24816	1391.02	1392.22	1392.61
24566	1390.39	1391.51	1391.89
24110	1389.73	1390.87	1391.19
23675	1389.01	1390.15	1390.44
23330	1387.27	1388.28	1388.56
23263	Inline Structure – River Road Park		
23185	1385.33	1386.6	1387.15
22814	1385.32	1386.63	1387.15
22448	1384.06	1385.13	1385.53
22066	1383.16	1384.21	1384.6
21373	1379.79	1380.57	1381.83
20984	1380.38	1381.34	1381.83
20925	Herff Road (Southbound)		
20906	1379.88	1380.81	1381.33

Cross Section	2% AEP Event WSE (ft)		
	Existing Conditions	Alternative 1 - No Action/FWOFI And Alternative 2 - Decommission	Alternative 3 – High Hazard Rehabilitation
20895	1379.93	1380.86	1381.33
20800	Herff Road (Northbound)		
20729	1379.09	1379.97	1380.51
20428	1378.67	1379.55	1380.06
19759	1376.97	1377.86	1378.38
19290	1376.21	1377.11	1377.64
18831	1375.54	1376.51	1377.14
18093	1373.16	1374.09	1374.69
17015	1370.19	1371.05	1371.72
16568	1369.23	1370.07	1370.8
15821	1367.68	1368.47	1369.39
14915	1364.68	1365.51	1366.43
13989	1363.88	1364.79	1365.82
13077	1360.52	1361.2	1362.12
11884	1359.35	1360.1	1361.14
11218	1357.26	1357.84	1358.8
10687	1355.05	1355.69	1356.72
9522	1351.72	1352.59	1354.04
8861	1350.5	1351.56	1353.28
8195	1349.59	1350.77	1352.63
7413	1348.04	1349.27	1351.22
6544	1347.85	1349.01	1350.87
6490	Old Railroad		
6414	1331.71	1333.08	1335.18
5265	1324.58	1325.41	1324.6
4097	1321.58	1322.28	1323.3
3239	1314.64	1315.32	1316.45
2107	1313.4	1314.02	1315.12
1261	1310.6	1311.16	1312.16

Table D-25. 1% AEP Event HEC-RAS 1D Water Surface Elevation Comparison

Cross Section	1% AEP Event WSE (ft)		
	Existing Conditions	Alternative 1 - No Action/FWOFI And Alternative 2 - Decommission	Alternative 3 – High Hazard Rehabilitation
56270	1562.03	1568.63	1561.45
55983	1560.71	1566.64	1560.27
55401	1553.84	1561.27	1553.22
55000	1548.72	1552.96	1548.18
53943	1539.22	1545.56	1538.65
53409	1534.42	1542.06	1533.84
53232	1533.6	1540.67	1533.13
53200	81 Ranger Creek Rd (Private)		
53112	1531.02	1537.77	1530.61
52884	1526.95	1532.57	1526.65
52367	1523.68	1528.69	1523.1
51976	1523.46	1529.28	1522.86
51900	103 Ranger Creek Rd (Private)		
51799	1518.72	1525.97	1518.15
51228	1515.21	1521.72	1514.52
50353	1506.99	1515.6	1506.49
49695	1502.84	1510.32	1502.04
49670	51 Ranger Creek Rd (Private)		
49392	1499.24	1506.58	1498.72
49075	1496.51	1502.59	1496.12
48496	1492.39	1498.69	1491.99
47625	1484.13	1491.43	1483.72
46573	1473.82	1476.59	1473.69
45782	1468.7	1473.79	1468.83
45492	1467.19	1471.1	1467.29
45430	25 Ranger Creek Rd (Private)		
45384	1466.86	1470.45	1466.94
45375	1466.74	1470.2	1466.81
45322	23 Ranger Creek Rd (Private)		
45254	1466.01	1468.84	1466.11
45246	1466.08	1469.4	1466.18
45202	21 Ranger Creek Rd (Private)		
45117	1463.9	1467.71	1464.01

Cross Section	1% AEP Event WSE (ft)		
	Existing Conditions	**Alternative 1 - No Action/FWOFI And Alternative 2 - Decommission**	**Alternative 3 – High Hazard Rehabilitation**
44653	1457.8	1460.01	1457.9
44066	1454.76	1459.36	1454.88
43107	1447.62	1452.21	1447.75
42208	1443.37	1446.04	1443.44
41967	1442.71	1445.29	1442.78
41800	I-10 Frontage Road (Eastbound)		
41665	1441.91	1444.17	1441.98
41646	1441.6	1443.83	1441.66
41572	I-10		
41524	1440.37	1442.66	1440.44
41499	1440.32	1442.63	1440.39
41350	I-10 Frontage Road (Westbound)		
41307	1439.42	1441.57	1439.48
40965	1438.21	1439.91	1438.26
40377	1436.84	1438.63	1436.89
39299	1430.03	1431.79	1430.08
38280	1427.95	1429.86	1428
37659	1425.36	1427.32	1425.41
36958	1423.39	1425.49	1423.44
36603	1421.29	1423.12	1421.34
36086	1419.99	1421.89	1420.04
35621	1419.11	1421.02	1419.16
35203	1418.2	1420.16	1418.25
34727	1416.66	1418.19	1416.7
33834	1415.07	1416.83	1415.11
33381	1414.13	1415.88	1414.18
32962	1412.62	1414.46	1412.67
31966	1410.1	1412.25	1410.17
31550	1409.27	1411.62	1409.34
31312	1409.15	1411.57	1409.23
30968	1408.49	1411.09	1408.57
30920	Johns Road		
30778	1405.83	1407.29	1405.87
30352	1403.87	1405.2	1403.94
29835	1403.89	1405.49	1403.94

Cross Section	1% AEP Event WSE (ft)		
	Existing Conditions	**Alternative 1 - No Action/FWOFI And Alternative 2 - Decommission**	**Alternative 3 – High Hazard Rehabilitation**
29403	1402.89	1404.38	1402.94
29121	1402.66	1404.15	1402.71
29010	School Street		
28937	1402.25	1403.7	1402.3
28349	1401.91	1403.61	1402.02
27990	1401.97	1403.56	1402.02
27678	1401.59	1403.06	1401.64
27551	1401.4	1402.84	1401.45
27457	San Antonio Ave		
27363	1400.75	1402.16	1400.81
27009	1400.72	1402.14	1400.79
26650	1400.74	1402.2	1400.79
26205	1400.7	1402.15	1400.76
25986	Theissen Street		
25879	1400.67	1402.12	1400.72
25572	1400.45	1401.88	1400.5
25053	1400.17	1401.62	1400.23
25017	US 87		
24938	1397.33	1397.9	1397.47
24916	1397.36	1397.93	1397.47
24850	US 87 River Road Turn		
24816	1392.54	1393.77	1392.61
24566	1391.8	1393.05	1391.89
24110	1391.14	1392.37	1391.19
23675	1390.41	1391.6	1390.44
23330	1388.53	1389.63	1388.56
23263	Inline Structure – River Road Park		
23185	1387.07	1388.45	1387.15
22814	1387.12	1388.55	1387.15
22448	1385.51	1386.61	1385.53
22066	1384.57	1385.65	1384.6
21373	1380.99	1381.86	1381.83
20984	1381.81	1382.89	1381.83
20925	Herff Road (Southbound)		
20906	1381.26	1382.24	1381.33

Cross Section	1% AEP Event WSE (ft)		
	Existing Conditions	**Alternative 1 - No Action/FWOFI And Alternative 2 - Decommission**	**Alternative 3 – High Hazard Rehabilitation**
20895	1381.3	1382.29	1381.33
20800	Herff Road (Northbound)		
20729	1380.49	1381.46	1380.51
20428	1380.04	1381	1380.06
19759	1378.36	1379.34	1378.38
19290	1377.62	1378.56	1377.64
18831	1377.11	1378.25	1377.14
18093	1374.67	1375.71	1374.69
17015	1371.69	1372.64	1371.72
16568	1370.77	1371.71	1370.8
15821	1369.36	1370.3	1369.39
14915	1366.41	1367.31	1366.43
13989	1365.79	1366.82	1365.82
13077	1362.1	1362.81	1362.12
11884	1361.12	1361.92	1361.14
11218	1358.78	1359.42	1358.8
10687	1356.7	1357.35	1356.72
9522	1354.01	1354.74	1354.04
8861	1353.24	1354	1353.28
8195	1352.58	1353.32	1352.63
7413	1351.17	1351.53	1351.22
6544	1350.83	1351.18	1350.87
6490	Old Railroad		
6414	1335.14	1337.44	1335.18
5265	1326.6	1327.44	1326.62
4097	1323.29	1323.98	1323.3
3239	1316.42	1317.17	1316.45
2107	1315.1	1315.76	1315.12
1261	1312.15	1312.75	1312.16

Table D-26. 0.2% AEP Event HEC-RAS 1D Water Surface Elevation Comparison

Cross Section	0.2% AEP Event WSE (ft)		
	Existing Conditions	Alternative 1 - No Action/FWOFI and Alternative 2 - Decommission	Alternative 3 – High Hazard Rehabilitation
56270	1566.76	1570.5	1566.75
55983	1564.66	1569.32	1564.64
55401	1558.71	1563.04	1558.69
55000	1551.53	1554.97	1551.53
53943	1543.43	1547.94	1543.42
53409	1540.01	1543.5	1540
53232	1538.17	1543.05	1538.15
53200	81 Ranger Creek Rd (Private)		
53112	1535.54	1540.05	1535.52
52884	1530.43	1534.84	1530.42
52367	1527.64	1529.94	1527.78
51976	1527.68	1530.85	1527.84
51900	103 Ranger Creek Rd (Private)		
51799	1523.84	1527.46	1523.83
51228	1519.62	1523.97	1519.61
50353	1512.54	1518.53	1512.52
49695	1510.69	1512.5	1510.67
49670	51 Ranger Creek Rd (Private)		
49392	1504	1509.03	1503.99
49075	1499.74	1504.6	1499.73
48496	1496.44	1498.15	1496.44
47625	1489.04	1494.27	1489.02
46573	1475.67	1476.88	1475.67
45782	1472.03	1476.43	1472
45492	1469.81	1473.84	1469.8
45430	25 Ranger Creek Rd (Private)		
45384	1469.6	1472.73	1469.59
45375	1469.08	1471.99	1469.05
45322	23 Ranger Creek Rd (Private)		
45254	1468.22	1470.74	1468.2
45246	1468.48	1468.92	1468.46
45202	21 Ranger Creek Rd (Private)		
45117	1466.36	1470.11	1466.35
44653	1459.17	1461.07	1459.16

Cross Section	0.2% AEP Event WSE (ft)		
	Existing Conditions	**Alternative 1 - No Action/FWOFI and Alternative 2 - Decommission**	**Alternative 3 – High Hazard Rehabilitation**
44066	1456.83	1461.25	1456.81
43107	1454.19	1454.58	1454.16
42208	1453.04	1452.91	1453.01
41967	1452.55	1452.42	1452.52
41800	I-10 Frontage Road (Eastbound)		
41665	1451.27	1451.14	1451.24
41646	1451.12	1450.99	1451.09
41572	I-10		
41524	1450.28	1450.16	1450.26
41499	1450.27	1450.15	1450.24
41350	I-10 Frontage Road (Westbound)		
41307	1447.64	1447.48	1447.61
40965	1443.67	1443.6	1443.65
40377	1442.57	1442.5	1442.55
39299	1436.64	1436.53	1436.62
38280	1434.75	1434.62	1434.72
37659	1433.06	1432.92	1433.03
36958	1430.78	1430.66	1430.75
36603	1427.78	1427.66	1427.75
36086	1426.6	1426.48	1426.58
35621	1425.83	1425.7	1425.8
35203	1425.35	1425.21	1425.32
34727	1421.18	1421.1	1421.17
33834	1420.67	1420.56	1420.65
33381	1419.5	1419.4	1414.18
32962	1418.04	1417.93	1412.67
31966	1414.46	1414.4	1410.17
31550	1413.38	1413.33	1409.34
31312	1413.91	1413.84	1409.23
30968	1413.03	1412.96	1408.57
30920	Johns Road		
30778	1409.9	1409.81	1405.87
30352	1408.3	1408.19	1403.94
29835	1408.64	1408.55	1403.94
29403	1406.87	1406.79	1402.94
29121	1406.71	1406.63	1402.71

Cross Section	0.2% AEP Event WSE (ft)		
	Existing Conditions	**Alternative 1 - No Action/FWOFI and Alternative 2 - Decommission**	**Alternative 3 – High Hazard Rehabilitation**
29010	School Street		
28937	1406.2	1406.13	1402.3
28349	1406.23	1406.15	1402.02
27990	1406.12	1406.04	1402.02
27678	1405.09	1405.04	1401.64
27551	1404.69	1404.65	1401.45
27457	San Antonio Ave		
27363	1403.39	1403.36	1400.81
27009	1403.81	1403.77	1400.79
26650	1403.65	1403.62	1400.79
26205	1403.54	1403.5	1400.76
25986	Theissen Street		
25879	1403.5	1403.47	1400.72
25572	1402.87	1402.84	1400.5
25053	1402.13	1402.11	1400.23
25017	US 87		
24938	1400.08	1400.04	1397.47
24916	1400.09	1400.06	1397.47
24850	US 87 River Road Turn		
24816	1396.9	1396.85	1392.61
24566	1395.81	1395.77	1391.89
24110	1395.24	1395.2	1391.19
23675	1394.92	1394.87	1390.44
23330	1390.97	1390.97	1388.56
23263	Inline Structure – River Road Park		
23185	1392.58	1392.49	1387.15
22814	1392.91	1392.82	1387.15
22448	1389.35	1389.29	1385.53
22066	1389.46	1389.38	1384.6
21373	1384.86	1384.89	1381.83
20984	1386.55	1386.53	1381.83
20925	Herff Road (Southbound)		
20906	1385.54	1385.55	1381.33
20895	1385.57	1385.57	1381.33
20800	Herff Road (Northbound)		
20729	1384.52	1384.55	1380.51

Cross Section	0.2% AEP Event WSE (ft)		
	Existing Conditions	**Alternative 1 - No Action/FWOFI and Alternative 2 - Decommission**	**Alternative 3 – High Hazard Rehabilitation**
20428	1384.06	1384.07	1380.06
19759	1382.37	1382.32	1378.38
19290	1382.03	1381.95	1377.64
18831	1382.11	1382.03	1377.14
18093	1379.15	1378.78	1374.69
17015	1375.38	1376.07	1371.72
16568	1374.27	1374.69	1370.8
15821	1372.36	1373.1	1369.39
14915	1370.9	1371.96	1366.43
13989	1370.33	1371.57	1365.82
13077	1365.55	1366.28	1362.12
11884	1364.97	1365.79	1361.14
11218	1362.74	1363.52	1358.8
10687	1360.28	1360.99	1356.72
9522	1358.33	1359.12	1354.04
8861	1357.77	1359.04	1353.28
8195	1357.19	1358.23	1352.63
7413	1356.55	1357.76	1351.22
6544	1355.29	1356.47	1350.87
6490	Old Railroad		
6414	1346.25	1347.53	1335.18
5265	1330.91	1331.72	1330.93
4097	1327.13	1327.91	1323.3
3239	1320.41	1321.2	1316.45
2107	1319.23	1320.02	1315.12
1261	1315.84	1316.55	1312.16

The preferred alternative for FRS No. 2 shows a decrease in the water surface elevation of the 1% AEP flood immediately below the FRS to cross section 46573 (near a private driveway culvert on Ranger Creek) that ranges between 0.8 foot and 0.13 foot. Note that starting at cross section 45782 and to the downstream extent of the model, the water surface elevation shows a slight increase. The maximum increase is 0.13 foot, but the increase is shown to be 0.05 foot or less for a majority of the cross sections.

Attachment D-1

Structure Type	Parameter	Start_Data																								
1ST-B	Stage	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	S	0	0	0.7	0.8	2.4	5.2	9	13.8	19.4	25.5	32	38.7	45.5	52.2	58.6	64.5	69.8	74.2	77.7	80.1	81.1	81.1	81.1	81.1	81.1	81.1
	SN	0	0	1.34	1.06	0.94	0.91	0.88	0.85	0.83	0.85	0.96	1.14	1.37	1.63	1.89	2.14	2.35	2.52	2.66	2.77	2.88	2.88	2.88	2.88	2.88	2.88
	Stage	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	C	0	0.1	0.8	2.1	3.7	5.7	8	10.5	13.2	16	18.9	21.8	24.7	27.4	30	32.4	34.5	36.3	37.7	38.6	39.1	39.1	39.1	39.1	39.1	39.1
	CN	0	1.6	1.16	0.92	0.81	0.78	0.76	0.74	0.72	0.74	0.83	0.98	1.17	1.39	1.6	1.81	1.99	2.13	2.25	2.35	2.45	2.45	2.45	2.45	2.45	2.45
	Struct	N		1							100																
1ST-NB	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16							
	S	0	2.5	13.4	23.3	32.1	40.1	47.1	53.2	58.6	63.2	67.2	70.5	73.2	75.4	77.2	78.5	79.5	80.2	80.7							
	SN	0	2.7	2	1.6	1.6	1.8	1.9	2	2.1	2.2	2.3	2.4	2.7	3	3.3	3.7	4.1	4.5	4.9							
	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16							
	C	0	2.4	8.1	13.3	17.9	22	25.7	28.8	31.5	33.8	35.7	37.2	38.4	39.2	39.7	40	40	40	40							
	CN	0	2.1	1.5	1.2	1.2	1.4	1.5	1.6	1.6	1.7	1.8	1.9	2.1	2.3	2.6	2.9	3.2	3.5	3.8							
	Struct	N		1							100																
2ST-B	Stage	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	S	0	1.7	1.7	1.9	2.9	4.7	7.2	10.2	13.9	17.9	22.3	27	31.9	36.9	41.9	46.9	51.8	56.4	60.8	64.8	68.4	71.4	73.7	75.4	76.4	76.4
	SN	0	2.7	2.7	2.11	1.8	1.66	1.56	1.47	1.37	1.32	1.35	1.5	1.75	2.04	2.34	2.63	2.89	3.13	3.38	3.71	4.22	5.02	6.19	7.79	9.84	12.36
	Stage	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	C	0	0	1	2.3	3.7	5.2	6.8	8.4	10.1	11.9	13.8	15.7	17.7	19.8	22	24.3	26.7	29.1	31.7	34.4	37.2	40	43	46.1	49.3	52.6
	CN	0	0	2.27	1.76	1.49	1.37	1.29	1.21	1.13	1.09	1.11	1.23	1.43	1.67	1.92	2.15	2.36	2.56	2.76	3.04	3.46	4.12	5.08	6.39	8.08	10.15
	Struct	N		1							100																
2ST-NB	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16							
	S	0	3	9.3	15.2	20.9	26.3	31.4	36.2	40.7	44.9	48.8	52.4	55.7	58.7	61.4	63.8	65.9	67.7	69.2							
	SN	0	4.1	3.4	3	2.8	2.9	3.2	3.4	3.7	3.9	4	4.1	4.2	4.2	4.2	4.2	4.3	4.6	5							
	Stage	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16							
	C	0	1	5	8.7	12.2	15.5	18.5	21.3	23.9	26.3	28.4	30.3	32	33.4	34.7	35.6	36.4	36.9	37.2							
	CN	0	3.5	2.9	2.6	2.5	2.5	2.7	3	3.2	3.3	3.4	3.5	3.5	3.5	3.5	3.5	3.6	3.8	4.2							
	Struct	N		1							100																

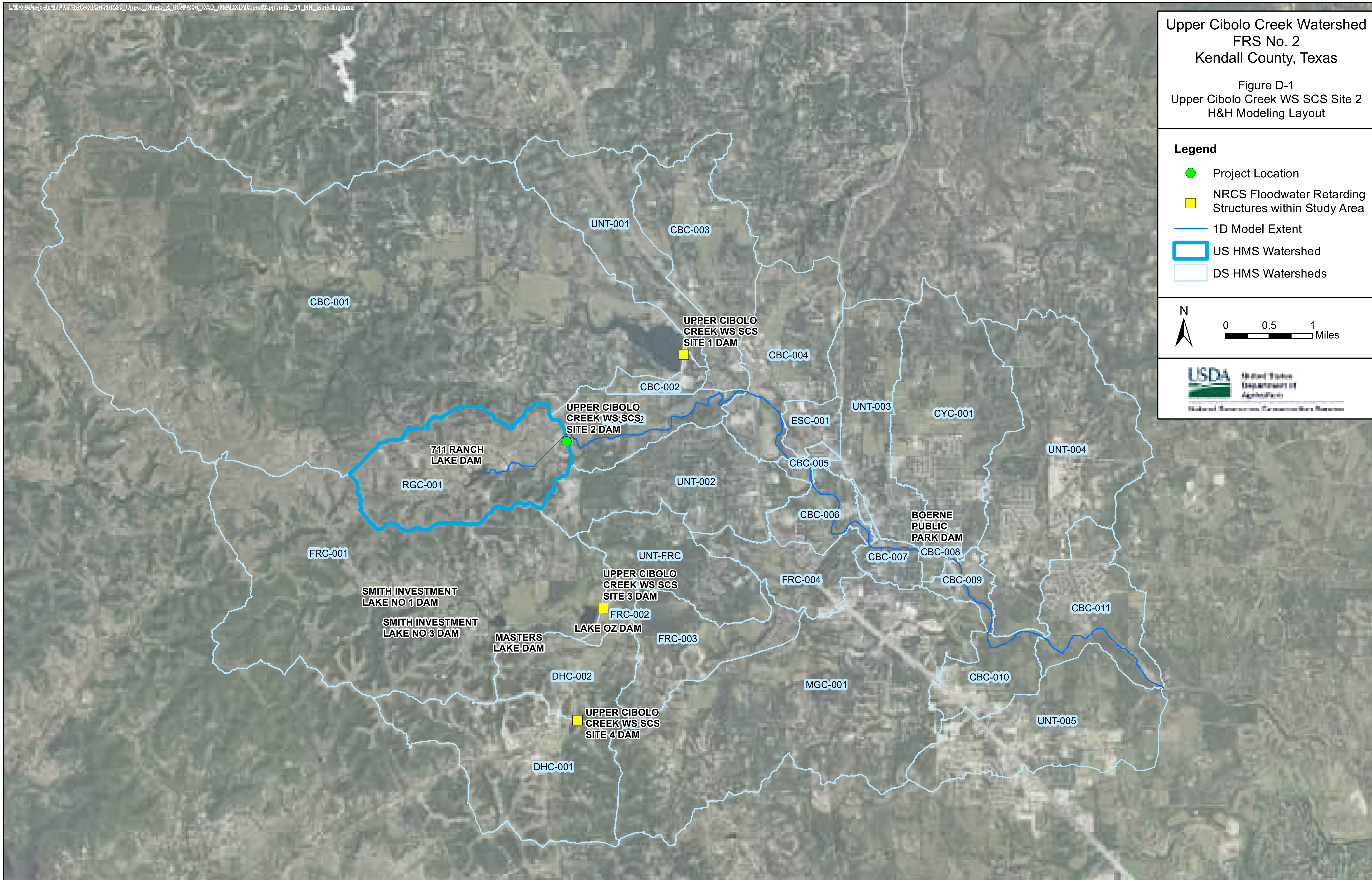
Structure Type	Parameter	Start_Data																								
A1	Stage	-1.5	-1	0	0.5	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18				
	S	0	0	0	7	28	46	62	76	87	97	100	100	100	100	100	100	100	100	100	100	100	100				
	Struct	N		1							0																
APT_P	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	S	0	0.5	0.5	1	8.5	12.5	16.1	20.4	25.9	31.7	33.5	37.5	39.4	42.2	45.1	46.6										
	STL	0	0	0	0	4.5	6.9	9.7	14.6	19.6	25.8	27.8	33.6	34.8	38	39.8	41										
	STU	0	1.1	1.3	3.3	14.8	17.5	22.9	28.7	33.2	39.3	40.1	44	46.6	50	53.5	55.5										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0	0	0	14.3	21.7	26.6	30.4	39	45	47.9	51.9	55.7	59.3	60.6	63.4										
	CTL	0	0	0	0	10	15	20	25	30	37.5	42	45	50	55	58	60										
	CTU	0	0	0	0	18	25	32	37	45	53	55	60	65	70	75	80										
	Struct	N		1							13																
CLOTH_P	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	S	0	0.5	0.5	1.1	9.1	13.2	16.9	20.5	26.6	33.3	36.4	41	43.9	47.7	51.3	52.4										
	STL	0	0	0	0	4.9	6.8	9.3	13.4	18.4	23.3	26.7	32.2	34.4	39.5	41.7	43.1										
	STU	0	1.2	1.4	3.1	15.8	19.1	24.5	30.9	37	44.5	47	50.7	54.9	58.9	62	63.2										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0	0	0	12.3	29	38.4	46.3	55.4	70	79	89	95.7	97.9	97.9	99.3										
	CTL	0	0	0	0	8	17.8	27.8	35.5	48	60	67.5	78	88	94	94	96										
	CTU	0	0	0	0	18	37.8	45.5	54.5	65	80	85	96	98	100	100	99.3										
	Struct	N		1							57																
CONV_P	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	S	0	0.4	0.4	1.1	11.1	16	21.6	25.3	34.1	41.9	45.4	51.4	57	60.6	62.8	63.6										
	STL	0	0	0	0	6.2	9.3	12.7	17	24.1	31.2	34.4	41.7	44.6	50.9	53.3	54.5										
	STU	0	1.3	1.3	2.7	17.6	22.1	29.2	34.2	42	49.8	52.5	60	63.8	66.4	68.5	69.5										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0	0	0	11.6	23.1	32.1	39.9	52.9	70.7	79.3	88	94.1	95.7	97.1	98.6										
	CTL	0	-0.1	-0.1	0	5	12.7	20	30	40	60	70	80	90	92	95	97										
	CTU	0	0	0	0	15	28	38	45	60	78	85	95	100	100	100	100										
	Struct	N		1							41																
FFR_P	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	S	0	0.3	0.3	0.6	11.1	15.9	22.5	28.7	37.4	47.3	52.1	58.3	63.5	67	70.9	72.2										
	STL	0	0	0	0	6.1	9.3	13.9	20.9	26.9	37.5	44	50.9	54.6	59.7	64.2	64.9										

Structure Type	Parameter	Start_Data																								
	STU	0	1.1	1.1	2.1	18.6	23.9	32	42.4	48.9	58.1	61.9	67.4	73.5	76.6	79	79.6										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0	0	0	10.6	21.3	29.4	38.6	52.7	62.6	73	79.3	88.3	94.9	98.6	98.6										
	CTL	0	0	0	0	5	15	20	30	44	54	65	72.5	80	85	90	92										
	CTU	0	0	0	0	15	28	36	50	60	72.5	80	80	95	100	100	100										
	Struct	N		1							32																
FURN_P	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	S	0	0.5	0.5	1.1	7.9	11.8	15.1	18.7	25.2	32.1	35	39.5	42.7	47.1	51.3	52.5										
	STL	0	0	0	0	3.7	5.7	8	11.8	16.8	22.3	24.8	30.8	32.8	38.3	41	42.9										
	STU	0	1.2	1.4	3.2	14.1	17.2	23	29.4	36	42.7	45.4	49.4	54.3	58.9	61.9	63.1										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0	0	0	39.9	46.9	53.3	61.9	68.1	79.1	85.7	90.7	97.1	99.3	99.3	99.3										
	CTL	0	0	0	0	25	33	44	50	55	70	75	82	85	93	95	98										
	CTU	0	0	0	0	45	55	64	70	75	86	95	95	100	100	100	100										
	Struct	N		1							46																
GROC_P	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	S	0	0.5	0.5	1.3	7.6	11.6	15.7	19.5	25.9	32.9	35.3	41.1	44.6	48.1	51.4	52.9										
	STL	0	0	0	0	4.1	5.6	8.2	12.4	17.7	22.9	25.3	31.8	33.9	39.3	41.8	42.9										
	STU	0	1.4	1.4	3.2	13.7	16.8	23	29.6	35.9	43.4	45.9	50.6	55.6	58.7	61.5	63.3										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0	0	0	24	30.7	36.8	40.9	52.9	64	75.4	87.3	98.9	100	100	100										
	CTL	0	0	0	0	10	20	25	27	35	48	60	70	80	100	100	100										
	CTU	0	0	0	0.2	30	38	44	50	60	75	82	95	100	100	100	100										
	Struct	N		1							88																
HTL_P	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	S	0	0.5	0.7	1.3	8.2	11.7	15.1	18.1	23.9	29.1	31.8	35.3	38.1	40.8	44.4	45.7										
	STL	0	0	0	0	3.9	5.2	7.2	10.7	15.2	19.8	20.8	25.7	26.9	30.9	32.9	34										
	STU	0	1.4	1.6	3.3	14.5	16.9	22.1	27.6	32.1	38.5	41	44	47.7	51.3	55.1	56.8										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0	0	0	11.8	16.1	18.6	26.3	34.1	39.7	48.7	52.4	58.4	61.3	63.1	64.9										
	CTL	0	0	0	0	6	10	14	20	28	33	40	45	50	55	58	60										
	CTU	0	0	0	0	15	20	25	31	40	45	55	60	66	75	80	80										
	Struct	N		1							32																

Structure Type	Parameter	Start_Data																								
MED_P	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	S	0	0.3	0.7	1.3	8.4	12.8	16.3	21	27.9	37.2	40.9	51.9	56.6	61.7	66	67.8										
	STL	0	0	0	0	4.7	7.2	9.7	14.5	19.3	27.2	31.5	39.6	45.1	52.6	56.1	59.3										
	STU	0	1.1	1.4	2.9	14.4	17.9	22.9	28.8	36.3	44.8	49.9	58.8	63.5	68.7	71.3	73.4										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0	0	0	9	14.3	18.4	26.9	40.4	57.1	67.3	75.4	82.3	91.3	96.3	96.9										
	CTL	0	0	0	0	5	10	14	20	30	44	50	65	75	80	85	92.5										
	CTU	0	0	0	0	15	20	30	34	50.5	70	80	90	100	100	100	100										
	Struct	N		1							70																
M_H	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	S	0	7.3	11.2	32.2	48.5	54	56.1	58.9	60.3	64.3	67.5	68	69	80	81.7	82.8										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0	0	0.1	15	30.1	45.6	58.8	69.2	78.3	82.4	84.3	84.4	84.4	84.4	84.4										
	Struct	N		1							139																
OFF_P	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	S	0	0.8	0.8	1.6	9.9	13.5	16.8	19.4	25.4	30.5	33.5	38.6	45.7	51.1	55	59.1										
	STL	0	0.3	0.3	0.4	5.2	7.5	10.3	13.4	18.3	22	24.2	29.1	34.4	39.8	43.7	44.7										
	STU	0	1.5	1.5	3.2	14.4	18.4	23.6	27.8	34	39.9	43.8	47.6	55.1	62.4	65.7	70.1										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0.2	0.7	0.7	14.3	20	26	34.3	45.4	55	63.9	73.3	76.4	83.4	89.3	91.4										
	CTL	0	0	0	0	5	12.2	20	28	35	45	54	65	70	78	80	87.5										
	CTU	0	0.5	0.9	0.9	20	25	32.2	42.5	55	65	72.5	80	83.8	100	100	100										
	Struct	N		1							21																
REC_P	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	S	0	0.5	0.5	0.9	8.8	13.5	18.2	23.6	31.3	38.6	42.1	47.6	50.3	54.2	57.5	59.1										
	STL	0	0	0	0	4	6.5	9.9	14.4	21.2	28.5	31.8	38	40.3	45.8	47.8	49.5										
	STU	0	1	1.3	3.1	15	19.1	25	32	40.8	48.2	50.8	56.3	59.5	63.6	66	67.4										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0	0	0	16.9	25.7	31.4	43.7	62.7	72.9	80	84	91.1	95	95	95										
	CTL	0	0	0	0	10	17.5	23.8	37.5	50	66.5	75	80	85	90	91	91.5										
	CTU	0	0	0	0	20	31.5	35	50	67.5	80	87.5	92.5	95	100	100	100										
	Struct	N		1							30																
REST_P	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										

Structure Type	Parameter	Start_Data																									
	S	0	0.3	0.3	1.9	14.8	19.4	25.3	32.4	41	49.6	56.3	63.9	67.2	71.3	72.7	73.5										
	STL	0	0	0	0.5	8.9	13.1	18.1	24.8	33	40.3	47	55.6	59.6	64.4	66.3	67										
	STU	0	1.7	1.7	3.6	21.7	26.4	35.5	42.1	49.9	58.4	64.9	71.4	76	77.4	79.1	79.7										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0	0	0	17.1	27.7	35.9	48.9	57.3	71.9	79.7	84.9	92.9	93.4	94.3	94.3										
	CTL	0	0	0	0	10	20	28	36	47.5	65	70	74	80	86	90	90										
	CTU	0	0	0	0	21	33	42.5	55	64	76	85	90	95	100	100	100										
	Struct	N		1							26																
RF_P	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	S	0	0.4	0.4	0.7	10.2	16.4	22.1	28.3	35.9	42.9	48.4	54.2	58.1	62.1	65.3	66.1										
	STL	0	0	0	0	5.4	9	13.6	20.1	27.5	33.8	39.1	46.1	50.4	55.2	58.4	59.6										
	STU	0	0.8	1.2	2.7	16.7	22.3	30.6	37.4	45.5	54.3	59.1	62.7	67.6	70.5	73.3	74.4										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0	0	0	19.7	29.3	41.3	48.4	60	69.3	76.4	81.4	88.4	94.3	97.1	97.1										
	CTL	0	0	0	0	15	25	35	42.5	50	61.3	68	75	79	87.5	90	92.5										
	CTU	0	0	0	0	25	35	47.5	56.3	68	77.5	85	90	93.8	99	100	100										
	Struct	N		1							8																
SCH_P	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	S	0	0.3	0.3	0.6	9.9	14.2	18.1	23.9	30.2	36.9	39.4	43.9	45.8	48.4	51.1	52.8										
	STL	0	0	0	0	5	8.1	11.4	16.9	22.5	29.8	32.6	39	40.5	43.2	45	46.4										
	STU	0	0.6	1	2.3	16.3	20	25.7	32.9	38.2	44.7	46	51.3	52.9	56.3	60	62.4										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0	0	0	14.3	21.7	26.6	30.4	39	45	47.9	51.9	55.7	59.3	60.6	63.4										
	CTL	0	0	0	0	10	15	20	25	30	40	45	50	55	58	59	60										
	CTU	0	0	0	0	20	25	33	40	50	55	66	72.5	75	85	90	90										
	Struct	N		1							8																
SERV_P	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	S	0	0.5	0.5	1.2	7.5	11.1	15	18.1	23.5	29.5	31.9	36.8	40.9	45.1	48.3	49.7										
	STL	0	0	0	0	3.7	5.1	7.4	10.9	15.2	20	21.1	27	29.3	33.7	35.6	36.7										
	STU	0	1.2	1.4	3.4	13.2	15.9	22	26.2	32.4	39.8	42.1	46	52.2	57.1	59.8	61.1										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0	0	0.4	11.7	16.4	21.9	28.9	40.9	57.7	63.3	70.7	79.3	84.3	87.1	87.1										
	CTL	0	0	0	0	5	10	14	20	30	45	55	60	70	75	80	80										

Structure Type	Parameter	Start_Data																								
	CTU	0	0	0	1	17.5	25	30	38	50	65	75	80	90	95	98	100										
	Struct	N		1							83																
WH_P	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	S	0	0.5	0.5	1.1	7.6	11.8	16.1	19.9	25.4	31.4	34.2	39	41.8	45.7	50.4	51.7										
	STL	0	0	0	0	3.5	5.1	7.6	11.7	16.4	21.2	22.3	28.3	29.9	34.5	37.6	38.7										
	STU	0	1.2	1.4	3.3	14	17.4	23.6	28.8	34.2	42.5	44.7	48.9	52.7	56.9	60.6	62.2										
	Stage	-2	-1	-0.5	0	0.5	1	1.5	2	3	4	5	6	7	8	9	10										
	C	0	0	0	0	13.4	20.7	27.6	33.7	47.4	56.9	65.6	73.6	81.3	88.4	91.6	93.6										
	CTL	0	0	0	0	7	15	20	25	35	40	50	60	70	76	84	90										
	CTU	0	0	0	0	20	25	35	45	55	66	75	85	90	100	100	100										
	Struct	N		1							47																


Upper Cibolo Creek Watershed
FRS No. 2
Kendall County, Texas
Figure D-1
Upper Cibolo Creek WS SCS Site 2
H&H Modeling Layout
Legend
Project Location
NRCS Floodwater Retarding Structures within Study Area
1D Model Extent
US HMS Watershed
DS HMS Watersheds
N
0
0.5
1
Miles
USDA
UNT-001
CBC-003
CBC-001
UPPER CIBOLO CREEK WS SCS SITE 1 DAM
CBC-004
CBC-002
UPPER CIBOLO CREEK WS SCS SITE 2 DAM
711 RANCH LAKE DAM
RGC-001
UNT-003
CYC-001
ESC-001
CBC-005
UNT-004
UNT-002
CBC-006
BOERNE PUBLIC PARK DAM
CBC-007
CBC-008
FRC-001
UNT-FRC
UPPER CIBOLO CREEK WS SCS SITE 3 DAM
FRC-004
CBC-009
SMITH INVESTMENT LAKE NO 1 DAM
SMITH INVESTMENT LAKE NO 3 DAM
FRC-002
LAKE OZ DAM
MASTERS LAKE DAM
FRC-003
CBC-011
DHC-002
MGC-001
CBC-010
UPPER CIBOLO CREEK WS SCS SITE 4 DAM
UNT-005
DHC-001

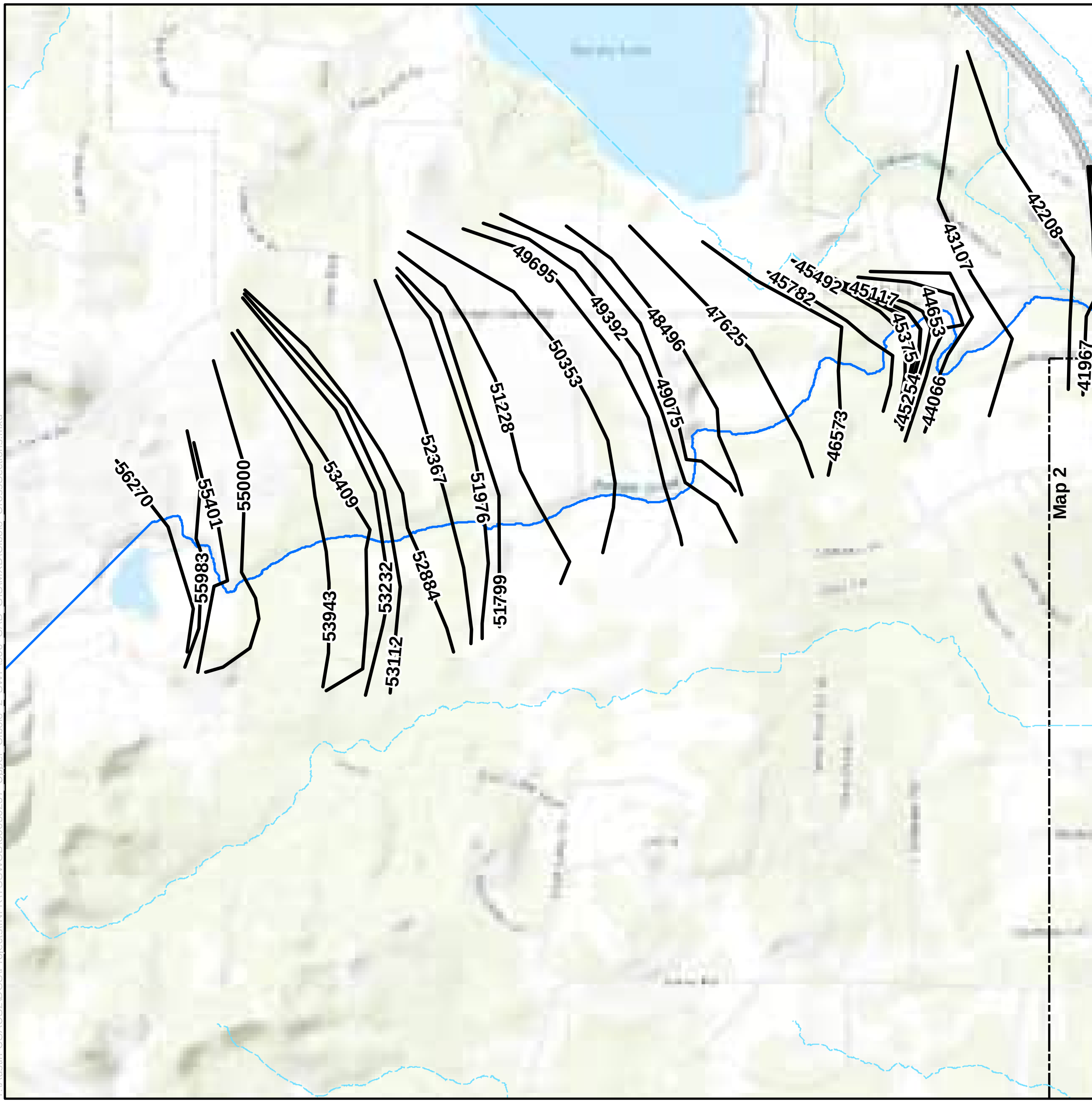


Figure D-2
Upper Cibolo Creek
WS SCS Site 2
1D Hydraulic Cross Sections
Map 1 of 4

Cross Section
1D Model Extent
Streamline
Matchline

N
0 2,000 Feet
1 inch = 2,000 feet

NRCS

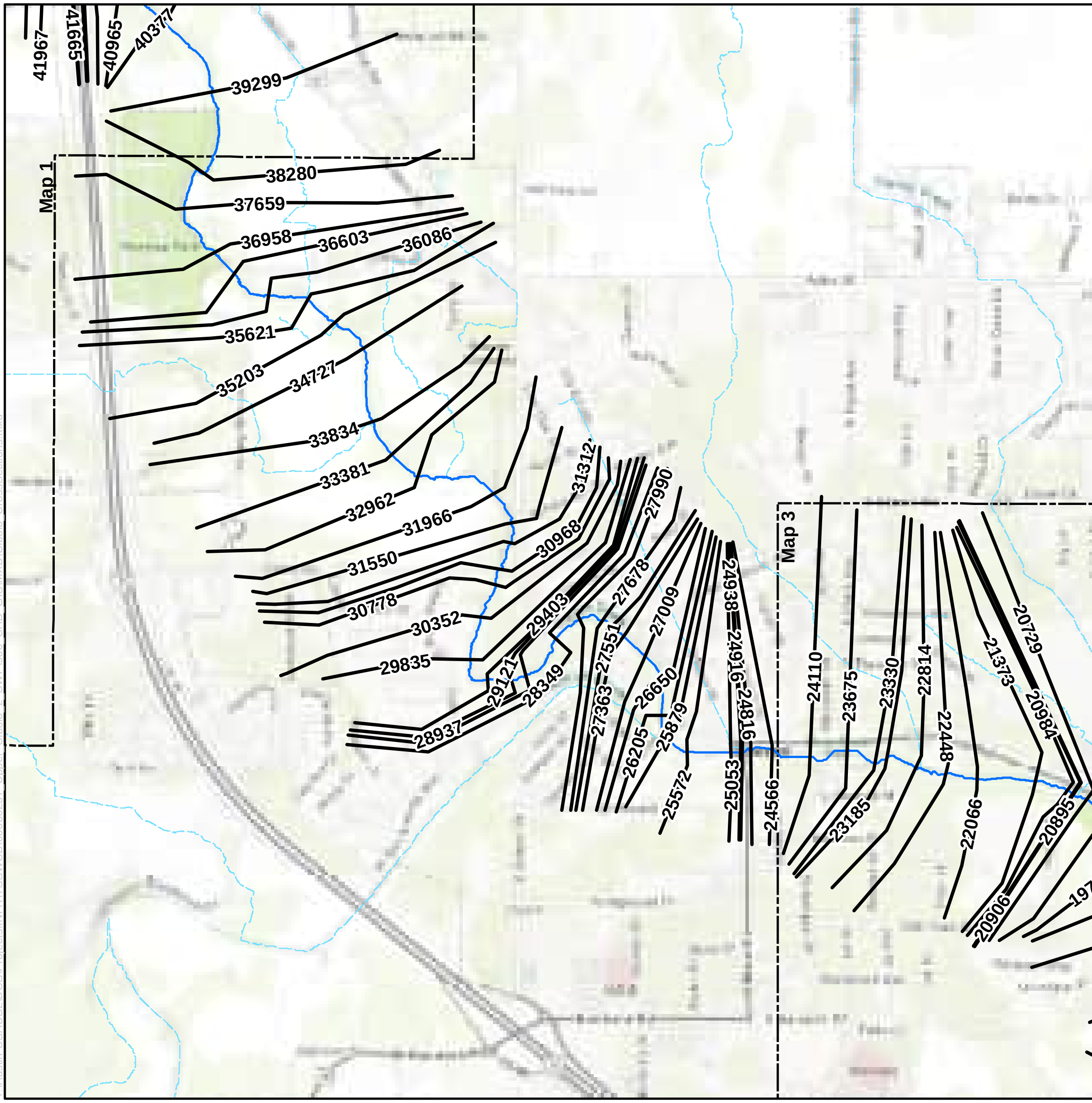


Figure D-2
Upper Cibolo Creek
WS SCS Site 2
1D Hydraulic Cross Sections
Map 2 of 4

Cross Section
1D Model Extent
Streamline
Matchline

N
0 2,000
Feet
1 inch = 2,000 feet

NRCS

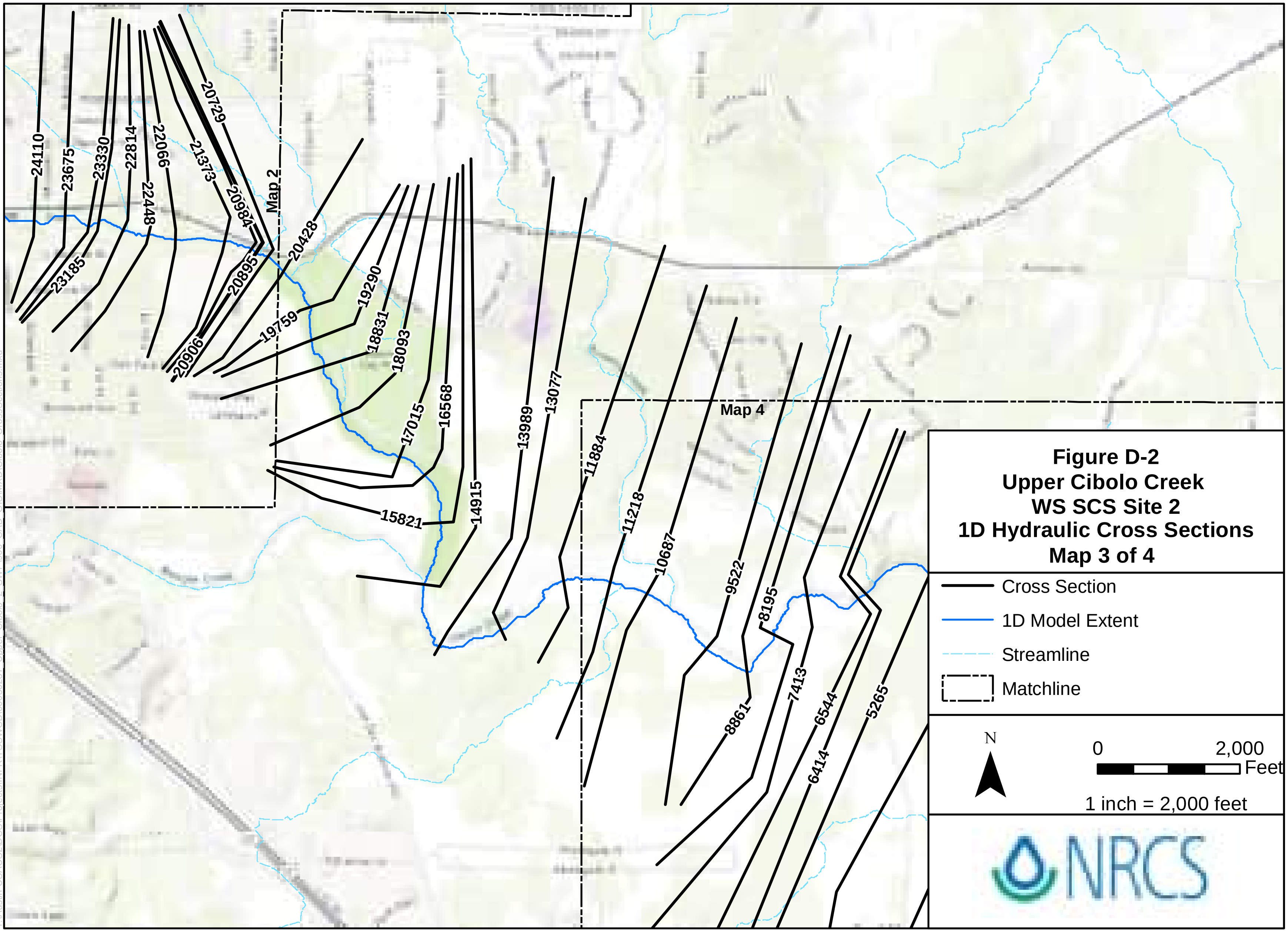


Figure D-2
Upper Cibolo Creek
WS SCS Site 2
1D Hydraulic Cross Sections
Map 3 of 4

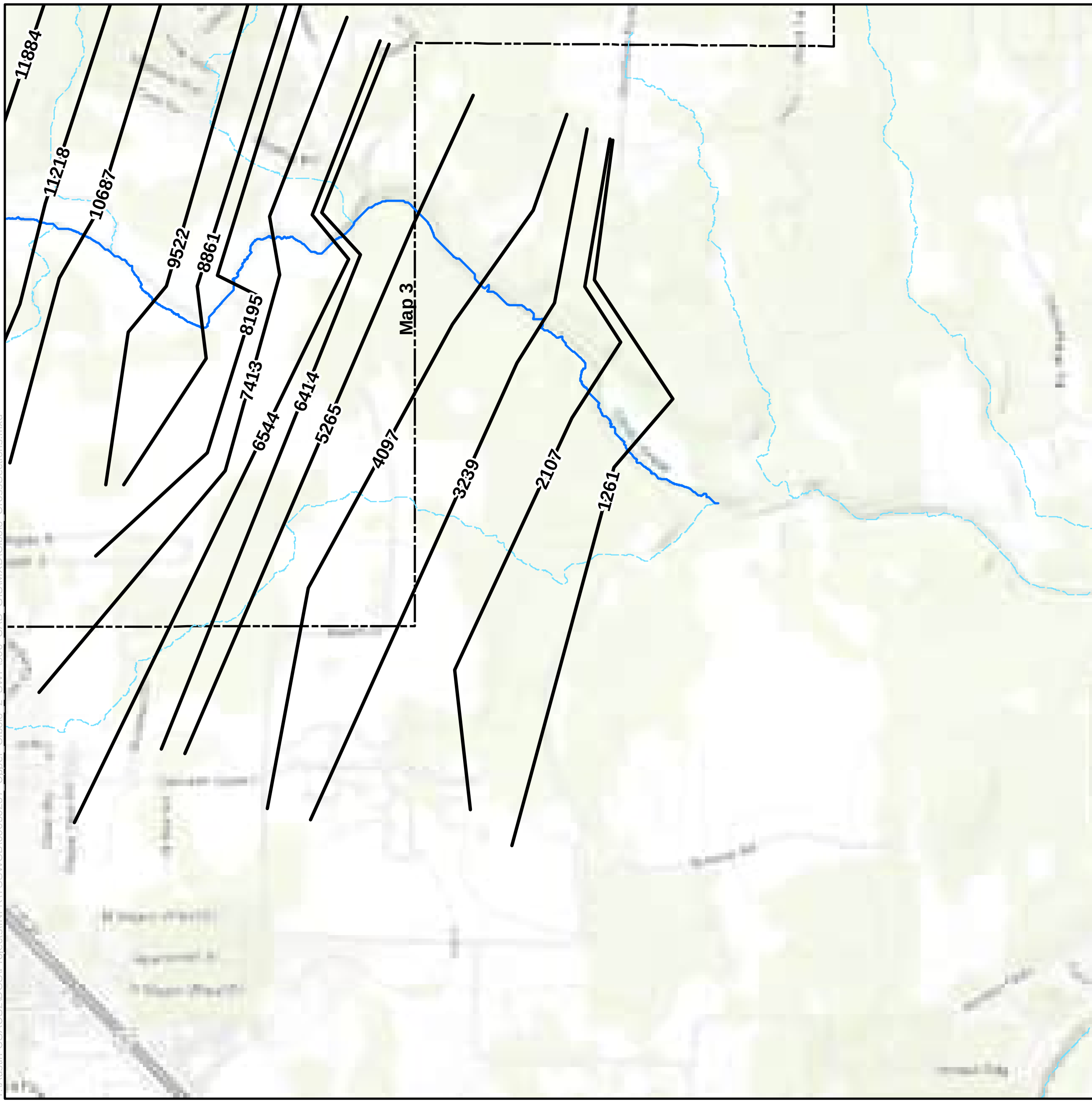


Figure D-2
Upper Cibolo Creek
WS SCS Site 2
1D Hydraulic Cross Sections
Map 4 of 4

Cross Section
1D Model Extent
Streamline
Matchline

N
0 2,000 Feet
1 inch = 2,000 feet

NRCS

Appendix E Other Supporting Information

E-1 Evaluation of Potential Rehabilitation Projects

EVALUATION OF POTENTIAL REHABILITATION PROJECTS

STATE	TX	**DAM**	Upper Cibolo Creek Dam No. 2	**BY**	ANB/ANR	**DATE**	9/15/2021	
	YEAR BUILT	1980	**DESIGN HAZARD CLASS**	L	**DRAINAGE AREA**		2.57	mi^2
	WORK PLAN DATE	11/1/1968	**CURRENT HAZARD CLASS**	H	**DAM HEIGHT**		50	ft
sht 1 of 5	**CONSEQUENCES OF DAM FAILURE (ver. 2013-02)**				**NID ID**		TX04902	

POTENTIAL DAM FAILURE:

Total Failure Index		195	A

POTENTIAL LOSS OF LIFE:

Maximum Population-at-Risk [PAR]	(number)	372	B
Total Risk Index		1,940	C

POTENTIAL LOSS OF PROPERTY:

Identify major community affected by breach and rate impact as High (H), Medium (M), Low (L) or None(blank)

Community	City of Boerne, TX	(H,M,L,-)	H	D
Number of homes, businesses, major buildings		(number)	88	E

POTENTIAL LIFELINE DISRUPTION:

Water supply, identify community disrupted by dam failure, and estimate number/amount

Municipal sole source		Users	(number)	0	F
Supplemental source		Users	(number)	0	G
Irrigation water		Storage	(Ac-Ft)	0	H

POTENTIAL INFRASTRUCTURE DISRUPTION:

Transportation system crossings, identify major crossing rendered unusable by dam failure, and estimate number

Major/Interstate	IH-10 (EB), IH-10 (WB), US-87, SH 46 (2 locations)	Roads	(number)	5	I
Secondary/County	TURNER AVE, PECAN ST, S PLANT AVE, HOLEKA	Roads	(number)	20	J

POTENTIAL ADVERSE IMPACTS ON THE ENVIRONMENT:

Describe impacts and rate each as High (H), Medium (M), Low (L), or None (blank)

Threatened & endangered species	Federally and state-listed species with the potential t	(H,M,L,-)	M	K
Sensitive riparian areas	Riparian areas are present along sediment pool and	(H,M,L,-)	L	L
Contaminated reservoir sediment	Area upstream appears to be undeveloped woodlan	(H,M,L,-)	L	M
Wetland and wildlife habitat	Fringe wetlands and wildlife habitat is likely present	(H,M,L,-)	L	N
Other		(H,M,L,-)	-	O

POTENTIAL ADVERSE SOCIAL IMPACTS:

Describe impacts and rate each as High (H), Medium (M), Low (L) or None(blank)

Known cultural resources	2 prehistoric archeological sites present	(H,M,L,-)	H	P
Historic preservation issues	1 historic-age resource present	(H,M,L,-)	L	Q
Socially disadvantaged community		(H,M,L,-)	L	R

POTENTIAL ADVERSE ECONOMIC IMPACTS:

Average annual benefits attributed to this dam, updated workplan value	($)	41,068	S
Changes in benefits since workplan; Increase(I), No change(NC), Decrease(D)	(I,NC,D)	I	T
Low income families impacted	(number)	0	U

INPUT BY STATE DAM SAFETY AGENCY:

State dam safety order issued for repair, modification, removal issued, Yes(Y), No(N)	(Y,N)	N	V
State Dam Safety Agency Priority, High(H), Medium(M), Low(L), None(blank)	(H,M,L,-)	-	W

OTHER CONSIDERATIONS:

Identify any other considerations and rate as High(H), Medium(M), Low(L) or None(blank)

	(H,M,L,-)	-	X
	(H,M,L,-)	-	Y

EVALUATION OF POTENTIAL REHABILITATION PROJECTS							
STATE	TX	**DAM**	Upper Cibolo Creek Dam No. 2	**BY**	ANB/ANR	**DATE**	9/15/2021
sht 2 of 5	**FAILURE & RISK INDEXES**						ver 2013-02

Adopted from Bureau of Reclamation "Risk Based Profile System"
see: http://www.usbr.gov/dsis/risk/rbpsdocumentation.pdf

LIFE LOSS:

Population-at-Risk [PAR], see NRCS dams inventory definition (number of people)

Estimate PAR for static loading failure; typically assume water at or above invert of the lowest open channel auxiliary spillway	372	A
Estimate PAR for hydrologic loading failure; typically assume water at or above invert of the lowest open channel auxiliary spillway	278	B
Estimate PAR for seismic loading failure; typically assume water at or above invert of the lowest non-gated spillway (sunny day failure)	166	C

Fatality Rates [FR] from dam breach

Adopted from BuRec "A Procedure for Estimating Loss of Life Caused by Dam Failure" DSO-99-06
see: http://www.usbr.gov/research/dam_safety/documents/dso-99-06.pdf

Flood Severity/Lethality [DV] is the average depth [D] times velocity [V] across flood plain (ft2/sec)
DV= (breach discharge - bank full discharge) / breach floodplain width

Warning Time [T] between failure warning and flood wave at population (minutes)

Flood Severity Understanding [U] of the warning issuer of the likely flooding magnitude

Scenario	Breach Discharge	Bankfull Discharge	Breach Floodplain Width	DV	Warning Time, T	Understanding, U
	(cfs)	(cfs)	(ft)	(ft2/sec)	(minutes)	(N/A or Vague)
Static	46,425	58	592	78	60	Vague
Hydrologic	39,252	58	456	86	65	Vague
Seismic	7,347	58	477	15	79	Vague

For DV≥50	T≤60	U=vague	FR=0.04
	T>60		FR=0.03
For DV<50	T≤60	U=vague	FR=0.007
	T>60		FR=0.0003

Estimate FR for static loading failure scenario	0.04	D
Estimate FR for hydrologic loading failure scenario	0.03	E
Estimate FR for seismic loading failure scenario	0.0003	F

Scenario	Load Factor	Response Factor	Failure Index	Fatality Rate	PAR	Risk Index
Static	1	48	48	0.04	372	714
Hydrologic	*	*	147	0.03	278	1,226
Seismic	0.00	#DIV/0!	0	0.0003	166	0
		TOTAL=	195		TOTAL=	1,940

EVALUATION OF POTENTIAL REHABILITATION PROJECTS								
STATE	TX	DAM	Upper Cibolo Creek Dam No. 2	BY	ANB/ANR	DATE	9/15/2021	
sht 3 of 5	STATIC FAILURE INDEX						ver 2013-02	

PRINCIPAL SPILLWAY SYSTEM (60 points max): (total points)	30		A
Downstream filter or filter zone around conduit (yes=0 or no=10)		10	B
Conduit trench deep (>2d) and narrow (<3d) and steep sideslope (<2:1) (no=0 or yes=10)		0	C
Principal spillway system (inlet, pipe, or outlet) in deteriorated condition (no=0 or yes=10)		0	D
Conduit has seepage cutoff collars or other compaction adverse features (no=0 or yes=10)		10	E
Conduit contains open joints, open cracks, steady seepage (no=0 or yes=10)		0	F
Conduit founded on competent bedrock (yes=0 or no=10)		10	G
Reservoir control gate located at outlet of conduit (no=0 or yes=10)		0	H
RESERVOIR FILLING HISTORY (75 points max): (total points)	0		I
Reservoir has filled to x% of effective height (earth spillway crest minus original streambed)		101	J
(<50%=75 or 51-75%=50 or 76-90%=25 or 91-95%=10 or 96-100%=5 or >100%=0)		0	K
SEEPAGE AND DEFORMATION (85 points max): (total points)	6		L
Seepage carrying fines, or seepage increases with reservoir elevation increases, or sinkholes/jugholes exist in embankment (no=0 or yes=80)		0	M
Large amounts of seepage (no=0 or yes=6)		0	N
Visible and significant slope movement or sloughing (no=0 or yes=6)		0	O
Longitudinal or transverse embankment cracking greater than one foot in depth (no=0 or yes=6)		0	P
Sinkholes/depressions within two times effective height of the dam, either face (no=0 or yes=6)		0	Q
Poor top of dam condition, eroded, trees, rodent holes, settlement (no=0 or yes=6)		0	R
Abnormally wet areas at downstream toe/groin of embankment (no=0 or yes=6)		0	S
Inadequate slope protection against erosion by rainfall or waves (no=0 or yes=6)		6	T
FOUNDATION GEOLOGY (41 points max): (total points)			U
Highly fractures rock under core (no=0 or treated=3 or untreated=30)		0	V
Karst terrain and soluble rock (gypsum or limestone) (no=0 or treated=3 or untreated=30)		0	W
Collapsible soils (no=0 or treated=3 or untreated=30)		0	X
Significant stress relief fractures in abutments (no=0 or treated=3 or untreated=30)		0	Y
History of underground mining under embankment area (no=0 or treated=3 or untreated=30)		0	Z
Coarse grained and highly permeable soils (no=0 or yes=3)		0	AA
Presence of weak layers/conditions diminishing embankment stability (no=0 or yes=3)		0	AB
Erodible soils (sandy/silty materials) or weakly cemented rock (no=0 or yes=3)		0	AC
Reservoir area prone to landslides that could cause overtopping (no=0 or yes=3)		0	AD
EMBANKMENT DESIGN AND CONSTRUCTION (24 points max): (total points)	8		AE
Filters for core or foundation or incompatibility between zones (no=4 or yes=0)		4	AF
Embankment or foundation drainage system (yes=0 or no=4)		4	AG
Erodible core material (sands, silts, dispersive clays) (no=0 or yes=4)		0	AH
Incomplete or no foundation cutoff of shallow permeable layers (no=0 or yes=4)		0	AI
Poorly placed earthfill, inadequate density (no=0 or yes=4)		0	AJ
Gate features to drain reservoir (yes=0 or no=4)		0	AK
EMBANKMENT MONITORING (15 points max): (total points)	4		AL
Instruments (except surficial survey points) installed at dam (yes=0 or no=4)		4	AM
Installed instruments routinely read and evaluated (yes=0 or no=4)		0	AN
Visual inspection of dam by engineer less often than yearly (no=0 or yes=4)		0	AO
Good physical/visual access to downstream groin/toe for inspection (yes=0 or no=4)		0	AP
STATIC FAILURE INDEX: A+I+L+U+AE+AL		48	AQ

EVALUATION OF POTENTIAL REHABILITATION PROJECTS							
STATE	TX	**DAM**	Upper Cibolo Creek Dam No. 2	**BY**	ANB/ANR	**DATE**	9/15/2021
sht 4 of 5	**HYDROLOGIC FAILURE INDEX**						ver 2013-02

HYDROLOGIC LOADING:						
Total Spillway Capacity (PS&ES) for 6hr storm [Pfb], Work Plan Tbl 3 (rainfall inches)					11.4	A
Obtained from Work Plan Tbl 3, or dams inventory data, or computer routings						
100 year, 6hr rainfall [P100] (inches)					9.3	B
Probable Maximum Precipitation [PMP] (inches)					28.8	C
if Pfb <=	P100	=	9.30	enter 40		
if Pfb =	P100+0.2(PMP-P100)	=	13.20	enter 25		
if Pfb =	P100+0.4(PMP-P100)		17.10	enter 15		
if Pfb =	P100+0.6(PMP-P100)	=	21.00	enter 7		
if Pfb =	P100+0.8(PMP-P100)	=	24.90	enter 3		
if Pfb =>	PMP	=	28.80	enter 1		
Enter interpolated value					32.1	D
HYDROLOGIC UNCERTAINTY:						
Drainage Area [DA] (square miles)					2.57	E
DA<10 enter 1.5 ; 10<DA<20 enter 1.4 ; 20<DA<50 enter 1.3 ; DA=>50 enter 1.2					1.5	F
PIPE SPILLWAY PLUGGING:						
Pipe Diameter [D] (inches)					24	G
D<12 enter 1.1; 12<=D<24 enter 1.0; 24<=D enter 0.9					0.9	H
Riser & trash rack type:						
Non-standardized inlet enter 1.1, Open Top riser enter 1.0; Covered or Baffle Top enter 0.9					1.0	I
EARTH SPILLWAY FLOW:						
Earth spillway flow depth [Des] from top of dam to spillway crest (feet)(10' max)					2.9	J
DAM EROSION RESISTANCE:						
Non-plastic (PI<10) fill enter 2.0 ; Plastic core enter 1.7 ; Overtopping armoring enter 0.8					1.7	K
Vegetal Cover Factor [Cf], see SITES or AH667					0.4	L
http://www.pswcrl.ars.usda.gov/ah667/ah667.htm						
Cf <0.4 enter 1.1; Cf < 0.7 enter 1.0; Cf<1.0 enter 0.9; larger Cf enter 0.8					1	M
EARTH SPILLWAY EROSION RESISTANCE:						
Low, can be excavated with hand tools, enter 2.0						
PI>10 and SPT blows<8, PI<10 and SPT blows>8, Kh<0.10, seismic velocity<2000fps						
Moderate, can be excavated with construction equipment, easy ripping, enter 1.2						
PI>10 and SPT blows>8, PI<10 and SPT blows>30, Kh<10, seismic velocity<7000fps						
High, very hard ripping, requires drilling and blasting, enter 0.2						
moderately hard rock, Kh>10, seismic velocity>7000fps					1.2	N
Vegetal Cover Factor [Cf], see SITES or AH667					0.8	O
Cf <0.4 enter 1.1; Cf < 0.7 enter 1.0; Cf<1.0 enter 0.9; larger Cf enter 0.8					0.9	P
HYDROLOGIC FAILURE INDEX:						
dam overtopping breach: (2)(D)(F)(H)(I)(K)(M)					147	Q
earth spillway breach: (D+5J)(F)(H)(I)(N)(P)					68	R
larger of (2)(D)(F)(H)(I)(K)(M) or (D+5J)(F)(H)(I)(N)(P) but less than 300					147	S

EVALUATION OF POTENTIAL REHABILITATION PROJECTS							
STATE	TX	DAM	Upper Cibolo Creek Dam No. 2	BY	ANB/ANR	DATE	9/15/2021
sht 5 of 5	SEISMIC FAILURE INDEX						ver 2013-02

SEISMIC LOADING:		
Latitude (degrees.decimal)	29.807	A
Longitude (degrees.decimal)	-98.790	B
See "http://earthquake.usgs.gov/hazards/products/conterminous/2008/maps/" (MAP LINK)		
PGA [peak ground acceleration] for 2% chance in 50 years, see NSHM maps (%g)	2.00	C
if PGA is less than 10% g, enter 0		
if PGA is between 10% g and 19% g, enter 0.15		
if PGA is between 20% g and 39% g, enter 0.30		
if PGA is between 40% g and 59% g, enter 0.65		
if PGA is greater than 60% g, enter 1.0	0.00	D
FOUNDATION LIQUEFACTION:		
Select the following foundation conditions which best represents the site		
Loose alluvium, lacustrine, loess materials, enter 10		
Bedrock, glacial till, highly clayey materials, enter 5	5	E
EMBANKMENT FREEBOARD FOR FOUNDATION LIQUEFACTION:		
Dam height (ft)	50	F
Freeboard - Elevation difference from top of dam to assumed pool surface (ft)	2.9	G
Freeboard percent of dam height (%)	6	H
if Freeboard is less than 25% of dam height, enter 10		
if Freeboard is 25% to 50% of dam height, enter 5		
if Freeboard is more than 50% of dam height, enter 1	10	I
EMBANKMENT FREEBOARD FOR EMBANKMENT CRACKING:		
Freeboard is less than or equal to 15 feet (no=0 or yes=1)	1	J
EMBANKMENT CRACKING:		
Embankment contains self-healing filter zones (no=4 or yes=0)	4	K
SEISMIC FAILURE INDEX:		
IF E=10, L=(D)(E)(I) ; IF E=5, L=(D)(E)(J+1)(K+1)); but less than 100	0	L

State Conservation Engineer's Signature
concurring with technical content of sheets 2 thru 5

COMPUTATION OF POPULATION AT RISK (PAR) DURING DAM FAILURE

STATE	TX		BY	TPB	DATE	9/7/21
DAM	Cibolo Site No. 2: Static		CHECKED BY	ANR	DATE	9/8/21
YEAR BUILT	1978	DESIGN HAZARD CLASS	L	DRAINAGE AREA	2.57	mi^2
WORK PLAN DATE	4/1/1969	CURRENT HAZARD CLASS	H	DAM HEIGHT	50	ft
sht 1 of 3	**STATIC FAILURE SCENARIO (ver. 2013-01)**				NID ID	TX04902

Structures (Elevated) Impacted by Potential Breach	**Number of Structures**			**PAR per Exposure with Inundation Depths >=2.0 Ft.**	**PAR**
	Inundation Depth Above Natural Ground		**Total**		
	<2.0 Ft	**>=2.0 Ft.**			
Mobile Homes				3	
Seasonal Use RV's				2	
Other					
Structures (With Foundations) Impacted by Potential Breach	**Number of Structures**			**PAR per Exposure with Inundation Depths >=1.0 Ft.**	**PAR**
	Inundation Depth Above Natural Ground		**Total**		
	<1.0 Ft	**>=1.0 Ft.**			
Homes	3	76	79	3	228
Seasonal Use Homes and Cabins				1.5	
Duplexes				5	
Apartments					
Commercial Buildings	1	12	13	6	72
Schools (In Use)					
Schools (Not in Use)					
Hospitals					
Other					
Highways and Railroads	**Number of Roads, Highways and Railways**			**PAR per Exposure with Inundation Depths >=1.0 Ft.**	**PAR**
	Road Overflow Depth		**Total**		
	<1.0 Ft	**>=1.0 Ft.**			
Main Local Roads and Minor State Highways					
AMP, ESSER RD S, W THEISSEN ST, ELM ST, N SCHOOL ST, J		10	10	2	20
CRK, S MAIN ST, E THEISSEN ST, SHORT ST, HERFF RD, JAM		10	10	2	20
Major State and Minor Federal Highways					
SH-46 (two locations)		2	2	4	8
Highway Name(s) or Number(s)				4	
Major Federal and Interstate Highways					
IH-10 (EB), IH-10 (WB)		2	2	8	16
US-87		1	1	8	8
Railroads					
UPSF Freight Traffic Only				3	
Passenger Traffic				20	
TOTAL NUMBER OF PEOPLE AT RISK (PAR)					**372**

COMPUTATION OF POPULATION AT RISK (PAR) DURING DAM FAILURE

STATE	TX		BY	TPB	DATE	9/7/21
DAM	Cibolo Site No. 2: Hydrologic		CHECKED BY	ANR	DATE	9/8/21
YEAR BUILT	1978	DESIGN HAZARD CLASS	L	DRAINAGE AREA	2.57	mi^2
WORK PLAN DATE	4/1/1969	CURRENT HAZARD CLASS	H	DAM HEIGHT	50	ft
sht 1 of 3	STATIC FAILURE SCENARIO (ver. 2013-01)				NID ID	TX04902

Structures (Elevated) Impacted by Potential Breach	Number of Structures: Inundation Depth Above Natural Ground <2.0 Ft	>=2.0 Ft.	Total	PAR per Exposure with Inundation Depths >=2.0 Ft.	PAR
Mobile Homes				3	
Seasonal Use RV's				2	
Other					

Structures (With Foundations) Impacted by Potential Breach	Number of Structures: Inundation Depth Above Natural Ground <1.0 Ft	>=1.0 Ft.	Total	PAR per Exposure with Inundation Depths >=1.0 Ft.	PAR
Homes	2	56	58	3	168
Seasonal Use Homes and Cabins				1.5	
Duplexes				5	
Apartments					
Commercial Buildings		9	9	6	54
Schools (In Use)					
Schools (Not in Use)					
Hospitals					
Other					

Highways and Railroads	Number of Roads, Highways and Railways: Road Overflow Depth <1.0 Ft	>=1.0 Ft.	Total	PAR per Exposure with Inundation Depths >=1.0 Ft.	PAR
Main Local Roads and Minor State Highways					
AMP, ESSER RD S, W THEISSEN ST, ELM ST, N SCHOOL ST, J		10	10	2	20
CRK, S MAIN ST, E THEISSEN ST, SHORT ST, HERFF RD, JAM		10	10	2	20
Major State and Minor Federal Highways					
SH-46 (two locations)		2	2	4	8
Highway Name(s) or Number(s)				4	
Major Federal and Interstate Highways					
IH-10 (EB)		1	1	8	8
Highway Name(s) or Number(s)				8	
Railroads					
UPSF Freight Traffic Only				3	
Passenger Traffic				20	
TOTAL NUMBER OF PEOPLE AT RISK (PAR)					**278**

COMPUTATION OF POPULATION AT RISK (PAR) DURING DAM FAILURE

STATE	TX		BY	TPB	DATE	9/7/21
DAM	Cibolo Site No. 2: Seismic		CHECKED BY	ANR	DATE	9/8/21
YEAR BUILT	1978	DESIGN HAZARD CLASS	L	DRAINAGE AREA	2.57	mi^2
WORK PLAN DATE	4/1/1969	CURRENT HAZARD CLASS	H	DAM HEIGHT	50	ft
sht 1 of 3	**STATIC FAILURE SCENARIO (ver. 2013-01)**				NID ID	TX04902

Structures (Elevated) Impacted by Potential Breach	Number of Structures: Inundation Depth Above Natural Ground <2.0 Ft	>=2.0 Ft.	Total	PAR per Exposure with Inundation Depths >=2.0 Ft.	PAR
Mobile Homes				3	
Seasonal Use RV's				2	
Other					

Structures (With Foundations) Impacted by Potential Breach	Number of Structures: Inundation Depth Above Natural Ground <1.0 Ft	>=1.0 Ft.	Total	PAR per Exposure with Inundation Depths >=1.0 Ft.	PAR
Homes	1	40	41	3	120
Seasonal Use Homes and Cabins				1.5	
Duplexes				5	
Apartments					
Commercial Buildings		7	7		0
Schools (In Use)					
Schools (Not in Use)					
Hospitals					
Other					

Highways and Railroads	Number of Roads, Highways and Railways: Road Overflow Depth <1.0 Ft	>=1.0 Ft.	Total	PAR per Exposure with Inundation Depths >=1.0 Ft.	PAR
Main Local Roads and Minor State Highways					
OLEKAMP, ESSER RD S, W THEISSEN ST, ELM ST, N SCHOOL		9	9	2	18
E ST, EDGE CRK, S MAIN ST, E THEISSEN ST, SHORT ST, HER		9	9	2	18
Major State and Minor Federal Highways					
SH-46 (two locations)		2	2	4	8
Highway Name(s) or Number(s)				4	
Major Federal and Interstate Highways					
Highway Name(s) or Number(s)				8	
Highway Name(s) or Number(s)				8	
Railroads					
UPSF Freight Traffic Only				3	
Passenger Traffic				20	
TOTAL NUMBER OF PEOPLE AT RISK (PAR)					**164**

E-2 Federal and State Listed Threatened and Endangered Species Assessment

AECOM

Federal and State Listed Threatened and Endangered Species Assessment

Upper Cibolo Creek Floodwater Retarding Structure No. 2 Rehabilitation Project
Kendall County, Texas

Texas State Soil and Water Conservation Board

Project number: 60630237

August 2022

Delivering a better world

Prepared for:

Texas State Soil and Water Conservation Board

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1. Background

1.1 Project description

AECOM Technical Services, Inc. (AECOM) conducted a federal and state listed threatened and endangered species habitat assessment for the proposed Upper Cibolo Creek Floodwater Retarding Structure (FRS) No. 2 Rehabilitation Project (Project). The proposed Project is located in Kendall County, Texas (**Appendix A, Figure 1**). A literature search and field investigation were conducted for the Project within a potential impact area encompassing approximately 66 acres (Study Area).

The Upper Cibolo Creek FRS No. 2 (dam) was designed and constructed in 1980. The dam was originally constructed as a low hazard dam for the primary purposes of watershed protection and flood prevention. Since construction of the dam in 1980, residential and commercial structures, highways, and utilities have been constructed downstream of it. As a result, a catastrophic failure of the dam would result in property and infrastructure damages as well as potential loss of life. Consequently, the dam has been reclassified by the Natural Resources Conservation Service (NRCS) as a high hazard dam. The existing dam does not meet current safety criteria and performance standards for high hazard dams. Texas State Soil and Water Conservation Board (TSSWCB) has contracted AECOM under Contract No. IDIQ-AECOM-2018-79017 to design proposed improvements that will rehabilitate the dam to meet high-hazard criteria.

The proposed Project involves preparing a final design for dam safety modifications to Upper Cibolo Creek FRS No. 2 on behalf of the TSSWCB. The purposes of the rehabilitation of Upper Cibolo Creek FRS No. 2 are to mitigate identified dam safety deficiencies associated with the dam's reclassification as a high hazard dam. Conceptual analyses and designs that serve the Project purposes were developed in the 2021 Dam Assessment. The proposed modifications presented in the dam assessment to allow the FRS to meet high hazard criteria included the following major components:

- Remove the existing principal spillway inlet (crest elevation 1,590.45 feet) and 24-inch diameter inner diameter (ID) conduit;
- Replace the existing principal spillway inlet and conduit with a new principal spillway inlet riser (crest elevation 1,585.75 feet) and new 36-inch diameter conduit;
- Regarding the inlet and outlet channel of the existing vegetated auxiliary spillway, widen crest from 200 feet to 350 feet, add a splitter dike, and lowering crest the crest 0.7 foot to elevation 1,611.30 feet;
- Protecting the downstream end of auxiliary spillway with rock riprap per stability evaluation;
- Adding a concrete cutoff wall at the control section of the auxiliary spillway;
- Raising and grading the top of dam level 2.3 feet from and elevation of 1,614.5 feet to 1,616.8 feet; and
- Replace rock on 2.5:1 embankment slope.

1.2 Purpose

The purpose of this assessment is to comply with Section 9 of the Endangered Species Act (ESA), Chapters 67 and 68 of the Texas Parks and Wildlife (TPW) Code, and Sections 65.171 - 65.176 of Title 31 of the Texas Administrative Code (TAC) to avoid ‘take’ of federal or state listed threatened or endangered species.

A list of the current United States (U.S.) Fish and Wildlife Service (USFWS) and Texas Parks and Wildlife Department (TPWD) threatened and endangered (T&E) species and their associated habitat requirements are described within this document.

2. Methodology

A literature search was conducted to identify federal and state listed T&E species of concern with the potential to occur within the Study Area. Species lists were accessed through the USFWS’s Environmental Conservation Online System (ECOS) Information for Planning and Consultation (IPaC) tool and through TPWD’s Rare, Threatened, and Endangered Species list for Kendall County. The literature search also included a review of studies and reports related to the ecology of the area as well as a review of TPWD's Texas Natural Diversity Database (TXNDD), which was obtained via email request. The TXNDD was reviewed on August 11, 2022 to report if any rare and/or listed threatened or endangered species have been previously observed within or adjacent to the Study Area.

Field investigations were conducted on July 21, 2022, to verify previously reviewed information, document the presence of potential federal and state listed species and/or potential habitat, and characterize habitat and vegetation types.

3. Regulations

3.1 U.S. Fish and Wildlife Service

3.1.1 Endangered Species Act

USFWS has legislative authority to list and monitor the status of species whose populations are considered to be imperiled. The federal legislative authority for the federal protection of threatened and endangered species issues from the ESA of 1973 and its subsequent amendments. Regulations supporting this Act are codified and regularly updated in Title 50 Code of Federal Regulations (CFR) Sections 17.11 and 17.12.

The ESA process stratifies potential candidates based upon the species' biological vulnerability. Species listed as endangered or threatened by the federal government are provided full protection under the law. This protection not only prohibits the direct possession (take) of a protected species, but also includes a prohibition of indirect take, such as destruction of habitat. Listed plant species are not protected from take, although it is illegal to collect or maliciously harm them on federal land. The ESA and accompanying regulations provide the necessary authority and incentive for individual states to establish their own regulatory vehicle for the management and protection of threatened and endangered species.

3.1.2 Migratory Bird Treaty Act

USFWS has legislative authority to prohibit, unless permitted by regulations, the kill, capture, collection, possession, buying, selling, trading, or transport of any migratory bird, nest, young, feather, or egg in part or in whole. The Migratory Bird Treaty Act (MBTA) and its subsequent amendments (16 U.S. Code [USC] 703-712) give the federal legislative authority for protection of migratory bird species. Regulations supporting the MBTA are codified and regularly updated in Title 50 CFR Parts 10 and 21.

3.2 Texas Parks and Wildlife Department

TPWD prohibits the take, possession, transportation, or sale of any of the animal or plant species designated by state law as endangered or threatened without the issuance of a permit (per Chapters 67 [Nongame Species] and 68 [Endangered Species] of the TPW Code and Sections 65.171 - 65.176 [Threatened and Endangered Nongame Species] of Title 31 of the TAC. “Take” is defined in the TPW Code as to “collect, hook, net, shoot, or snare, by any means or device, and includes an attempt to take or to pursue in order to take”.

Unlike federally listed species, there is no protection of habitat afforded to species that are only listed by the state.

4. Environmental Setting

Publicly available data was reviewed to identify aquatic features, soil types, and vegetation types within the Study Area. Data resources reviewed included the U.S. Geological Survey (USGS) National Hydrography Dataset (NHD), the U.S. Department of Agriculture (USDA) NRCS Web Soil Survey, USGS 7.5’ quadrangle sheets, and recent aerial photography. This data review was used to describe the site-specific information below.

4.1 Land use

The majority of the Study Area consisted of an open water reservoir, a dam structure, an overflow spillway, and undeveloped land. Based on NHD, one perennial stream, Ranger Creek, and one open water feature, Soil Conservation Site 2 Reservoir (Upper Cibolo Creek FRS No. 2 Reservoir) are mapped within the Study Area (USGS 2018). The Study Area is surrounded by undeveloped land. One residential structure is located northeast and one residential structure is located southwest of the Study Area. Ranger Creek Road is located approximately 886 feet north of the Study Area.

4.2 Topography

The USGS 7.5-minute quadrangle map for Ranger Creek displays the topography of the Study Area (**Appendix A, Figure 2**). Topography within the Study Area is shaped by the current reservoir and dam system and the canyon lands surrounding Ranger Creek. The surface gradient slopes to the center of the Study Area from the north and south, with the highest elevation located at the southern boundary of the Study Area at approximately 1700 feet above mean sea level (MSL [National Geodetic Vertical Datum of 1929]). The lowest elevation is located along Ranger Creek in the eastern portion of the Study Area at approximately 1550 feet above MSL (USGS 2019).

4.3 Soils

According to the USDA NRCS Web Soil Survey Report, the Study Area is mapped as being underlain by four soil types (as shown on **Table 1** below and within **Appendix A, Figure 3**) (USDA 2020).

Table 1. NRCS Soil Mapping Units

Mapping Unit	Soil Type	Listed as Hydric by NRCS
5	Brackett-Real association, 10 to 30 percent slopes	No
9	Doss-Brackett association, undulating	No
12	Krum silty clay, 1 to 3 percent slopes	No
13	Krum silty clay, 3 to 5 percent slopes	No

4.4 Vegetation

4.4.1 Historically Mapped and Documented Vegetation Types

According to TPWD's Ecoregion data, the Study Area falls within the Edwards Plateau Level 3 Ecoregion and the Balcones Canyonlands Level 4 Ecoregion.

The Study Area lies within one Land Resource Region (LRR I) and one Major Land Resource Area (MLRA 81C). LRR I denotes the Southwest Plateaus and Plains Range and Cotton Region and consists of mesas, plateaus, and limestone ridges and hills. MLRA 81C is the Edwards Plateau, Eastern part, which can be described as limestone ridges and canyons nearly level to gently sloping valley floors. This region supports a plant community of trees, shrubs and mid or tall grasses with majority of the region comprised of grasslands. More information on LRR I and MLRA 81C can be read within USDA's Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin, Handbook 296. Additionally, the study area is located over the Edwards Aquifer and the Upper Edwards Karst Zone (NRCS 2016).

According to TPWD's Ecological Mapping System of Texas (EMST), the vegetation mapped within the Study Area is identified as Edwards Plateau: Ashe Juniper Slope Forest, Edwards Plateau: Oak/Ashe Juniper Slope Forest, Edwards Plateau: Oak/Hardwood Forest, Edwards Plateau: Floodplain Herbaceous Vegetation, Edwards Plateau: Live Oak Motte and Woodland, Edwards Plateau: Deciduous Oak/Evergreen Motte and Woodland, Edwards Plateau: Oak/Hardwood Motte and Woodland, Edwards Plateau: Savanna Grassland, Edwards Plateau: Ashe Juniper/Live Oak Shrubland, Edwards Plateau Riparian Live Oak Forest, Edwards Plateau: Riparian Hardwood Forest, Edwards Plateau: Riparian Herbaceous Vegetation, Native Invasive: Mesquite Shrubland, and Open Water (**Appendix A, Figure 4**) (Elliot et al 2014).

4.4.2 Existing Conditions

Field investigations documented vegetation types throughout the Study Area. The majority of the Study Area consisted of undeveloped grassland, Ashe juniper / oak (*Juniperus ashei / Quercus* spp.) woodlands, riparian Ashe juniper / deciduous hardwood forest and woodlands, and canyonland. Common species observed within the tree and sapling/shrub stratum included Ashe juniper, plateau live oak (*Quercus fusiformis*), eastern cottonwood (*Populus deltoides*), and black willow (*Salix nigra*). Common herbaceous species observed within and around the drainages include creek oats (*Chasmanthium latifolium*), switchgrass (*Panicum virgatum*), wild rye (*Elymus canadensis*), sunflower (*Helianthus* spp.), bluestem grasses (*Andropogon* spp.), bermuda grass (*Cynodon dactylon*), upright prairie coneflower (*Ratibida columnifera*), frog fruit (*Phyla nodiflora*), and Johnson grass (*Sorghum halepense*). See **Appendix B** for representative photographs of the Study Area.

5. Federal and State Listed T&E Species Review

A literature search and database review were conducted to identify federal and state listed T&E species of concern with the potential to occur within the Study Area. Species lists were accessed through the USFWS ECOS IPaC tool and through TPWD's Rare, Threatened, and Endangered Species of Texas (**Appendix C**). Additionally, the literature search included a review of studies and reports related to the ecology of the area.

Four species were listed by the USFWS as federally endangered in Kendall County. These species include the golden-cheeked warbler (*Setophaga chrysoparia*), Comal Springs dryopid beetle (*Stygoparnus comalensis*), Comal Springs riffle beetle (*Heterelmis comalensis*), and Peck's Cave amphipod (*Stygobromus pecki*) (USFWS 2022).

Two species, the piping plover (*Charadrius melodus*) and the red knot (*Calidris canutus rufa*) were listed as federally threatened by the USFWS in Kendall County (USFWS 2022).

One species, the bracted twistflower (*Strepthanthus bracteatus*), was listed by USFWS as proposed threatened and one species, the monarch butterfly (*Danaus plexippus*) was listed by the USFWS as a federal candidate species in Kendall County. However, species proposed to be listed and candidate species receive no statutory protection under the ESA (USFWS 2022).

TPWD listed an additional federally endangered species, the whooping crane (*Grus americana*); and three proposed endangered species, Guadalupe fatmucket (*Lampsilis bergmanni*), Guadalupe orb (*Cyclonaias necki*), and false spike (*Fusconaia mitchelli*) for Kendall County that were not included in the USFWS IPaC list (TPWD 2022a).

Fifteen species were listed as state threatened in Kendall County by TPWD. These include the white-faced ibis (*Plegadis chihi*), zone-tailed hawk (*Buteo albonotatus*), Texas salamander (*Eurycea neotenes*), Cascade Caverns salamander (*Eurycea latitans*), plateau shiner, *(Cyprinella lepida*), headwater catfish (*Ictalurus lupus*), Guadalupe darter (*Percina apristis*), black bear (*Ursus americanus*), white-nosed coati (*Nasua narica*), false spike, Guadalupe orb, Guadalupe fatmucket, Cagle's map turtle (*Graptemys caglei*), Texas tortoise (*Gopherus berlandieri*), and Texas horned lizard (*Phrynosoma cornutum*). In addition, two species were listed as state endangered in Kendall County by TPWD. These include the golden-cheeked warbler and whooping crane (TPWD 2022a).

Suitable habitat for the federal and state endangered golden-cheeked warbler was identified within the Study Area during the site visit. Suitable habitat is located in the southern portion of the Study Area and is approximately 3.6 acres in size (**Appendix A, Figure 5**).

A summary of federal and state listed species for Kendall County, their habitat requirements, and potential habitat determinations are shown in **Table 2**.

Table 2. Listed Threatened and Endangered Species in Kendall County, Texas

Common Name	Scientific Name	Listing Status		Habitat Requirements / Species Description	Potential Habitat within Study Area	Determination
		Federal	State*			
Birds						
Golden-cheeked Warbler	*Setophaga chrysoparia*	LE	E	Ashe juniper in mixed stands with various oaks (*Quercus* spp.). Edges of cedar brakes. Dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer.	Yes	Ashe juniper/oak woodlands were present that may provide potentially suitable nesting habitat. Approximately 3.6 acres of potentially suitable nesting habitat is located within the Study Area and additional habitat is adjoining the Study Area (**Appendix A, Figure 5**).
Piping Plover	*Charadrius melodus*	LT	T	Sand and gravel shores of rivers and lakes. Beaches, sandflats, and dunes along Gulf Coast beaches and adjacent offshore islands.	No	Species may occur as a migrant/transient; however, no sand or gravel shores of rivers or lakes are present within the Study Area.
Red Knot	*Calidris canutus rufa*	LT	T	Prefers the shoreline of coast and bays and also uses mudflats during rare inland encounters.	No	Species may occur as a migrant/transient; however, coastal/bay shorelines and mudflats are not present within the Study Area.
White-faced Ibis	*Plegadis chihi*	NL	T	Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats.	No	Species may occur as a migrant/transient; however, freshwater marshes, sloughs, irrigated rice fields, and brackish habitats are not present within the Study Area.

Common Name	Scientific Name	Listing Status		Habitat Requirements / Species Description	Potential Habitat within Study Area	Determination
		Federal	State*			
Whooping Crane	*Grus americana*	LE	E	Large, shallow ponds, marshes, and flooded grain fields for both roosting and foraging. Potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties.	No	Species may occur as a rare migrant/transient; however, marshes and flooded grain fields are not present within the Study Area.
Zone-tailed hawk	*Grus americana*	NL	T	Arid open country, including open deciduous or pine-oak woodland, mesa or mountain county, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains; nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions	Yes	Wooded canyons and cottonwoods in riparian areas are present within the Study Area. Additionally, the Study Area is located within breeding range for this species. Species may also occur as a migrant/transient.
Mollusks						
Guadalupe Fatmucket	*Lampsilis bergmanni*	PE	T	Reported to occur in slow to moderate current in sand, mud, and gravel substrates among large cobble, boulders, bedrock ledges, horizontal cracks in bedrock slabs, and macrophyte beds. Has also been observed inhabiting the roots of cypress trees and vegetation along steep banks. Reported in lakes at Kerrville, Texas, which suggests it may occasionally persist in some impoundment conditions.	Yes	Habitats including slow to moderate current in mud and gravel substrates among large cobble, boulders, and bedrock ledges occur within the Study Area.
Guadalupe Orb	*Cyclonaias necki*	PE	T	Species' distribution is limited to the Guadalupe River basin. Occurs in both mainstem and tributary habitats. Often found in substrates composed of sand, gravel, and cobble, including mud-silt or gravel-filled cracks in bedrock slabs. Considered intolerant of reservoirs, but are known to occur in them.	No	Study area is located outside of the Guadalupe River basin. Species is also considered intolerant of reservoirs.

Common Name	Scientific Name	Listing Status		Habitat Requirements / Species Description	Potential Habitat within Study Area	Determination
		Federal	State*			
False Spike	*Fusconaia mitchelli*	PE	T	Occurs in small streams to medium-size rivers in habitats such as riffles and runs with flowing water. Is often found in stable substrates of sand, gravel, and cobble.	Yes	Small streams with riffles and runs with flower water are present within the Study Area.
Mammals						
White-nosed Coati	*Nasua narica*	NL	T	Woodlands, riparian corridors and canyons. Most individuals in Texas probably transients from Mexico; diurnal and crepuscular; very sociable; forages on ground and in trees; omnivorous; may be susceptible to hunting, trapping, and pet trade.	No	Study Area is located outside of the current range of this species.
Black Bear	*Ursus americanus*	NL	T	Generalist. Historically found throughout Texas. In Chisos, prefers higher elevations where pinyon-oaks predominate; also occasionally sighted in desert scrub of Trans-Pecos (Black Gap Wildlife Management Area) and Edwards Plateau in juniper-oak habitat. For ssp. luteolus, bottomland hardwoods, floodplain forests, upland hardwoods with mixed pine; marsh. Bottomland hardwoods and large tracts of inaccessible forested areas.	No	This species is extirpated from the Study Area.

Common Name	Scientific Name	Listing Status		Habitat Requirements / Species Description	Potential Habitat within Study Area	Determination
		Federal	State*			
Reptiles						
Cagle's Map Turtle	*Graptemys caglei*	NL	T	Aquatic: shallow water with swift to moderate flow and gravel or cobble bottom, connected by deeper pools with a slower flow rate and a silt or mud bottom; gravel bar riffles and transition areas between riffles and pools especially important in providing insect prey items; nests on gently sloping sand banks within ca. 30 feet of water's edge.	No	No potential habitat, including aquatic areas, is present within the Study Area.
Texas Horned Lizard	*Phrynosoma cornutum*	NL	T	Arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive.	No	No potential habitat, including sparse vegetation, scattered brush, cactus, or scrubby trees, and sandy to rocky areas, is present within the Study Area.
Texas Tortoise	*Gopherus berlandieri*	NL	T	Terrestrial: Open scrub woods, arid brush, lomas, grass-cactus association; often in areas with sandy well-drained soils. When inactive occupies shallow depressions dug at base of bush or cactus; sometimes in underground burrow or under object. Eggs are laid in nests dug in soil near or under bushes.	No	No potential habitat, including open scrub woods, arid brush, lomas, and grass-cactus associations, is present within the Study Area.
Amphibians						
Cascade Caverns Salamander	*Eurycea latitans*	NL	T	Aquatic; springs, streams and caves with rocky or cobble beds.	No	Aquatic features are present; however, based on the location of the Study Area it is unlikely that there is potential habitat for this species. A geologic assessment and water quality BMPS will be implemented to minimize and avoid potential downstream impacts.

Common Name	Scientific Name	Listing Status		Habitat Requirements / Species Description	Potential Habitat within Study Area	Determination
		Federal	State*			
Texas Salamander	*Eurycea neotenes*	NL	T	Aquatic; springs, streams and caves with rocky or cobble beds.	No	Aquatic features are present; however, based on the location of the Study Area it is unlikely that there is potential habitat for this species. A geologic assessment and water quality BMPS will be implemented to minimize and avoid potential downstream impacts.
Fishes						
Guadalupe Darter	*Percina apristis*	NL	T	Endemic to the Guadalupe River Basin; Found in riffles; most common under or around 25-30 cm boulders in the main current; seems to prefer moderately turbid water.	No	No potential habitat, including riffles in the main current of the Guadalupe River, is located within the Study Area.
Headwater Catfish	*Ictalurus lupus*	NL	T	Originally throughout streams of the Edwards Plateau and the Rio Grande basin, currently limited to Rio Grande drainage, including Pecos River basin; springs, and sandy and rocky riffles, runs, and pools of clear creeks and small rivers.	No	This species has been extirpated from streams/river basins within range of the Study Area.
Plateau Shiner	*Cyprinella lepida*	NL	T	Edwards Plateau portion of Nueces basin, mainstem and tributaries of Nueces, Frio, and Sabinal rivers; may also be endemic to upper reaches of the Guadalupe River; clear, cool, spring-fed headwater creeks; usually over gravel and limestone substrates.	No	Study area is located outside of the Nueces and Guadalupe river basin.
Insects						

Common Name	Scientific Name	Listing Status		Habitat Requirements / Species Description	Potential Habitat within Study Area	Determination
		Federal	State*			
Comal Springs Dryopid Beetle	*Stygoparnus comalensis*	LE	E	Dryopids usually cling to objects in a stream; dryopids are sometimes found crawling on stream bottoms or along shores; adults may leave the stream and fly about, especially at night; most dryopid larvae are vermiform and live in soil or decaying wood. Found in Comal and San Marcos Springs.	No	Comal and San Marcos Springs are not located within the Study Area.
Comal Springs riffle beetle	*Heterelmis comalensis*	LE	E	Found in Comal and San Marcos Springs.	No	Comal and San Marcos Springs are not located within the Study Area.
Monarch Butterfly	*Danaus plexippus*	C	NL	Monarch butterflies are habitat generalists but require milkweed species (*Asclepias* spp.) as larval hosts and a nectar source for adults (TPWD 2016). Monarch butterflies complete a multi-generational migration from Mexico northward starting in Spring. Monarch butterflies fly to Texas from Mexico beginning in March and lay their eggs on milkweed species present in the state. Those monarch butterflies have completed their journey and reproduction. The eggs and resulting larvae present on milkweeds in Texas then use the milkweed as a food source to prepare for metamorphosis to their butterfly form. Those butterflies then mate and continue to lay eggs on milkweed species as they move north for the summer. In the fall, monarch butterflies start moving into the panhandle of Texas during migration to overwintering grounds in Mexico. In Texas, monarch butterflies and their eggs and larvae are present from March-June and September- October (TPWD 2016).	No	No suitable habitat, including milkweed species, were observed within the Study Area. However, species may occur within the Study Area as stop over or in foraging areas.
Crustaceans						
Peck's Cave Amphipod	*Stygobromus pecki*	LE	E	Small, aquatic crustacean; lives underground in the Edwards Aquifer; collected at Comal Springs and Hueco Springs.	No	Study Area is located over the Edwards Aquifer and aquatic areas are present. However, the Study Area is located outside of Comal and Hueco Springs.

Common Name	Scientific Name	Listing Status		Habitat Requirements / Species Description	Potential Habitat within Study Area	Determination
		Federal	State*			
Plants						
Bracted Twistflower	*Streptanthus bracteatus*	PT	NL	Shallow, well-drained gravelly clays and clay loams over limestone in oak juniper woodlands and associated openings, on steep to moderate slopes and in canyon bottoms; several known soils include Tarrant, Brackett, or Speck over Edwards, Glen Rose, and Walnut geologic formations; populations fluctuate widely from year to year, depending on winter rainfall; flowering mid-April-late May, fruit matures and foliage withers by early summer.	No	Gravelly clay and clay loams over limestone in oak juniper woodlands are not present within the Study Area.

LE- Listed Endangered, LT- Listed Threatened, NL- Not Listed, T- State Threatened, E- State Endangered, PE-Proposed Endangered, C-Candidate

Source: USFWS, 2022; TPWD, 2022b

**Status as returned in a county specific query, not a statewide listing*

6. TXNDD Element Occurrence Review and Critical Habitat

A review of USFWS Critical Habitat was performed for the vicinity of the Study Area. No critical habitat for federally listed species was mapped within or immediately adjacent to the Study Area (USFWS 2021).

Additionally, TPWD's TXNDD was reviewed on August 11, 2022 to assess if any rare and/or listed endangered and threatened species have been previously observed within or adjacent to the Study Area. No elements of occurrence (EOs) were reported within the limits of the Study Area. Four EOs for state or federally listed species were reported within five miles of the study area and include golden-cheeked warbler, black bear, Cascade Caverns salamander, and the Texas salamander. Nineteen EOs for non-listed species were also reported within five miles of the Study Area and include baldcypress-sycamore series, big red sage (*Salvia pentstemonoides*), bigtooth maple-oak series (*Acer grandidentatum-quercus spp. series*), black bear (*Ursus americanus*), buckley tridens (*Tridens buckleyanus*), canyon mock-orange (*Philadelphus texensis var. ernestii*), darkstem noseburn (*Tragia nigricans*), eastern box turtle (*Terrapene carolina*), Guadalupe bass (*Micropterus treculii*), hairy sycamore-leaf snowbell (*styrax platanifolious ssp. stellatus*), Heller's marbleseed (*Onosmodium helleri*), hill country wild-mercury (*Argythamnia aphoroides*), plateau milkvine (*Matelea edwardsensis*), spreading leastdaisy (*Chaetopappa effusa*), Strecker's chorus frog (*Pseudacris streckeri*), Texas amorpha (*Amorpha roemeriana*), Texas mock-orange (*Philadelphus texensis var. texensis*), Texas seymeria (*Seymeria texana*), Texas shiner (*Notropis amabilis*), and western box turtle *(Terrapene ornata*) (**Appendix A**, **Figure 6**) (TPWD 2022b).

No recorded EOs for species does not mean that there is an absence of endangered, threatened, or rare species and should not be solely used for presence/absence determinations.

7. Conclusions

This assessment found that potentially suitable habitat for one federal and state listed endangered species, the golden-cheeked warbler; three state threatened species, zone-tailed hawk, the Guadalupe fatmucket, false spike, and one candidate species, monarch butterfly is present within the Study Area and these species may be affected by improvement activities. No additional federal or stated listed T&E species were determined to have suitable habitat and are not likely to be impacted by the proposed Project. Coordination with USFWS and TPWD may be required to avoid potential impacts to protected species and comply with general requirements under federal and state protected species regulations. Project activities, including temporary dewatering, have the potential to impact mollusk and aquatic species (if present). A 2017 interagency coordination letter between TPWD and TSSWCB stated that mussel surveys and aquatic relocations are not warranted for this type of dam repair project and recommend that best management practices (BMPs) per TPWD's *Guidelines for Aquatic Resource Relocation Plans (ARRP) for Fish and Shellfish, Including Freshwater Mussels* (PWD LF T3200-1958) be implemented during construction. However, the federal listing status of the mollusk species proposed for federal listing should be monitored regularly through construction completion of the Project. If these species become listed as threatened or endangered by the USFWS prior to or during construction and Project activities have the potential to impact these species, then USFWS consultation and subsequent impact minimization measures may be necessary to comply with federal regulations.

No USFWS Critical Habitat was mapped within the Study Area. Additionally, no TXNDD EO's for federal or state listed T&E species were recorded within the Study Area. However, four TXNDD EO's for federal or state listed T&E species were recorded within five miles of the Study Area and include the golden-cheeked warbler, black bear, Cascade Caverns salamander, and the Texas salamander. Suitable habitat for the federal and state endangered golden-cheeked warbler was identified within the southern portion Study Area during the site visit totaling 3.6 acres in size (**Appendix A**, **Figure 5**). Presenece absence surveys for this species is recommended prior to the occurrence of construction activities.

Depending on the timing of construction and amount of tree/shrub clearing required for construction activities, migratory birds could potentially be impacted by the project. If clearing of trees and shrubs is necessary, then AECOM recommends conducting nest surveys prior to clearing activities. In accordance with the MBTA, construction activities and any vegetation clearing should be conducted outside peak-nesting seasons (March-August) to avoid any adverse effects to migratory birds and their habitats. Should construction and vegetation clearing occur from March through August, active bird nest surveys should be conducted by a biologist no more than 5 days prior to construction.

8. References

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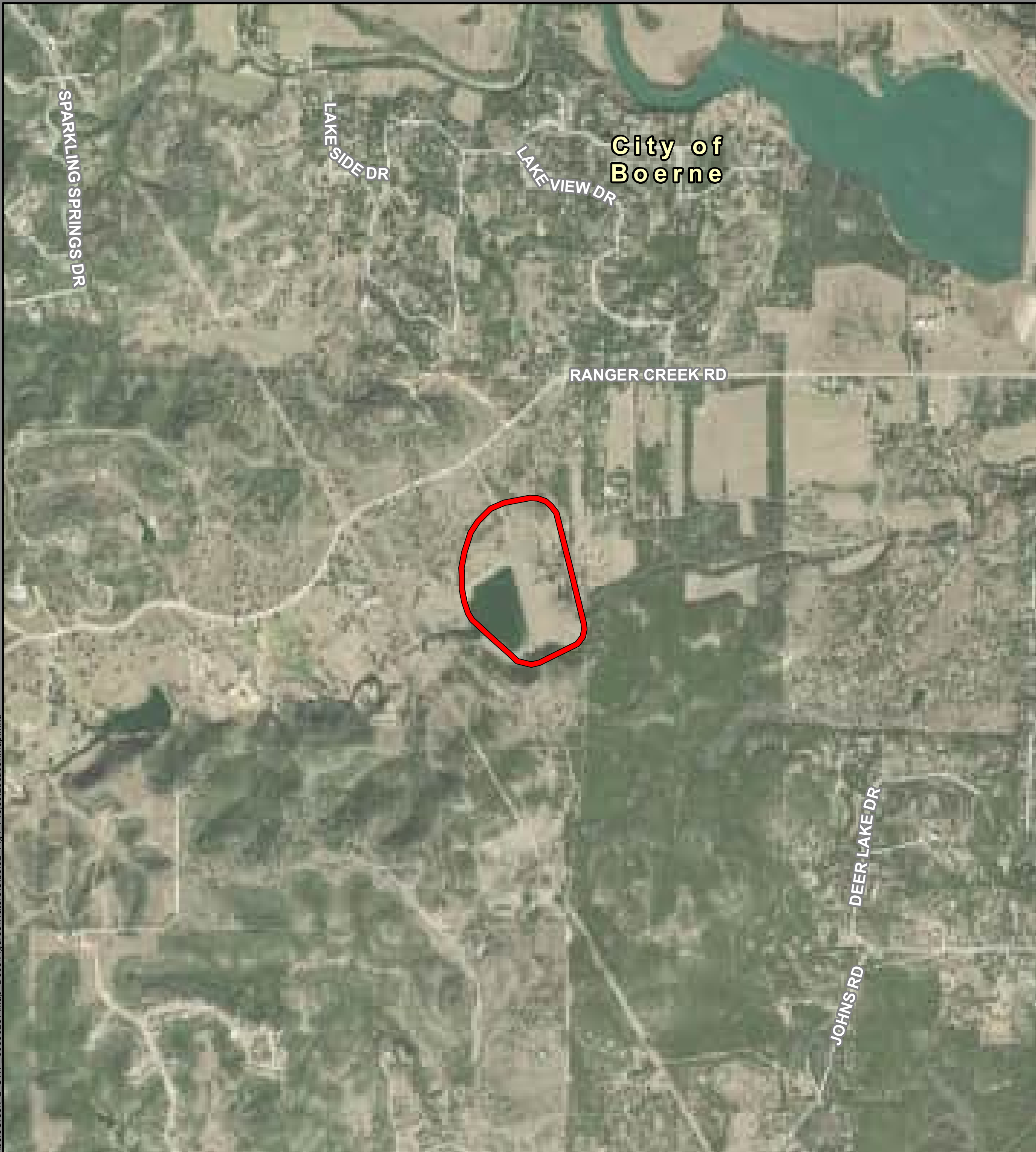
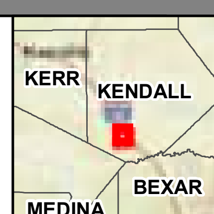
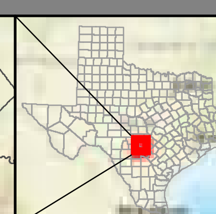
—. 7.5-Minute Quarter Quadrangle, Ranger Creek, Texas. 2019

Appendix A Figures



Study Area





Project Location Map

Upper Cibolo Creek FRS No. 2
Kendall County, Texas

N W E S

0 1,000 2,000
Feet

Data Sources: Roads - TxDOT 2018; Cities - TxDOT 2018; County Boundaries - TIGER 2015
Basemap: Maxar 1/12/2019

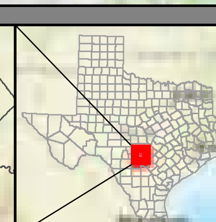
AECOM

August 2022

Figure 1

Author: helen.potter; Document Path: M:\Dallas GIS\Projects\TSSWCB\CiboloCreek 2 SWP 60630237\Map Docs\Figures\Waters\Cibolo2 Fig1 ProjectLocationMap.mxd

Study Area



USGS Topographic Map

Upper Cibolo Creek FRS No. 2
Kendall County, Texas

N W E S

0 1,000 2,000
Feet

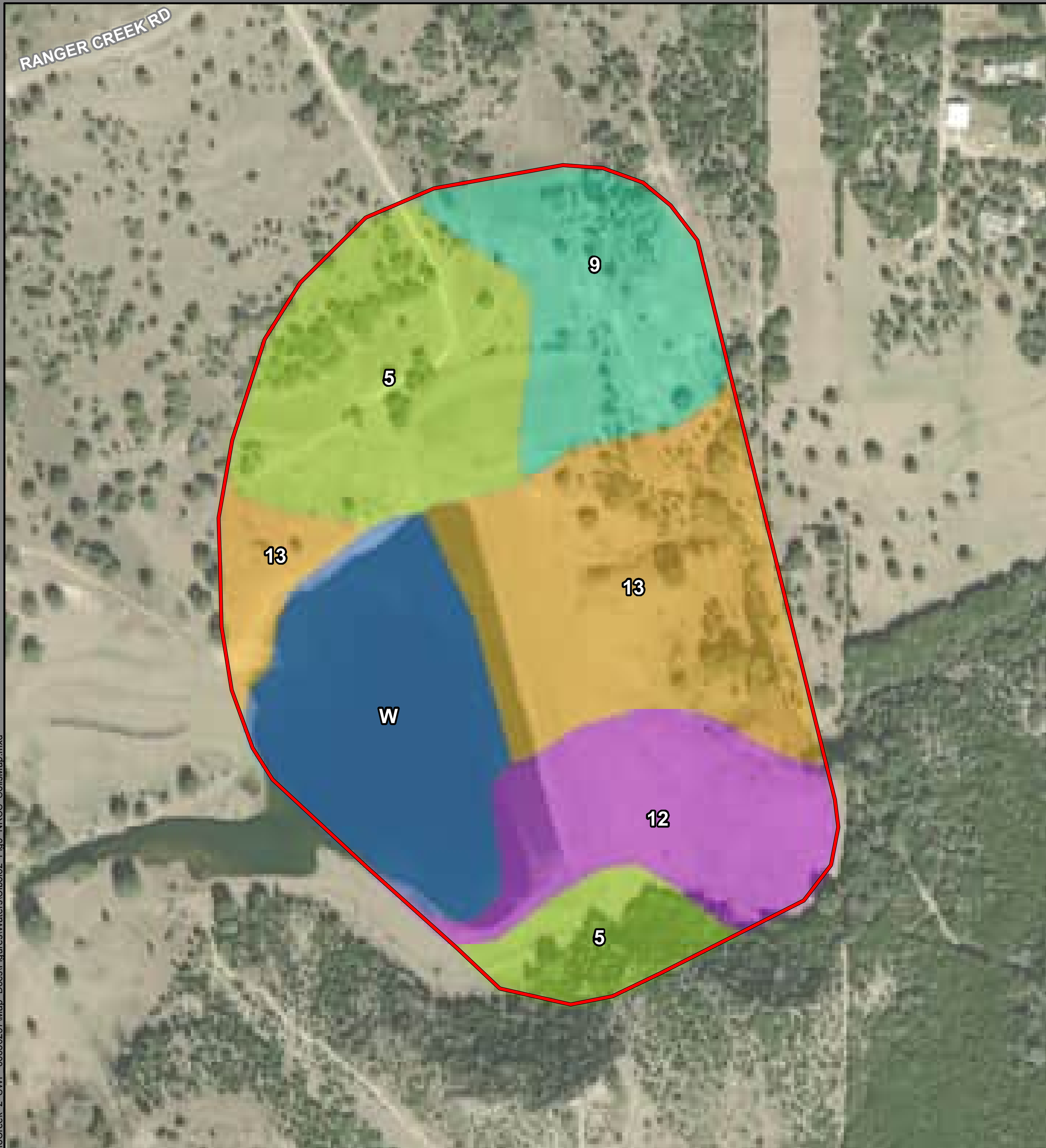
Data Sources: Roads - TxDOT 2018; County Boundaries - TIGER 2015
Basemap: USGS 7.5-minute Topographic Maps: Ranger Creek Quadrangle

AECOM

August 2022

Figure 2

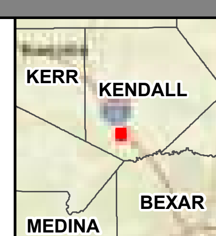
Author: helen.potter; Document Path: M:\Dallas GIS\Projects\TSSWCB\CiboloCreek 2 SWP 60630237\Map Docs\Figures\Waters\Cibolo2 Fig2 USGS TopoMap.mxd



Study Area

NRCS Soil Types

12 - Krum silty clay, 1 to 3 percent slopes
13 - Krum silty clay, 3 to 5 percent slopes
5 - Brackett-Real association, 10 to 30 percent slopes
9 - Doss-Brackett association, undulating
W - Water



NRCS Soils Map

Upper Cibolo Creek FRS No. 2
Kendall County, Texas

N W E S

0 100 200 300
Feet

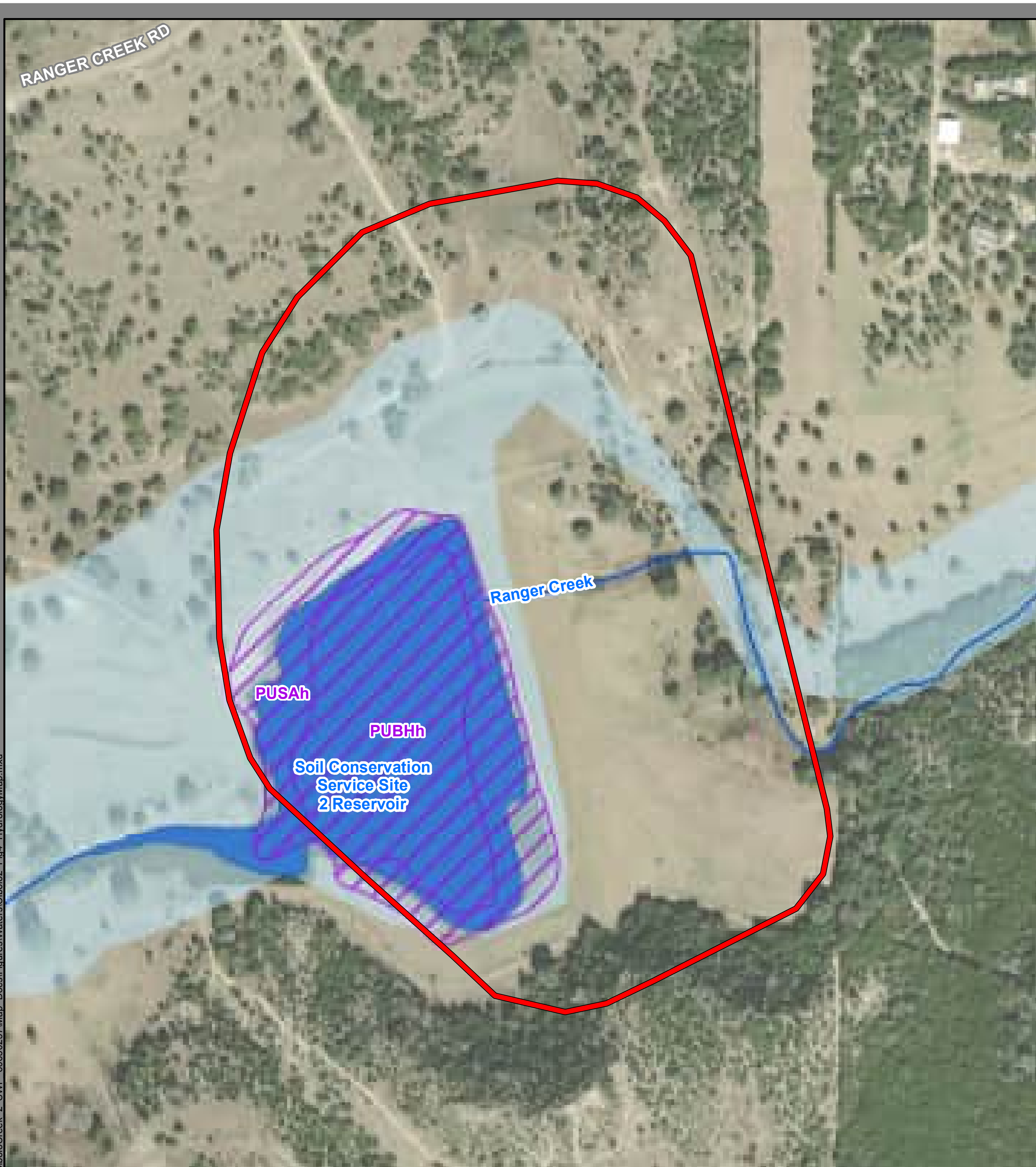
Data Sources: Soils - NRCS 2018; Roads - TxDOT 2018; County Boundaries - TIGER 2015
Basemap: Maxar 1/12/2019

AECOM

August 2022

Figure 3

Author: helen.potter; Document Path: M:\Dallas GIS\Projects\TSSWCB\CiboloCreek 2 SWP 60630237\Map Docs\Figures\Waters\Cibolo2 Fig3 NRCS SoilsMap.mxd



Study Area

National Hydrography Dataset (NHD)

Stream/River (Perennial)

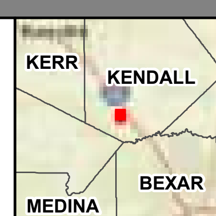
Lake/Pond

National Wetlands Inventory (NWI)

Freshwater Pond

FEMA Flood Zones

100-year Floodplain (1% Annual Chance)



Hydrology Map

Upper Cibolo Creek FRS No. 2
Kendall County, Texas

N W E S

0 100 200 300
Feet

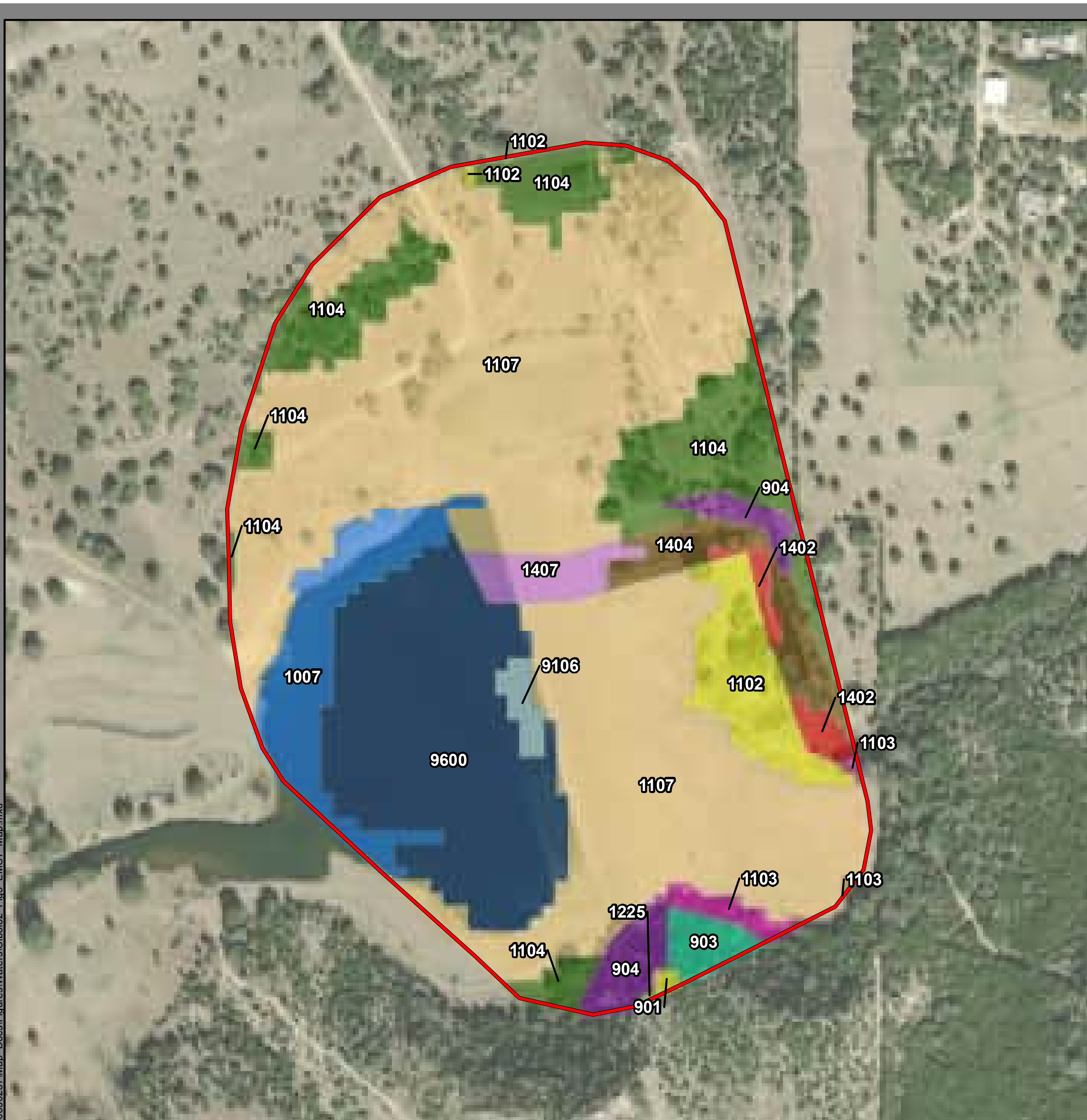
Data Sources: Roads - TxDOT 2018; County Boundaries - TIGER 2015; NHD - USGS 2021; NWI - USFWS 2018; Flood Zones - FEMA 2020
Basemap: Maxar 1/12/2019

AECOM

August 2022

Figure 4

Author: helen.potter; Document Path: M:\Dallas GIS\Projects\TSSWCB\CiboloCreek 2 SWP 60630237\Map Docs\Figures\Waters\Cibolo2 Fig4 HydrologyMap.mxd



EMST Vegetation Types

- 901, Edwards Plateau: Ashe Juniper Slope Forest
- 903, Edwards Plateau: Oak / Ashe Juniper Slope Forest
- 904, Edwards Plateau: Oak / Hardwood Slope Forest
- 1007, Edwards Plateau: Floodplain Herbaceous Vegetation
- 1102, Edwards Plateau: Live Oak Motte and Woodland
- 1103, Edwards Plateau: Deciduous Oak / Evergreen Motte and Woodland
- 1104, Edwards Plateau: Oak / Hardwood Motte and Woodland
- 1107, Edwards Plateau: Savanna Grassland
- 1225, Edwards Plateau: Ashe Juniper / Live Oak Slope Shrubland
- 1402, Edwards Plateau: Riparian Live Oak Forest
- 1404, Edwards Plateau: Riparian Hardwood Forest
- 1407, Edwards Plateau: Riparian Herbaceous Vegetation
- 9106, Native Invasive: Mesquite Shrubland
- 9600, Open Water
- Study Area

Ecological Mapping Systems of Texas (EMST) Map

Upper Cibolo Creek FRS No. 2
Kendall County, Texas

N
W E
S

0 100 200 300
Feet

Data Sources: EMST - TPWD 2018; Roads - TxDOT 2018; County Boundaries - TIGER 2015
Basemap: Maxar 1/12/2019

AECOM

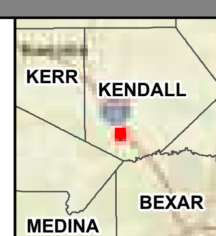
August 2022

Figure 5

Author: helen.potter; Document Path: M:\Dallas_GIS\Projects\TSSWCB\CiboloCreek_2_SWP_60630237\Map_Docs\Figures\Waters\Cibolo2_Fig5_EMST_Map.mxd

Study Area

Potentially Suitable Golden-cheeked Warbler Habitat



Golden-cheeked Warbler Habitat Map

Upper Cibolo Creek FRS No. 2
Kendall County, Texas

N
W E
S

0 100 200 300
Feet

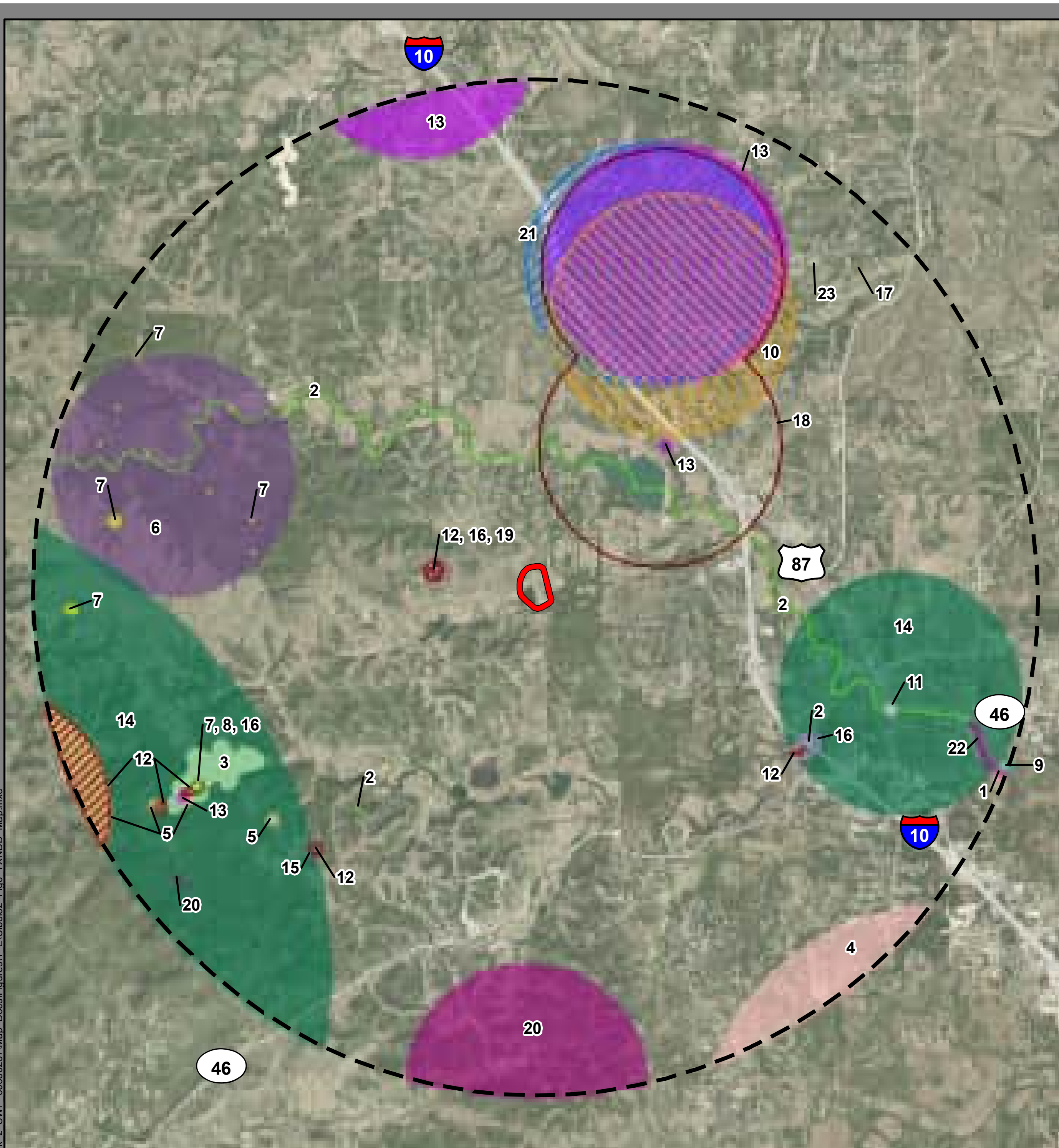
Data Sources: GCWA Habitat - AECOM Field Survey 7/6/2022; Roads - TxDOT 2018; County Boundaries - TIGER 2015
Basemap: Maxar 1/12/2019

AECOM

August 2022

Figure 5

Author: helen.potter; Document Path: M:\Dallas GIS\Projects\TSSWCB\CiboloCreek\CiboloCreek 2 SWP 60630237\Map Docs\Figures\T E\Cibolo2 Fig5 GCWA Habitat Map.mxd



- Study Area
- 5 Mile Study Area Buffer

TXNDD Element Occurrence Record (EOR)

- 1: Baldcypress-sycamore Series
- 2: Big Red Sage
- 3: Bigtooth Maple-oak Series
- 4: Black Bear
- 5: Buckley Tridens
- 6: Canyon Mock-orange
- 7: Cascade Caverns Salamander
- 8: Darkstem Noseburn
- 9: Eastern Box Turtle
- 10: Golden-cheeked Warbler
- 11: Guadalupe Bass
- 12: Hairy Sycamore-leaf Snowbell
- 13: Heller's Marbleseed
- 14: Hill Country Wild-mercury
- 15: Plateau Milkvine
- 16: Spreading Leastdaisy
- 17: Strecker's Chorus Frog
- 18: Texas Amorpha
- 19: Texas Mock-orange
- 20: Texas Salamander
- 21: Texas Seymeria
- 22: Texas Shiner
- 23: Western Box Turtle

Texas Natural Diversity Database (TXNDD) Map

Upper Cibolo Creek FRS No. 2
Kendall County, Texas

N W E S

0 0.5 1 1.5
Miles

Data Sources: Roads - TxDOT 2018; County Boundaries - TIGER 2015; TXNDD EOR - TPWD 8/1/2022
Basemap: Maxar 2019

AECOM

August 2022

Figure 6

Author: helen.potter; Document Path: M:\Dallas GIS\Projects\TSSWCB\CiboloCreek 2 SWP 60630237\Map Docs\Figures\T E\Cibolo2 Fig6 TXNDD Map.mxd

Appendix B Photographic Log

Site Name:	Site Location:	Project No.
Upper Cibolo Creek FRS No. 2	Kendall County, TX	60630237

Photo No.	Date:
1	07/21/22

Direction Photo Taken:

Southwest

Description:

View of the Study Area west of the Upper Cibolo Creek FRS No. 2 Reservoir (reservoir).

Photo No.	Date:
2	07/21/22

Direction Photo Taken:

Southeast

Description:

View of potential golden-cheeked warbler (*Setophaga chrysoparia*) habitat east of the reservoir within the Study Area.

AECOM	PHOTOGRAPHIC LOG

Site Name: Upper Cibolo Creek FRS No. 2	Site Location: Kendall County, TX	Project No. 60630237

Photo No. 3	Date: 07/21/22

Direction Photo Taken:

Southeast

Description:

View of potential golden-cheeked warbler habitat east of the reservoir within the Study Area.

Photo No. 4	Date: 07/21/22

Direction Photo Taken:

Southeast

Description:

View of Study Area north of the dam structure.

Site Name: Upper Cibolo Creek FRS No. 2	Site Location: Kendall County, TX	Project No. 60630237

Photo No. 5

Date: 07/21/22

Direction Photo Taken:

Southeast

Description:

View of Study Area north of the dam structure with potential golden-cheeked warbler habitat to the east.

Photo No. 6

Date: 07/21/22

Direction Photo Taken:

Southeast

Description:

View of Study Area north of the dam structure with potential golden-cheeked warbler habitat.

Site Name: Upper Cibolo Creek FRS No. 2	Site Location: Kendall County, TX	Project No. 60630237

Photo No. 7	Date: 07/21/22
Direction Photo Taken: Northeast	
Description: View of Study Area north of the dam structure with potential golden-cheeked warbler habitat.	

Photo No. 8	Date: 07/21/22
Direction Photo Taken: Southeast	
Description: View of Ranger Creek north of the dam structure within the Study Area.	

Appendix C Federal and State Database Review

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Austin Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, TX 78758-4460
Phone: (512) 490-0057 Fax: (512) 490-0974

In Reply Refer To: August 01, 2022
Project Code: 2022-0069599
Project Name: Upper Cibolo Creek FRS 2

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Austin Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, TX 78758-4460
(512) 490-0057

Project Summary

Project Code: 2022-0069599
Project Name: Upper Cibolo Creek FRS 2
Project Type: Dam - Maintenance/Modification
Project Description: FRS 2
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@29.80693995,-98.79076559198319,14z

Counties: Kendall County, Texas

Endangered Species Act Species

There is a total of 8 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 2 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Golden-cheeked Warbler *Setophaga chrysoparia* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/33	Endangered
Piping Plover *Charadrius melodus* Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. The location of the critical habitat is not available. This species only needs to be considered under the following conditions: ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot *Calidris canutus rufa* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. This species only needs to be considered under the following conditions: ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened

Insects

NAME	STATUS
Comal Springs Dryopid Beetle *Stygoparnus comalensis* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/7175	Endangered
Comal Springs Riffle Beetle *Heterelmis comalensis* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/3403	Endangered
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Crustaceans

NAME	STATUS
Peck's Cave Amphipod *Stygobromus (=Stygonectes) pecki* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/8575	Endangered

Flowering Plants

NAME	STATUS
Bracted Twistflower *Streptanthus bracteatus* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/2856	Proposed Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

IPaC User Contact Information

Agency: Texas General Land Office
Name: Payton Prather
Address: 9400 Amberglenn Blvd #E
City: Austin
State: TX
Zip: 78729
Email paytonp1776@gmail.com
Phone: 7134942044

Last Update: 7/12/2022

KENDALL COUNTY

AMPHIBIANS

Cascade Caverns salamander *Eurycea latitans*

Aquatic; springs, streams and caves with rocky or cobble beds.

Federal Status: State Status: T SGCN: Y

Endemic: Y Global Rank: G3 State Rank: S2

Strecker's chorus frog *Pseudacris streckeri*

Terrestrial and aquatic: Wooded floodplains and flats, prairies, cultivated fields and marshes. Likes sandy substrates.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3

Texas salamander *Eurycea neotenes*

Aquatic; springs, streams and caves with rocky or cobble beds.

Federal Status: State Status: T SGCN: Y

Endemic: Y Global Rank: G1G2 State Rank: S1S2

Valdina Farms sinkhole salamander *Eurycea troglodytes*

Aquatic; springs, streams and caves with rocky or cobble beds.

Federal Status: State Status: SGCN: N

Endemic: Y Global Rank: G3 State Rank: S3S4

Woodhouse's toad *Anaxyrus woodhousii*

Terrestrial and aquatic: A wide variety of terrestrial habitats are used by this species, including forests, grasslands, and barrier island sand dunes. Aquatic habitats are equally varied.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: SU

BIRDS

bald eagle *Haliaeetus leucocephalus*

Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3B,S3N

KENDALL COUNTY

BIRDS

black-capped vireo *Vireo atricapilla*

Oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous and broad-leaved shrubs and trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nesting season March-late summer

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G3 State Rank: S3B

chestnut-collared longspur *Calcarius ornatus*

Occurs in open shortgrass settings especially in patches with some bare ground. Also occurs in grain sorghum fields and Conservation Reserve Program lands

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3

Franklin's gull *Leucophaeus pipixcan*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. This species is only a spring and fall migrant throughout Texas. It does not breed in or near Texas. Winter records are unusual consisting of one or a few individuals at a given site (especially along the Gulf coastline). During migration, these gulls fly during daylight hours but often come down to wetlands, lake shore, or islands to roost for the night.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S2N

golden-cheeked warbler *Setophaga chrysoparia*

Ashe juniper in mixed stands with various oaks (Quercus spp.). Edges of cedar brakes. Dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer.

Federal Status: LE State Status: E SGCN: Y

Endemic: N Global Rank: G2 State Rank: S2S3B

lark bunting *Calamospiza melanocorys*

Overall, it's a generalist in most short grassland settings including ones with some brushy component plus certain agricultural lands that include grain sorghum. Short grasses include sideoats and blue gramas, sand dropseed, prairie junegrass (Koeleria), buffalograss also with patches of bluestem and other mid-grass species. This bunting will frequent smaller patches of grasses or disturbed patches of grasses including rural yards. It also uses weedy fields surrounding playas. This species avoids urban areas and cotton fields.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S4B

mountain plover *Charadrius montanus*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Breeding: nests on high plains or shortgrass prairie, on ground in shallow depression; nonbreeding: shortgrass plains and bare, dirt (plowed) fields; primarily insectivorous.

Federal Status: State Status: SGCN: Y

KENDALL COUNTY

BIRDS

Endemic: N | Global Rank: G3 | State Rank: S2

Sprague's pipit *Anthus spragueii*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Habitat during migration and in winter consists of pastures and weedy fields (AOU 1983), including grasslands with dense herbaceous vegetation or grassy agricultural fields.

Federal Status: | State Status: | SGCN: Y

Endemic: N | Global Rank: G3G4 | State Rank: S3N

western burrowing owl *Athene cunicularia hypugaea*

Open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows

Federal Status: | State Status: | SGCN: Y

Endemic: N | Global Rank: G4T4 | State Rank: S2

white-faced ibis *Plegadis chihi*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; currently confined to near-coastal rookeries in so-called hog-wallow prairies. Nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats.

Federal Status: | State Status: T | SGCN: Y

Endemic: N | Global Rank: G5 | State Rank: S4B

whooping crane *Grus americana*

The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Small ponds, marshes, and flooded grain fields for both roosting and foraging. Potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties.

Federal Status: LE | State Status: E | SGCN: Y

Endemic: N | Global Rank: G1 | State Rank: S1S2N

zone-tailed hawk *Buteo albonotatus*

Arid open country, including open deciduous or pine-oak woodland, mesa or mountain county, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains; nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions

Federal Status: | State Status: T | SGCN: Y

Endemic: N | Global Rank: G4 | State Rank: S3B

KENDALL COUNTY

CRUSTACEANS

Balcones Cave amphipod *Stygobromus balconis*

Subaquatic, subterranean obligate amphipod

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G2G3 State Rank: S2

Cascade Cave amphipod *Stygobromus dejectus*

Subaquatic crustacean; subterranean obligate; in pools

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G1G2 State Rank: S1

FISH

Guadalupe bass *Micropterus treculii*

Endemic to the streams of the northern and eastern Edwards Plateau including portions of the Brazos, Colorado, Guadalupe, and San Antonio basins; species also found outside of the Edwards Plateau streams in decreased abundance, primarily in the lower Colorado River; two introduced populations have been established in the Nueces River system. A pure population was re-established in a portion of the Blanco River in 2014. Species prefers lentic environments but commonly taken in flowing water; numerous smaller fish occur in rapids, many times near eddies; large individuals found mainly in riffle tail races; usually found in spring-fed streams having clear water and relatively consistent temperatures.

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3 State Rank: S3

Guadalupe darter *Percina apristis*

Endemic to the Guadalupe River Basin; Found in riffles; most common under or around 25-30 cm boulders in the main current; seems to prefer moderately turbid water.

Federal Status: State Status: T SGCN: Y

Endemic: Y Global Rank: G4 State Rank: S2

headwater catfish *Ictalurus lupus*

Originally throughout streams of the Edwards Plateau and the Rio Grande basin, currently limited to Rio Grande drainage, including Pecos River basin; springs, and sandy and rocky riffles, runs, and pools of clear creeks and small rivers.

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G3 State Rank: S1S2

plateau shiner *Cyprinella lepida*

Edwards Plateau portion of Nueces basin, mainstem and tributaries of Nueces, Frio, and Sabinal rivers; may also be endemic to upper reaches of the Guadalupe River; clear, cool, spring-fed headwater creeks; usually over gravel and limestone substrates.

Federal Status: State Status: T SGCN: Y

Endemic: Y Global Rank: G1G2 State Rank: S2?

KENDALL COUNTY

FISH

Texas shiner *Notropis amabilis*

In Texas, it is found primarily in Edwards Plateau streams from the San Gabriel River in the east to the Pecos River in the west. Typical habitat includes rocky or sandy runs, as well as pools.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G4 State Rank: S4

INSECTS

American bumblebee *Bombus pensylvanicus*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Global Rank: G3G4 State Rank: SNR

No accepted common name *Rhadine speca*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G2 State Rank: S2

No accepted common name *Baetodes alleni*

Mayflies distinguished by aquatic larval stage; adult stage generally found in shoreline vegetation

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G1G2 State Rank: S1?

MAMMALS

big brown bat *Eptesicus fuscus*

Any wooded areas or woodlands except south Texas. Riparian areas in west Texas.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S5

big free-tailed bat *Nyctinomops macrotis*

Habitat data sparse but records indicate that species prefers to roost in crevices and cracks in high canyon walls, but will use buildings, as well; reproduction data sparse, gives birth to single offspring late June-early July; females gather in nursery colonies; winter habits undetermined, but may hibernate in the Trans-Pecos; opportunistic insectivore

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3

KENDALL COUNTY

MAMMALS

black bear *Ursus americanus*

Generalist. Historically found throughout Texas. In Chisos, prefers higher elevations where pinyon-oaks predominate; also occasionally sighted in desert scrub of Trans-Pecos (Black Gap Wildlife Management Area) and Edwards Plateau in juniper-oak habitat. For ssp. luteolus, bottomland hardwoods, floodplain forests, upland hardwoods with mixed pine; marsh. Bottomland hardwoods and large tracts of inaccessible forested areas.

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3

black-tailed prairie dog *Cynomys ludovicianus*

Dry, flat, short grasslands with low, relatively sparse vegetation, including areas overgrazed by cattle; live in large family groups

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G4 State Rank: S3

cave myotis bat *Myotis velifer*

Colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (Hirundo pyrrhonota) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G4G5 State Rank: S2S3

eastern red bat *Lasiurus borealis*

Red bats are migratory bats that are common across Texas. They are most common in the eastern and central parts of the state, due to their requirement of forests for foliage roosting. West Texas specimens are associated with forested areas (cottonwoods). Also common along the coastline. These bats are highly mobile, seasonally migratory, and practice a type of "wandering migration". Associations with specific habitat is difficult unless specific migratory stopover sites or wintering grounds are found. Likely associated with any forested area in East, Central, and North Texas but can occur statewide.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G3G4 State Rank: S4

eastern spotted skunk *Spilogale putorius*

Generalist; open fields prairies, croplands, fence rows, farmyards, forest edges & woodlands. Prefer wooded, brushy areas & tallgrass prairies. S.p. ssp. interrupta found in wooded areas and tallgrass prairies, preferring rocky canyons and outcrops when such sites are available.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G4 State Rank: S1S3

hoary bat *Lasiurus cinereus*

Hoary bats are highly migratory, high-flying bats that have been noted throughout the state. Females are known to migrate to Mexico in the winter, males tend to remain further north and may stay in Texas year-round. Commonly associated with forests (foliage roosting species) but are found in unforested parts of the state and lowland deserts. Tend to be captured over water and large, open flyways.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G3G4 State Rank: S4

Llano pocket gopher *Geomys texensis texensis*

KENDALL COUNTY

MAMMALS

Found in deep, brown loamy sands or gravelly sandy loams and is isolated from other species of pocket gophers by intervening shallow stony to gravelly clayey soils

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3T2	State Rank: S2

long-tailed weasel *Mustela frenata*

Includes brushlands, fence rows, upland woods and bottomland hardwoods, forest edges & rocky desert scrub. Usually live close to water.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S5

mountain lion *Puma concolor*

Generalist; found in a wide range of habitats statewide. Found most frequently in rugged mountains & riparian zones.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S2S3

northern yellow bat *Lasiurus intermedius*

Occurs mainly along the Gulf Coast but inland specimens are not uncommon. Prefers roosting in spanish moss and in the hanging fronds of palm trees. Common where this vegtation occurs. Found near water and forages over grassy, open areas. Males usually roost solitarily, whereas females roost in groups of several individuals.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S4

swamp rabbit *Sylvilagus aquaticus*

Primarily found in lowland areas near water including: cypress bogs and marshes, floodplains, creeks and rivers.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G5	State Rank: S5

tricolored bat *Perimyotis subflavus*

Forest, woodland and riparian areas are important. Caves are very important to this species.

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3G4	State Rank: S2

western hog-nosed skunk *Conepatus leuconotus*

Habitats include woodlands, grasslands & deserts, to 7200 feet, most common in rugged, rocky canyon country; little is known about the habitat of the ssp. telmalestes

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G4	State Rank: S4

KENDALL COUNTY

MAMMALS

western spotted skunk *Spilogale gracilis*

Brushy canyons, rocky outcrops (rimrock) on hillsides and walls of canyons. In semi-arid brushlands in U.S., in wet tropical forests in Mexico. When inactive or bearing young, occupies den in rocks, burrow, hollow log, brush pile, or under building.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S5

white-nosed coati *Nasua narica*

Woodlands, riparian corridors and canyons.Most individuals in Texas probably transients from Mexico; diurnal and crepuscular; very sociable; forages on ground and in trees; omnivorous; may be susceptible to hunting, trapping, and pet trade

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G5 State Rank: S1

MOLLUSKS

false spike *Fusconaia mitchelli*

Occurs in small streams to medium-size rivers in habitats such as riffles and runs with flowing water. Is often found in stable substrates of sand, gravel, and cobble (Howells 2010; Randklev et al. 2012; Sowards et al. 2013; Tsakiris and Randklev 2016). [Mussels of Texas 2019]

Federal Status: PE State Status: T SGCN: Y

Endemic: N Global Rank: GNR State Rank: S1

Guadalupe fatmucket *Lampsilis bergmanni*

Reported to occur in slow to moderate current in sand, mud, and gravel substrates among large cobble, boulders, bedrock ledges, horizontal cracks in bedrock slabs, and macrophyte beds. Has also been observed inhabiting the roots of cypress trees and vegetation along steep banks. Reported in lakes at Kerrville, Texas, which suggests it may occasionally persist in some impoundment conditions (Robert G. Howells, personal communication). (Mussels of Texas, 2020)

Federal Status: PE State Status: T SGCN: Y

Endemic: Y Global Rank: G1 State Rank: SNR

Guadalupe orb *Cyclonaias necki*

Species' distribution is limited to the Guadalupe River basin. Occurs in both mainstem and tributary habitats. Often found in substrates composed of sand, gravel, and cobble, including mud-silt or gravel-filled cracks in bedrock slabs. Considered intolerant of reservoirs, but are known to occur in them (Howells 2010m; Randklev et al. 2017b). [Mussels of Texas 2020]

Federal Status: PE State Status: T SGCN: Y

Endemic: Y Global Rank: GNR State Rank: S2

horseshoe liptooth *Daedalochila hippocrepis*

Terrestrial snail known only from the steep, wooded hillsides of Landa Park in New Braunfels

Federal Status: State Status: SGCN: Y

Endemic: Global Rank: G1 State Rank: S1

KENDALL COUNTY

MOLLUSKS

No accepted common name *Phreatodrobia micra*

Habitat description is not available at this time.

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G2G3 State Rank: S2

REPTILES

Cagle's map turtle *Graptemys caglei*

Aquatic: shallow water with swift to moderate flow and gravel or cobble bottom, connected by deeper pools with a slower flow rate and a silt or mud bottom; gravel bar riffles and transition areas between riffles and pools especially important in providing insect prey items; nests on gently sloping sand banks within ca. 30 feet of waters edge.

Federal Status: State Status: T SGCN: Y

Endemic: Y Global Rank: G3 State Rank: S1

eastern box turtle *Terrapene carolina*

Terrestrial: Eastern box turtles inhabit forests, fields, forest-brush, and forest-field ecotones. In some areas they move seasonally from fields in spring to forest in summer. They commonly enters pools of shallow water in summer. For shelter, they burrow into loose soil, debris, mud, old stump holes, or under leaf litter. They can successfully hibernate in sites that may experience subfreezing temperatures.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3

plateau spot-tailed earless lizard *Holbrookia lacerata*

Terrestrial: Habitats include moderately open prairie-brushland regions, particularly fairly flat areas free of vegetation or other obstructions (e.g., open meadows, old and new fields, graded roadways, cleared and disturbed areas, prairie savanna, and active agriculture including row crops); also, oak-juniper woodlands and mesquite-prickly pear associations (Axtell 1968, Bartlett and Bartlett 1999).

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: GNR State Rank: S2

slender glass lizard *Ophisaurus attenuatus*

Terrestrial: Habitats include open grassland, prairie, woodland edge, open woodland, oak savannas, longleaf pine flatwoods, scrubby areas, fallow fields, and areas near streams and ponds, often in habitats with sandy soil.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3

Tamaulipan spot-tailed earless lizard *Holbrookia subcaudalis*

Terrestrial: Habitats include moderately open prairie-brushland regions, particularly fairly flat areas free of vegetation or other obstructions (e.g., open meadows, old and new fields, graded roadways, cleared and disturbed areas, prairie savanna, and active agriculture including row crops); also, oak-juniper woodlands and mesquite-prickly pear associations (Axtell 1968, Bartlett and Bartlett 1999).

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: GNR State Rank: S2

KENDALL COUNTY

REPTILES

Texas garter snake *Thamnophis sirtalis annectens*

Terrestrial and aquatic: Habitats used include the grasslands and modified open areas in the vicinity of aquatic features, such as ponds, streams or marshes. Damp soils and debris for cover are thought to be critical.

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G5T4 State Rank: S1

Texas horned lizard *Phrynosoma cornutum*

Terrestrial: Open habitats with sparse vegetation, including grass, prairie, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive. Occurs to 6000 feet, but largely limited below the pinyon-juniper zone on mountains in the Big Bend area.

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G4G5 State Rank: S3

Texas tortoise *Gopherus berlandieri*

Terrestrial: Open scrub woods, arid brush, lomas, grass-cactus association; often in areas with sandy well-drained soils. When inactive occupies shallow depressions dug at base of bush or cactus; sometimes in underground burrow or under object. Eggs are laid in nests dug in soil near or under bushes.

Federal Status: State Status: T SGCN: Y

Endemic: N Global Rank: G4 State Rank: S2

western box turtle *Terrapene ornata*

Terrestrial: Ornate or western box trutles inhabit prairie grassland, pasture, fields, sandhills, and open woodland. They are essentially terrestrial but sometimes enter slow, shallow streams and creek pools. For shelter, they burrow into soil (e.g., under plants such as yucca) (Converse et al. 2002) or enter burrows made by other species.

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G5 State Rank: S3

PLANTS

basin bellflower *Campanula reverchonii*

Among scattered vegetation on loose gravel, gravelly sand, and rock outcrops on open slopes with exposures of igneous and metamorphic rocks; may also occur on sandbars and other alluvial deposits along major rivers; flowering May-July

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G2 State Rank: S2

big red sage *Salvia pentstemonoides*

Moist to seasonally wet, steep limestone outcrops on seeps within canyons or along creek banks; occasionally on clayey to silty soils of creek banks and terraces, in partial shade to full sun; basal leaves conspicuous for much of the year; flowering June-October

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G1 State Rank: S1

KENDALL COUNTY

PLANTS

bigflower cornsalad *Valerianella stenocarpa*

Usually along creekbeds or in vernally moist grassy open areas (Carr 2015).

Federal Status: State Status: SGCN: Y
Endemic: Y Global Rank: G3 State Rank: S3

bracted twistflower *Streptanthus bracteatus*

Shallow, well-drained gravelly clays and clay loams over limestone in oak juniper woodlands and associated openings, on steep to moderate slopes and in canyon bottoms; several known soils include Tarrant, Brackett, or Speck over Edwards, Glen Rose, and Walnut geologic formations; populations fluctuate widely from year to year, depending on winter rainfall; flowering mid April-late May, fruit matures and foliage withers by early summer

Federal Status: PT State Status: SGCN: Y
Endemic: Y Global Rank: G1 State Rank: S1

Buckley tridens *Tridens buckleyanus*

Occurs in juniper-oak woodlands on rocky limestone slopes; Perennial; Flowering/Fruiting April-Nov

Federal Status: State Status: SGCN: Y
Endemic: Y Global Rank: G3G4 State Rank: S3S4

canyon bean *Phaseolus texensis*

Narrowly endemic to rocky canyons in eastern and southern Edwards Plateau occurring on limestone soils in mixed woodlands, on limestone cliffs and outcrops, frequently along creeks.

Federal Status: State Status: SGCN: Y
Endemic: Y Global Rank: G2 State Rank: S2

canyon mock-orange *Philadelphus texensis var. ernestii*

Usually found growing from honeycomb pits on outcrops of Cretaceous limestone exposed as rimrock along mesic canyons, usually in the shade of mixed evergreen-deciduous canyon woodland; flowering April-June, fruit dehiscing September-October

Federal Status: State Status: SGCN: Y
Endemic: N Global Rank: G3T3 State Rank: S3

canyon sedge *Carex edwardsiana*

Dry-mesic decidous and deciduous-juniper woodlands in canyons and ravines, usually in clay loams very high in calcium on rocky banks and slopes just above streams and stream beds. Carex edwardsiana usually grows near C. planostachys. Fruiting spring (Ball, Reznicek, and 2003).

Federal Status: State Status: SGCN: Y
Endemic: Y Global Rank: G3G4 State Rank: S3S4

darkstem noseburn *Tragia nigricans*

Occurs in oak-juniper woodlands on mesic limestone slopes and canyon bottoms; Perennial; Flowering/Fruiting April-Oct

Federal Status: State Status: SGCN: Y
Endemic: Y Global Rank: G3 State Rank: S3

KENDALL COUNTY

PLANTS

Glass Mountains coral-root *Hexalectris nitida*

Apparently rare in mixed woodlands in canyons in the mountains of the Brewster County, but encountered with regularity, albeit in small numbers, under Juniperus ashei in woodlands over limestone on the Edwards Plateau, Callahan Divide and Lampasas Cutplain; Perennial; Flowering June-Sept; Fruiting July-Sept

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S3

hairy sycamore-leaf snowbell *Styrax platanifolius ssp. stellatus*

Rare throughout range, in habitats similar to those of var. platanifolius - usually in oak-juniper woodlands on steep rocky banks and ledges along intermittent or perennial streams, rarely far from some reliable source of moisture; Perennial; Flowering April-Oct; Fruiting May-Sept

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3T3	State Rank: S3

Hall's prairie clover *Dalea hallii*

In grasslands on eroded limestone or chalk and in oak scrub on rocky hillsides; Perennial; Flowering May-Sept; Fruiting June-Sept

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3	State Rank: S2

Heller's marbleseed *Onosmodium helleri*

Occurs in loamy calcareous soils in oak-juniper woodlands on rocky limestone slopes, often in more mesic portions of canyons; Perennial; Flowering March-May

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3	State Rank: S3

Hill Country wild-mercury *Argythamnia aphoroides*

Mostly in bluestem-grama grasslands associated with plateau live oak woodlands on shallow to moderately deep clays and clay loams over limestone on rolling uplands, also in partial shade of oak-juniper woodlands in gravelly soils on rocky limestone slopes; Perennial; Flowering April-May with fruit persisting until midsummer

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G2G3	State Rank: S3

plateau milkvine *Matelea edwardsensis*

Occurs in various types of juniper-oak and oak-juniper woodlands; Perennial; Flowering March-Oct; Fruiting May-June

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3	State Rank: S3

KENDALL COUNTY

PLANTS

scarlet leather-flower *Clematis texensis*

Usually in oak-juniper woodlands in mesic rocky limestone canyons or along perennial streams; Perennial; Flowering March-July; Fruiting May-July

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3G4 State Rank: S3S4

spreading leastdaisy *Chaetopappa effusa*

Limestone cliffs, ledges, bluffs, steep hillsides, sometimes in seepy areas, oak-juniper, oak, or mixed deciduous woods, 300-500 m elevation; Perennial; Flowering (May) July-Oct

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3G4 State Rank: S4

sycamore-leaf snowbell *Styrax platanifolius ssp. platanifolius*

Rare throughout range, usually in oak-juniper woodlands on steep rocky banks and ledges along intermittent or perennial streams, rarely far from some reliable source of moisture; Perennial; Flowering April-May; Fruiting May-Aug.

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3T3 State Rank: S3

Texas amorpha *Amorpha roemeriana*

Juniper-oak woodlands or shrublands on rocky limestone slopes, sometimes on dry shelves above creeks; Perennial; Flowering May-June; Fruiting June-Oct

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G3 State Rank: S3

Texas fescue *Festuca versuta*

Occurs in mesic woodlands on limestone-derived soils on stream terraces and canyon slopes; Perennial; Flowering/Fruiting April-June

Federal Status: State Status: SGCN: Y

Endemic: N Global Rank: G3 State Rank: S3

Texas mock-orange *Philadelphus texensis var. texensis*

Limestone slopes and ravines, slopes in oak-juniper woodlands; variety texensis has a more westward range than var. ernestii; it is known from Bandera, Bexar, Edwards, Kendall, Medina, Real, and Uvalde counties in central Texas; Flowering Apr–May; fruiting Jun–Oct (Freeman 2017).

Federal Status: State Status: SGCN: N

Endemic: N Global Rank: G3T2 State Rank: S2

Texas seymeria *Seymeria texana*

Found primarily in grassy openings in juniper-oak woodlands on dry rocky slopes but sometimes on rock outcrops in shaded canyons; Annual; Flowering May-Nov; Fruiting July-Nov

Federal Status: State Status: SGCN: Y

Endemic: Y Global Rank: G3 State Rank: S3

KENDALL COUNTY

PLANTS

threeflower penstemon *Penstemon triflorus ssp. triflorus*

Occurs sparingly on rock outcrops and in grasslands associated with juniper-oak woodlands (Carr 2015).

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3T3	State Rank: S3

tree dodder *Cuscuta exaltata*

Parasitic on various Quercus, Juglans, Rhus, Vitis, Ulmus, and Diospyros species as well as Acacia berlandieri and other woody plants; Annual; Flowering May-Oct; Fruiting July-Oct

Federal Status:	State Status:	SGCN: Y
Endemic: N	Global Rank: G3	State Rank: S3

turnip-root scurfpea *Pediomelum cyphocalyx*

Grasslands and openings in juniper-oak woodlands on limestone substrates on the Edwards Plateau and in north-central Texas (Carr 2015).

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3G4	State Rank: S2S3

Wright's milkvetch *Astragalus wrightii*

On sandy or gravelly soils; April (Diggs et al. 1999).

Federal Status:	State Status:	SGCN: Y
Endemic: Y	Global Rank: G3	State Rank: S3

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E-3 Investigation of Potentially Jurisdictional Waters of the United States

Investigation of Potentially Jurisdictional Waters of the United States

Upper Cibolo Creek Floodwater Retarding Structure No. 2
Rehabilitation Project
Kendall County, Texas

Texas State Soil and Water Conservation Board

Project number: 60630237

August 2022

Delivering a better world

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1. Introduction

AECOM Technical Services, Inc. (AECOM) conducted an investigation of potentially jurisdictional waters of the United States (U.S.) (WOTUS), including wetlands, for the proposed Upper Cibolo Creek Floodwater Retarding Structure (FRS) No. 2 Rehabilitation Project (Project). The proposed Project is located in Kendall County. (**Appendix A, Figure 1**). A data review and field investigations were conducted for the Project within a study area encompassing approximately 66 acres (Study Area).

The Upper Cibolo Creek FRS No. 2 structure (dam) was designed and constructed in 1980. The dam was originally constructed as a low hazard dam for the primary purposes of watershed protection and flood prevention. Since construction of the dam in 1980, residential and commercial structures, highways, and utilities have been constructed downstream of it. As a result, a catastrophic failure of the dam would result in property and infrastructure damages as well as potential loss of life. Consequently, the dam has been reclassified by the Natural Resources Conservation Service (NRCS) as a high hazard dam. The existing dam does not meet current safety criteria and performance standards for high hazard dams. Texas State Soil and Water Conservation Board (TSSWCB) has contracted AECOM under Contract No. IDIQ-AECOM-2018-79017 to design proposed improvements that will rehabilitate the dam to meet high-hazard criteria.

The proposed Project involves preparing a final design for dam safety modifications to Upper Cibolo Creek FRS No. 2 on behalf of the TSSWCB. The purposes of the rehabilitation of Upper Cibolo Creek FRS No. 2 are to mitigate identified dam safety deficiencies associated with the dam's reclassification as a high hazard dam. Conceptual analyses and designs that serve the project purposes were developed in the 2021 Dam Assessment. The proposed modifications presented in the dam assessment to allow the FRS to meet high hazard criteria included the following major components:

- Remove the existing principal spillway inlet (crest elevation 1,590.45 feet) and 24-inch diameter inner diameter (ID) conduit;
- Replace the existing principal spillway inlet and conduit with a new principal spillway inlet riser (crest elevation 1,585.75 feet) and new 36-inch diameter conduit;
- Regarding the inlet and outlet channel of the existing vegetated auxiliary spillway, widen crest from 200 feet to 350 feet, add a splitter dikeand lowering crest the crest 0.7 foot to elevation 1,611.30 feet;
- Protecting the downstream end of auxiliary spillway with rock riprap per stability evaluation;
- Adding a concrete cutoff wall at the control section of the auxiliary spillway;
- Raising and grading the top of dam level 2.3 feet from and elevation of 1,614.5 feet to 1,616.8 feet;
- Replace rock on 2.5:1 embankment slope.

The purpose of the investigation was to identify and delineate water resources within the Study Area that exhibit characteristics meeting the regulatory definition of WOTUS. These resources were then assessed for their potential to be considered jurisdictional WOTUS subject to regulation by the U.S. Army Corps of Engineers (USACE) Fort Worth District under jurisdiction of Section 404 of the Clean Water Act (CWA).

2. Environmental Setting

Publicly available data was reviewed to identify potentially jurisdictional streams, waterbodies, wetlands, soil types, and vegetation types within the Study Area. Data resources reviewed included the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps, the U.S. Geological Survey (USGS) National Hydrography Dataset (NHD), the U.S. Department of Agriculture (USDA) NRCS Web Soil Survey, USGS 7.5' quadrangle sheets, Federal Emergency Management Agency (FEMA) floodplain maps, and recent aerial photography. This data review was used to describe the site-specific information below.

2.1 Land Use

The majority of the Study Area consisted of an open water reservoir, a dam structure, an overflow spillway, and undeveloped land. Based on NHD, one perennial stream, Ranger Creek, and one open water feature (Upper Cibolo Creek FRS No. 2 Reservoir) are mapped within the Study Area (USGS 2018). The Study Area is surrounded by undeveloped land. One residential structure is located northeast and one residential structure is located southwest of the Study Area. Ranger Creek Road is located approximately 886 feet north of the Study Area.

2.2 Topography

The USGS 7.5-minute quadrangle map for Ranger Creek displays the topography of the Study Area (**Appendix A, Figure 2**). Topography within the Study Area is shaped by the current reservoir and dam system and the canyon lands surrounding Ranger Creek. The surface gradient slopes to the center of the Study Area from the north and south, with the highest elevation located at the southern boundary of the Study Area at approximately 1,700 feet above mean sea level (MSL [National Geodetic Vertical Datum of 1929]). The lowest elevation is located along Ranger Creek in the eastern portion of the Study Area at approximately 1,550 feet above MSL (USGS 2019).

2.3 Soils

According to the USDA NRCS Web Soil Survey Report, the Study Area is mapped as being underlain by four soil types (as shown on **Table 1** below and within **Appendix A, Figure 3**) (USDA 2020).

Table 1. NRCS Soil Mapping Units

Mapping Unit	Soil Type	Listed as Hydric by NRCS
5	Brackett-Real association, 10 to 30 percent slopes	No
9	Doss-Brackett association, undulating	No
12	Krum silty clay, 1 to 3 percent slopes	No
13	Krum silty clay, 3 to 5 percent slopes	No

2.4 Hydrology

The Study Area lies within the Cibolo watershed (8-Digit Hydrologic Unit Code [HUC] 12100304) and the Frederick Creek-Cibolo Creek subwatershed (12-Digit HUC 121003040101).

The USGS NHD was reviewed to gather information on the potential locations of areas that may exhibit characteristics of WOTUS. Two NHD features, Ranger Creek and Soil Conservation Site 2 Reservoir (Upper Cibolo Creek FRS No. 2 Reservoir) were identified by the NHD data and are shown on **Appendix A, Figure 4**.

USFWS NWI maps and associated geographic information system (GIS) data were reviewed to gather information on the potential location of areas that may exhibit characteristics of wetlands. According to the NWI data, several features associated with Ranger Creek and Upper Cibolo Creek Reservoir are located within the Study Area (**Appendix A, Figure 4**). Documented NWI wetland types include Riverine, Unknown Perennial, Unconsolidated Bottom, Permanently Flooded (R5UBH); Palustrine, Unconsolidated Bottom, Permanently Flooded, Diked/Impounded (PUBHh); and Palustrine, Unconsolidated Shore, Temporary Flooded, Diked/Impounded (PUSAh).

2.4.1 Floodplain

Based on a review of the FEMA digital flood insurance rate map (dFIRM) panel number 48259C0400G (effective May 15, 2020), one flood zone designations, Zone AE was identified within the Study Area. Zone AE is mapped in the western portion of the Study Area at the reservoir area and Ranger Creek below the dam **Appendix A, Figure 4**.

Zone AE includes the regulatory floodway and areas where base flood elevations have been determined within the 100-year floodplain.

2.4.2 Vegetation

Historically Mapped and Documented Vegetation Types

According to TPWD's Ecoregion data, the Study Area falls within the Edwards Plateau Level 3 Ecoregion and the Balcones Canyonlands Level 4 Ecoregion.

The Study Area lies within one Land Resource Region (LRR I) and one Major Land Resource Area (MLRA 81C). LRR I denotes the Southwest Plateaus and Plains Range and Cotton Region and consists of mesas, plateaus, and limestone ridges and hills. MLRA 81C is the Edwards Plateau, Eastern part, which can be described as limestone ridges and canyons nearly level to gently sloping valley floors. This region supports a plant community of trees, shrubs and mid or tall grasses with majority of the region comprised of grasslands. More information on LRR I and MLRA 81C can be read within USDA's Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin, Handbook 296. Additionally, the Study Area is located over the Edwards Aquifer and the Upper Edwards Karst Zone (NRCS 2016).

According to TPWD's Ecological Mapping System of Texas (EMST), the vegetation mapped within the Study Area is identified as Edwards Plateau: Ashe Juniper Slope Forest, Edwards Plateau: Oak/Ashe Juniper Slope Forest, Edwards Plateau: Oak/Hardwood Forest, Edwards Plateau: Floodplain Herbaceous Vegetation, Edwards Plateau: Live Oak Motte and Woodland, Edwards Plateau: Deciduous Oak/Evergreen Motte and Woodland, Edwards Plateau: Oak/Hardwood Motte and Woodland, Edwards Plateau: Savanna Grassland, Edwards Plateau: Ashe Juniper/Live Oak Shrubland, Edwards Plateau Riparian Live Oak Forest, Edwards Plateau: Riparian Hardwood Forest, Edwards Plateau: Riparian Herbaceous Vegetation, Native Invasive: Mesquite Shrubland, and Open Water (**Appendix A, Figure 5**) (Elliot et al 2014).

Existing Conditions

Field investigations documented vegetation types throughout the Study Area. The majority of the Study Area consisted of undeveloped grassland, Ashe juniper / oak (*Juniperus ashei / Quercus spp.*) woodlands, riparian Ashe juniper / deciduous hardwood forest and woodlands, and canyonland. Common species observed within the tree and sapling/shrub stratum included Ashe juniper, plateau live oak (*Quercus fusiformis*), eastern cottonwood (*Populus deltoides*), and black willow (*Salix nigra*). Common herbaceous species observed within and around the drainages include creek oats (*Chasmanthium latifolium*), switchgrass (*Panicum virgatum*), wild rye (*Elymus canadensis*), sunflower (*Helianthus* spp.), bluestem grasses (*Andropogon* spp.), bermuda grass (*Cynodon dactylon*), upright prairie coneflower (*Ratibida columnifera*), frog fruit (*Phyla nodiflora*), and Johnson grass (*Sorghum halepense*). See **Appendix B** for representative photographs of the Study Area.

3. Potentially Jurisdictional Waters of the U.S.

3.1 USACE Regulatory Authority

The USACE, acting under Section 404 of the CWA and Section 10 of the Rivers and Harbors Act of 1899, regulates certain activities occurring within WOTUS. Under Section 404 of the CWA, authorization must be obtained from the USACE for discharges of dredged and fill material into jurisdictional WOTUS, including wetlands. The USACE's regulatory authority over WOTUS includes jurisdictional determinations and permitting under Section 404 of the CWA. In addition, under Section 10 of the Rivers and Harbors Act of 1899, the USACE regulates any work in or affecting navigable WOTUS (Environmental Protection Agency [EPA], 2015). The proposed project is regulated in accordance with the CWA by the Fort Worth District of the USACE.

3.2 Field Delineation Methodology

The USACE asserts jurisdiction over the following categories of water bodies: 1) traditionally navigable waters (TNWs); 2) wetlands adjacent to TNWs; 3) relatively permanent waters (RPWs) (i.e., waters that typically flow year round or have continuous flow at least seasonally); 4) non-RPWs with a significant nexus to TNWs; 5) wetlands directly abutting RPWs; 6) wetlands adjacent to but not directly abutting RPWs; and 7) wetlands adjacent to non-RPWs with a significant nexus to TNWs (USACE, 2007).

The limit of jurisdiction for non-tidal jurisdictional WOTUS extends to the ordinary high-water mark (OHWM), the limit of adjacent wetlands, or the limit of other special aquatic sites (SAS). SAS include sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes (40 CFR Section 230.10(a)(3) of the CWA). The OHWM is determined by signs of natural lines impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, presence of litter and debris, wracking, vegetation matted down, bent, or absent, sediment sorting, leaf litter disturbed or washed away, scour, deposition, multiple observed flow events, bed and banks, water staining, change in plant community; and/or other appropriate means that consider the characteristics of the surrounding areas.

The USACE's determination of a jurisdictional wetland is based on the wetland criteria of the 1987 Corps of Engineers Wetland Delineation Manual (Environmental Laboratory 1987), as amended by USACE memoranda dated August 23 and 27, 1991, and March 6, 1992; Questions and Answers to the 1987 Manual (October 7, 1991); and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0, March 2010) (USACE 2010). Wetlands are based on three criteria: hydrophytic vegetation, hydric soils, and wetland hydrology. All three criteria must be present for an area to qualify as a wetland; however, some exceptions can occur in disturbed areas or in newly formed wetlands, where one indicator (such as hydric soils) might be lacking.

Field investigations were conducted on July 21, 2022. AECOM used a Trimble Geo7X Global Positioning System (GPS), capable of sub-meter accuracy, to collect geographically-referenced features, such as OHWMs, wetland boundaries, and soil station data points. The field data was then transferred to GIS software (ESRI ArcMap 10.5) to analyze identified features, calculate areas and lengths, and generate the figures provided in Appendix A, Figure 6.

Appendix B contains a detailed photo log showing conditions of each feature as documented within the Study Area.

3.3 Potentially Jurisdictional WOTUS (Non-Wetland)

Upper Cibolo Creek FRS No. 2 Reservoir is approximately 8.63 acres in areal extent within the Study Area. This reservoir captures hydrologic flow from Ranger Creek then discharges below the dam (via spillway) to connect Ranger Creek back to its previous channel bank. Ranger Creek then leaves Upper Cibolo Creek FRS No. 2 flowing approximately 2.5 miles east before discharging into Cibolo Creek, followed by the San Antonio River, the Guadalupe River and then ultimately discharging into the Gulf of Mexico at the Texas Gulf Coast. Based on NHD and field investigations, this is a perennial water feature that receives hydrologic flow from a perennial stream; therefore, can be considered potentially jurisdictional per USACE WOTUS classification. Refer to Appendix B, Photos 1-2 for conditions documented during the field investigation.

Ranger Creek (below the Upper Cibolo Creek FRS No. 2) spans approximately 1,050 linear feet (LF) (0.62 acres in areal extent) within the Study Area. The average OHWM width was approximately 10 feet. OHWM indicators observed include bed and bank, shelving, natural lines impressed on the bank, litter disturbed or washed away, and scour. Ranger Creek leaves Upper Cibolo Creek Reservoir flowing approximately 2.5 miles east before discharging into Cibolo Creek, followed by the San Antonio River, the Guadalupe River and then ultimately discharging into the Gulf of Mexico at the Texas Gulf Coast. Based on NHD and field investigations, Ranger Creek can be considered a perennial stream and potentially jurisdictional per USACE WOTUS classification. Refer to Appendix B, Photos 3-8 for conditions documented during the field investigation.

Table 2 below summarizes potentially jurisdictional WOTUS (non-wetlands) within the Study Area.

Table 2. Potentially Jurisdictional WOTUS (Non-Wetlands) within the Study Area

Name	USACE Classification	Flow Regime	Length (LF)	Average Width (feet)	Area within Study Area (acre)
Upper Cibolo Creek FRS No. 2 Reservoir	Potentially Jurisdictional	Perennial	N/A	N/A	8.63
Ranger Creek	Potentially Jurisdictional	Perennial	1,050	10	0.62
		Total	1,050	--	9.25

3.4 Potentially Jurisdictional Wetlands

No potentially jurisdictional wetlands were observed within the Study Area.

3.5 Non-Jurisdictional Features

No potentially non-jurisdictional features were identified within the Study Area.

4. Conclusions

In AECOM's professional opinion, potentially jurisdictional WOTUS identified within the Study Area include Upper Cibolo Creek Reservoir, Upper Cibolo Creek FRS No. 2, and Ranger Creek.

Based on the findings from data analysis and field investigations, two potentially jurisdictional WOTUS (non-wetland) totaling 1,050 LF (9.25 acres) were identified and mapped within the Study Area (as shown on **Table 3** below, and within **Appendix A, Figure 6**).

Table 3. Potentially Jurisdictional WOTUS within the Study Area

Name	USACE Classification	Flow Regime	Length (LF)	Area within Study Area (acres)
Waterbodies				
Upper Cibolo Creek FRS No. 2 Reservoir	Potentially Jurisdictional	Perennial	N/A	N/A
Ranger Creek	Potentially Jurisdictional	Perennial	1,050	10
		Total	1,050	-10

These features are subject to regulation by the USACE, Fort Worth District, under Section 404 of the CWA and would require permit authorization if proposed project activities involve the discharge of dredged or fill material into these identified WOTUS.

The USACE is the official regulatory agency to make the final jurisdictional determination of WOTUS and associated wetlands.

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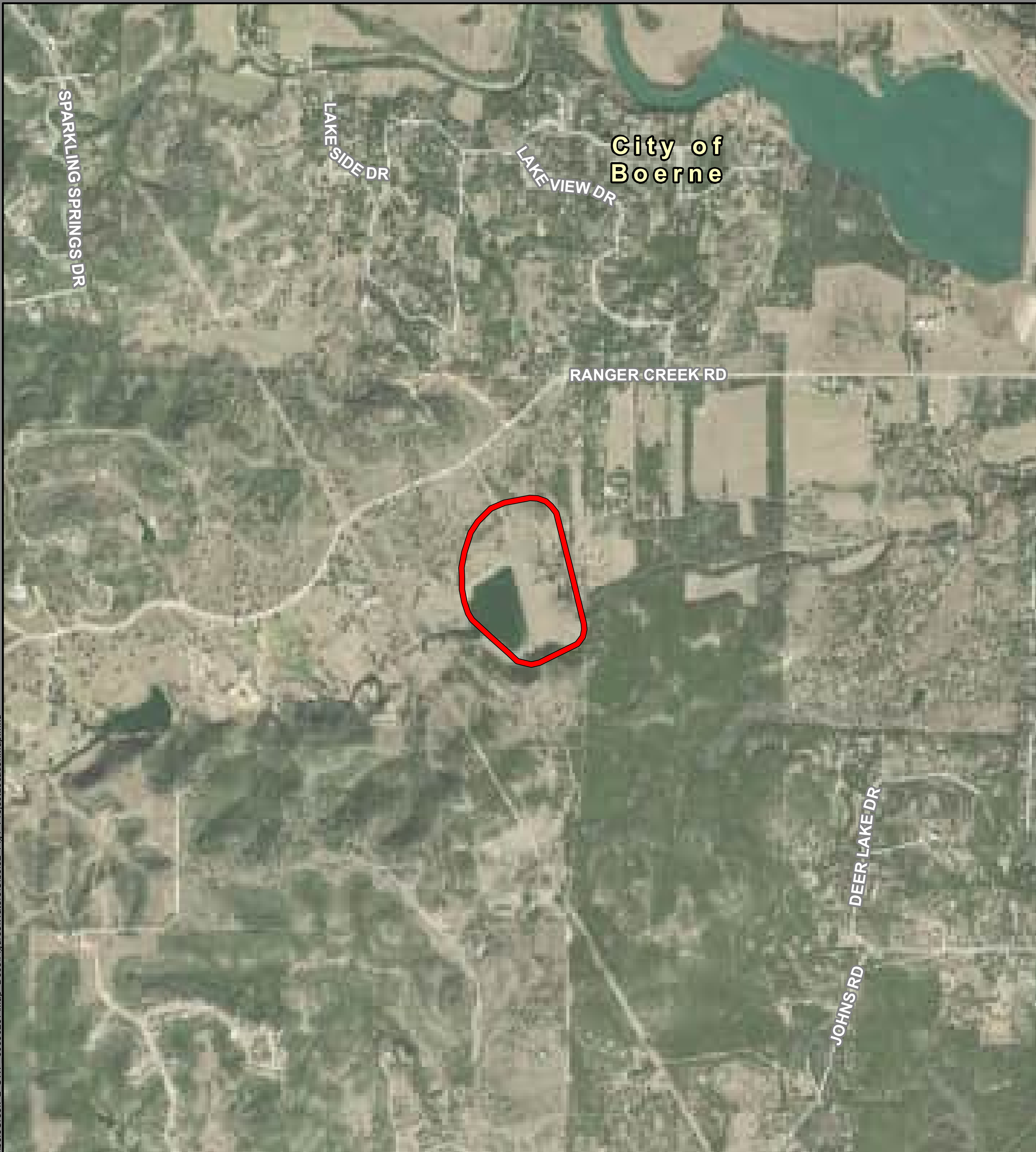
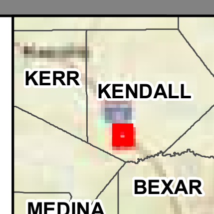
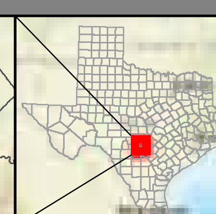
—. 7.5-Minute Quarter Quadrangle, Ranger Creek, Texas. 2019

Appendix A Figures



Study Area





Project Location Map

Upper Cibolo Creek FRS No. 2
Kendall County, Texas

N
W E
S

0 1,000 2,000
Feet

Data Sources: Roads - TxDOT 2018; Cities - TxDOT 2018; County Boundaries - TIGER 2015
Basemap: Maxar 1/12/2019

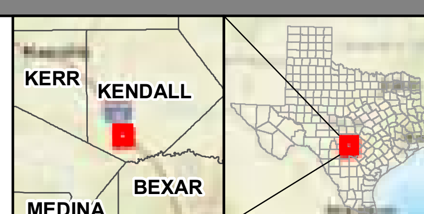
AECOM

August 2022

Figure 1

Author: helen.potter; Document Path: M:\Dallas_GIS\Projects\TSSWCB\CiboloCreek_2_SWP_60630237\Map_Docs\Figures\Waters\Cibolo2_Fig1_ProjectLocationMap.mxd

Study Area



USGS Topographic Map

Upper Cibolo Creek FRS No. 2
Kendall County, Texas

N W E S

0 1,000 2,000
Feet

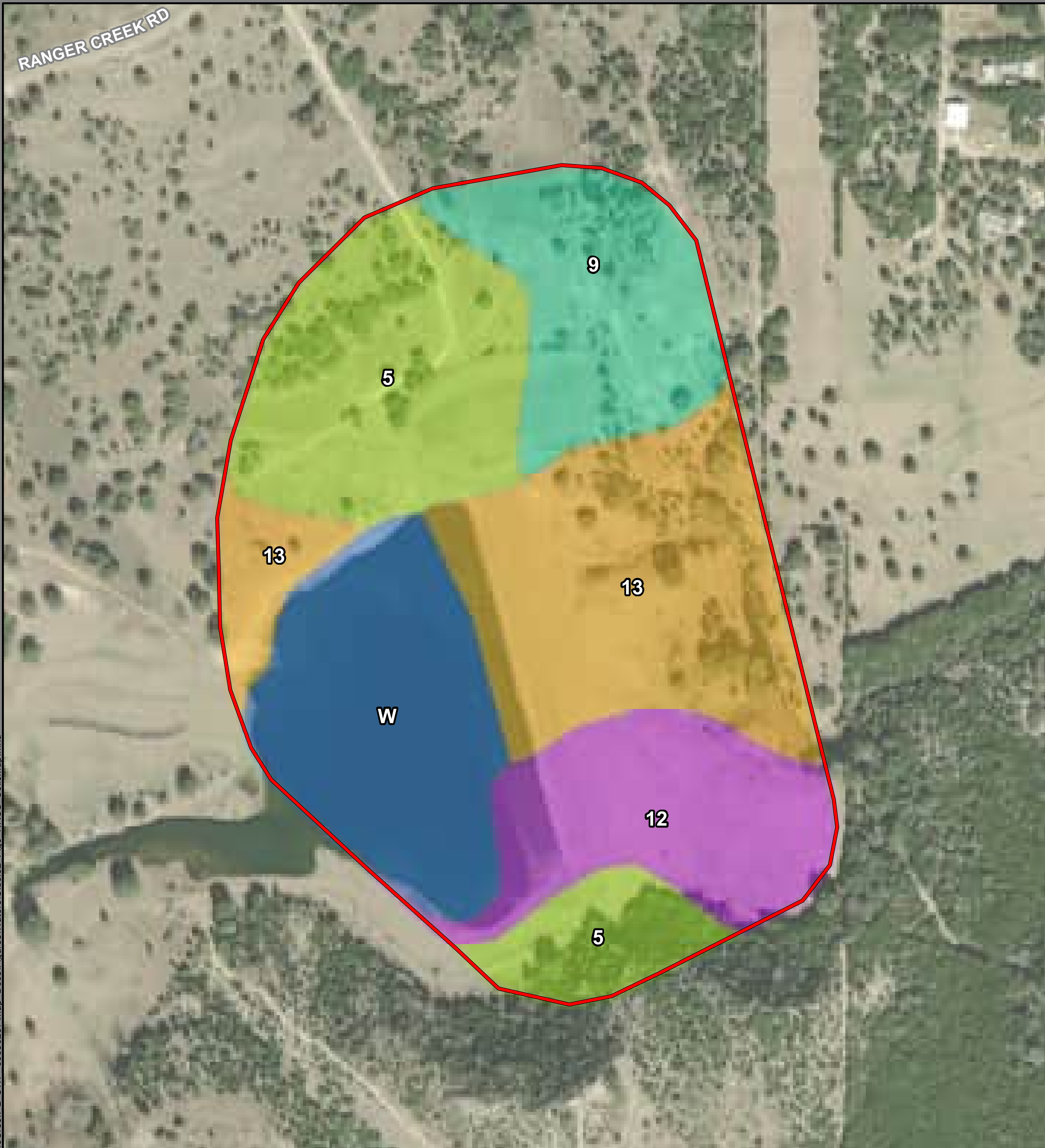
Data Sources: Roads - TxDOT 2018; County Boundaries - TIGER 2015
Basemap: USGS 7.5-minute Topographic Maps: Ranger Creek Quadrangle

AECOM

August 2022

Figure 2

Author: helen.potter; Document Path: M:\Dallas GIS\Projects\TSSWCB\CiboloCreek 2 SWP 60630237\Map Docs\Figures\Waters\Cibolo2 Fig2 USGS TopoMap.mxd



Author: helen.potter; Document Path: M:\Dallas_GIS\Projects\TSSWCB\CiboloCreek_2_SWP_60630237\Map_Docs\Figures\Waters\Cibolo2_Fig3_NRCS_SoilsMap.mxd

Study Area

NRCS Soil Types

- 12 - Krum silty clay, 1 to 3 percent slopes
- 13 - Krum silty clay, 3 to 5 percent slopes
- 5 - Brackett-Real association, 10 to 30 percent slopes
- 9 - Doss-Brackett association, undulating
- W - Water

NRCS Soils Map

Upper Cibolo Creek FRS No. 2
Kendall County, Texas

N W E S

0 100 200 300
Feet

Data Sources: Soils - NRCS 2018; Roads - TxDOT 2018; County Boundaries - TIGER 2015
Basemap: Maxar 1/12/2019

AECOM

August 2022

Figure 3

Author: helen.potter; Document Path: M:\Dallas_GIS\Projects\TSSWCB\CiboloCreek_2_SWP_60630237\Map_Docs\Figures\Waters\Cibolo2_Fig4_HydrologyMap.mxd

Hydrology Map

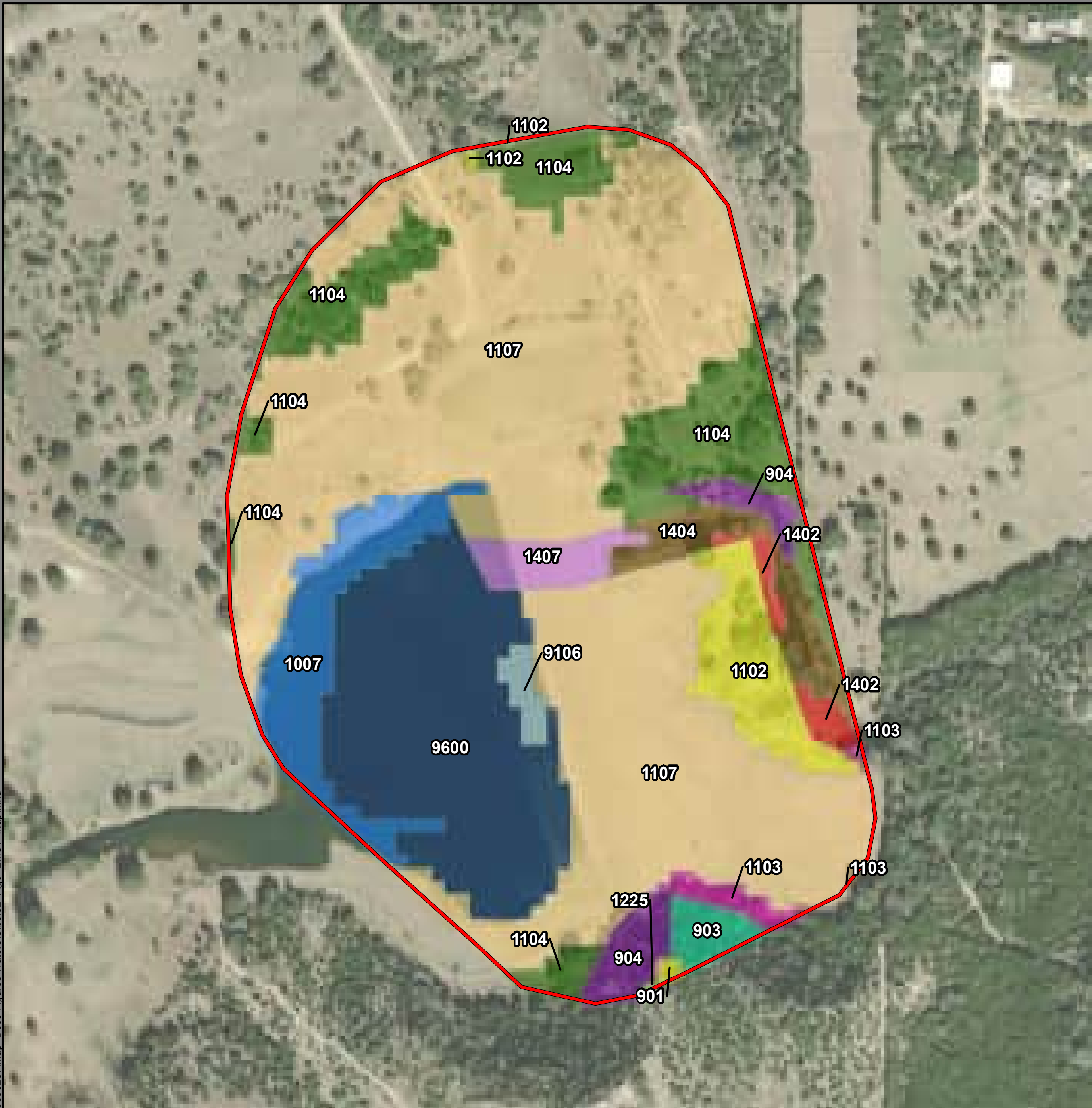
Upper Cibolo Creek FRS No. 2
Kendall County, Texas

Data Sources: Roads - TxDOT 2018; County Boundaries - TIGER 2015; NHD - USGS 2021; NWI - USFWS 2018; Flood Zones - FEMA 2020
Basemap: Maxar 1/12/2019

AECOM

August 2022

Figure 4



EMST Vegetation Types

- 901, Edwards Plateau: Ashe Juniper Slope Forest
- 903, Edwards Plateau: Oak / Ashe Juniper Slope Forest
- 904, Edwards Plateau: Oak / Hardwood Slope Forest
- 1007, Edwards Plateau: Floodplain Herbaceous Vegetation
- 1102, Edwards Plateau: Live Oak Motte and Woodland
- 1103, Edwards Plateau: Deciduous Oak / Evergreen Motte and Woodland
- 1104, Edwards Plateau: Oak / Hardwood Motte and Woodland
- 1107, Edwards Plateau: Savanna Grassland
- 1225, Edwards Plateau: Ashe Juniper / Live Oak Slope Shrubland
- 1402, Edwards Plateau: Riparian Live Oak Forest
- 1404, Edwards Plateau: Riparian Hardwood Forest
- 1407, Edwards Plateau: Riparian Herbaceous Vegetation
- 9106, Native Invasive: Mesquite Shrubland
- 9600, Open Water
- Study Area

Ecological Mapping Systems of Texas (EMST) Map

Upper Cibolo Creek FRS No. 2
Kendall County, Texas

N W E S

0 100 200 300
Feet

Data Sources: EMST - TPWD 2018; Roads - TxDOT 2018; County Boundaries - TIGER 2015
Basemap: Maxar 1/12/2019

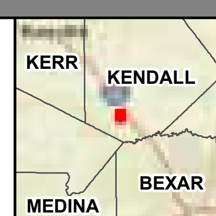
AECOM

August 2022

Figure 5

Author: helen.potter; Document Path: M:\Dallas_GIS\Projects\TSSWCB\CiboloCreek_2_SWP_60630237\Map_Docs\Figures\Waters\Cibolo2_Fig5_EMST_Map.mxd

Study Area
Upper Cibolo Creek FRS No. 2
Ranger Creek



Potentially Jurisdictional Waters of the U.S. Map

Upper Cibolo Creek FRS No. 2
Kendall County, Texas

N W E S

0 100 200 300
Feet

Data Sources: Roads - TxDOT 2018; County Boundaries - TIGER 2015; Field-Collected Water Features - AECOM Field Surveys July 2022
Basemap: Maxar 1/12/2019

AECOM

August 2022

Figure 6

Author: helen.potter; Document Path: M:\Dallas GIS\Projects\TSSWCB\CiboloCreek 2 SWP 60630237\Map Docs\Figures\Waters\Cibolo2 Fig6 PotentiallyJurisdictionalWOTUS Map.mxd

Appendix B Photographic Log

AECOM	PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No.
Upper Cibolo Creek FRS No. 2	Kendall County, TX	60630237

Photo No. 1	Date: 07/21/22
Direction Photo Taken: Southwest	
Description: View of the Study Area facing the reservoir and dam area.	

Photo No. 2	Date: 07/21/22
Direction Photo Taken: Northeast	
Description: View of the Study Area facing the reservoir and dam area.	

AECOM Imagine it. Delivered.		PHOTOGRAPHIC LOG
Site Name: Upper Cibolo Creek FRS No. 2	Site Location: Kendall County, TX	Project No. 60630237

Photo No. 3	Date: 07/21/22
Direction Photo Taken: Northwest	
Description: View of the outflow of the dam structure downstream into Ranger Creek within the Study Area.	

Photo No. 4	Date: 07/21/22
Direction Photo Taken: Southeast	
Description: Downstream view of Ranger Creek within the Study Area.	

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No.
Upper Cibolo Creek FRS No. 2	Kendall County, TX	60630237

Photo No.	Date:
5	07/21/22

Direction Photo Taken:

Southeast

Description:

Downstream view of Ranger Creek within the Study Area.

Photo No.	Date:
6	07/21/22

Direction Photo Taken:

Southeast

Description:

Upstream view of Ranger Creek within the Study Area.

Site Name: Upper Cibolo Creek FRS No. 2	Site Location: Kendall County, TX	Project No. 60630237

Photo No.	Date:
7	07/21/22

Direction Photo Taken:

Southeast

Description:

Across stream view of Ranger Creek within the Study Area.

Photo No.	Date:
8	07/21/22

Direction Photo Taken:

Southeast

Description:

Downstream view of Ranger Creek exiting the Study Area.

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E-4 Cultural Resources Survey in Support of the Supplemental Watershed Plan for The Rehabilitation of the Upper Cibolo Creek Watershed FRS No. 2

AECOM

Cultural Resources Survey in Support of the Supplemental Watershed Plan for the Rehabilitation of the Upper Cibolo Creek Watershed Floodwater Retarding Structure No. 2, Kendall County, Texas

Prepared by
Steve Ahr
Jonathon Strok
Seth Reed
Lucy Harrington
Amanda Hargrave
Shelley Hartsfield

Prepared for
Texas State Soil and Water Conservation Board

Principal Investigator
Steve Ahr, PhD, RPA

Texas Antiquities Permit No. 30077

October 2021

Cultural Resources Survey in Support of the Supplemental Watershed Plan for the Rehabilitation of the Upper Cibolo Creek Watershed Floodwater Retarding Structure No. 2, Kendall County, Texas

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Steve Ahr, PhD, RPA

Texas Antiquities Permit No. 30077

October 2021

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Management Summary

The Texas State Soil and Water Conservation Board and local sponsors, including the Kendall County Soil and Water Conservation District, Kendall County, and the City of Boerne, are preparing a Supplemental Watershed Plan (SWP) in order to evaluate rehabilitation alternatives for the Upper Cibolo Creek Watershed Floodwater Retarding Structure No. 2 (FRS No. 2), located in Kendall County, Texas.

AECOM conducted a cultural resources survey of a 66-acre Study Area in support of the SWP April 13-14, and 20, 2021, under Texas Antiquities Permit No. 30077. The pedestrian survey was supplemented with the excavation of 76 shovel tests and resulted in the identification of one previously unrecorded prehistoric archeological site (41KE294), one prehistoric isolated find (IF-1), and one historic age (ca. 1950) concrete dam (Resource 001). Site 41KE294 consists of a large scatter of prehistoric lithic materials and early twentieth century historic artifacts situated atop a Pleistocene terrace. IF-1 contains two chert flakes in an eroded, upland setting. Given the absence of features, the surficial setting of artifacts, the lack of definitive diagnostics, and on-going natural erosion and site formation processes on ancient land surfaces, 41KE294 and IF-1 are not likely to yield information important to prehistory or history. Therefore, 41KE294 and IF-1 are recommended as Not Eligible for listing in the National Register of Historic Places (NRHP) or for designation as a State Antiquities Landmark, and no further investigations are recommended. Following review by a qualified architectural historian, historic-age Resource 001 (concrete dam) was assessed as failing to meet the NRHP criteria of eligibility and is therefore recommended Not Eligible for listing in the NRHP.

A geomorphic assessment determined that the Study Area exhibits variable potential for containing buried and intact archeological deposits. Four geomorphic surfaces (T-2, T-1, T-0a, and T-0b) were identified within the Study Area, which are underlain by four alluvial stratigraphic units, designated from oldest to youngest as Units 1 through 4. The greatest potential for deep artifact burial and preservation exists within T-1 (Unit 2) and T-0a (Unit 3). Based on correlations with other alluvial chronologies in Central Texas, Unit 2 could contain Paleoindian through Middle Archaic archeological materials in stratified context. Unit 3 could contain Late Archaic through Late Prehistoric and possibly historic archeological materials in a stratified context. T-2 (Unit 1) and T-0b (Unit 4) were found to be too old and too young, respectively, to exhibit archeological relevance.

Based on the results of the investigations and our understanding of the nature of the proposed rehabilitation measures, AECOM recommends that the rehabilitation of FRS No. 2 should have No Effect on properties included in, or eligible for inclusion in, the NRHP, or that merit designation as SALs, and that construction can proceed without further investigations. This recommendation is made on the assumption that deep impacts will not occur within any previously undisturbed areas that were assessed as having potential for containing buried and preserved archeological deposits. In other words, no deep impacts are anticipated to occur within undisturbed T-1 (Unit 2) or T-0a (Unit 3) deposits. Should the scope of the project change such that deep impacts to T-1 (Unit 2) or T-0a (Unit 3) would occur, then additional archeological investigations such as exploratory backhoe trenching may be necessary.

In the event that previously undiscovered sites are found during construction, appropriate actions should be taken in accordance with the Prototype Programmatic Agreement between the United States Department of Agriculture, Texas Natural Resources Conservation Service (NRCS) State Office, and the Texas State Historic Preservation Officer (SHPO), as well as the National Programmatic Agreement among NRCS, the National Conference of SHPOs, and the Advisory Council on Historic Preservation, and NRCS General Manual 420, Part 401 guidance.

If any unmarked prehistoric or historic human remains or burials are encountered at any point during the project, the area of the remains is considered a cemetery under current Texas law and all construction activities must cease immediately to avoid impacting the remains. The Texas Historical Commission must be notified immediately by contacting the Archeology Division at (512) 463-6096. All cemeteries are protected under State law and cannot be disturbed. Further protection is provided in Section 28.03(f) of the Texas Penal Code, which provides that intentional damage or destruction inflicted on a human burial site is a state jail felony.

No artifacts were collected during the survey. Correspondence, field records, and photographs generated during field investigations were prepared for permanent curation at the Texas Archeological Research Laboratory, Austin, Texas.

1 Introduction

The Texas State Soil and Water Conservation Board (TSSWCB) and local sponsors, including the Kendall County Soil and Water Conservation District, Kendall County, and the City of Boerne, are preparing a Supplemental Watershed Plan (SWP) in order to evaluate rehabilitation alternatives for the Upper Cibolo Creek Watershed Floodwater Retarding Structure No. 2 (FRS No. 2), located in Kendall County, Texas (**Figure 1**).

FRS No. 2 was constructed in 1980 on Ranger Creek, approximately 4 miles northwest of downtown Boerne, Texas. FRS No. 2 is a single-purpose FRS that was designed and constructed as a low hazard dam. The National Inventory of Dams Identification Number is TX04902. FRS No. 2 is shown on the "Ranger Creek" United States Geological Survey (USGS) quadrangle map at Latitude 29.8073 and Longitude -98.7901. FRS No. 2 is 1,545 feet (ft) long with a maximum height of 50 ft and detention pool of 56 acres. The embankment contains 230,804 cubic yards of earthen fill. The principal spillway type is a drop inlet (24 inches x 72 inches x 22 ft) ported at 1,590.1 ft elevation; 300 ft of 24-inch diameter, prestressed, concrete-lined, steel cylinder pipe with eight anti-seep collars. The auxiliary spillway is 200 ft wide (URS Corporation 2010). FRS No. 2 does not meet the current dam safety design criteria for a high hazard dam.

Detailed plans for the structural rehabilitation are not yet available. However, to meet high hazard criteria, the rehabilitation would likely entail raising the embankment height 3.9 ft and increasing the auxiliary spillway width from 200 to 300 ft. The existing 24-inch principal spillway conduit would likely remain in place (URS Corporation 2010). All rehabilitation activities would be confined to a 66-acre environmental study area (Study Area), which is currently assumed to be the Area of Potential Effects (APE) for cultural resources (**Figure 2**). Currently, no details exist for potential construction staging or material storage areas within the Study Area.

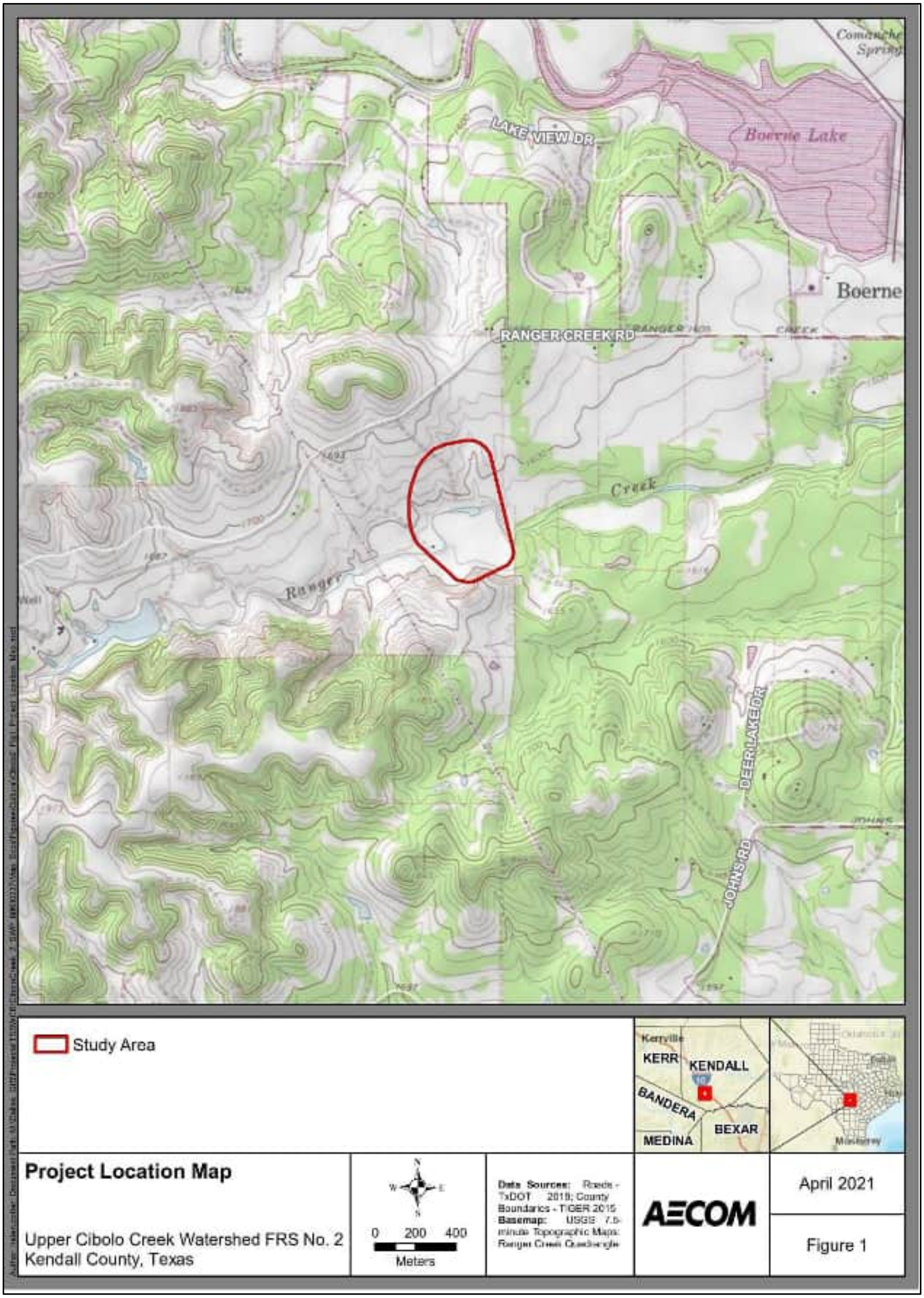

Figure 1. Upper Cibolo Creek Watershed FRS No. 2 Study Area, Kendall County, Texas

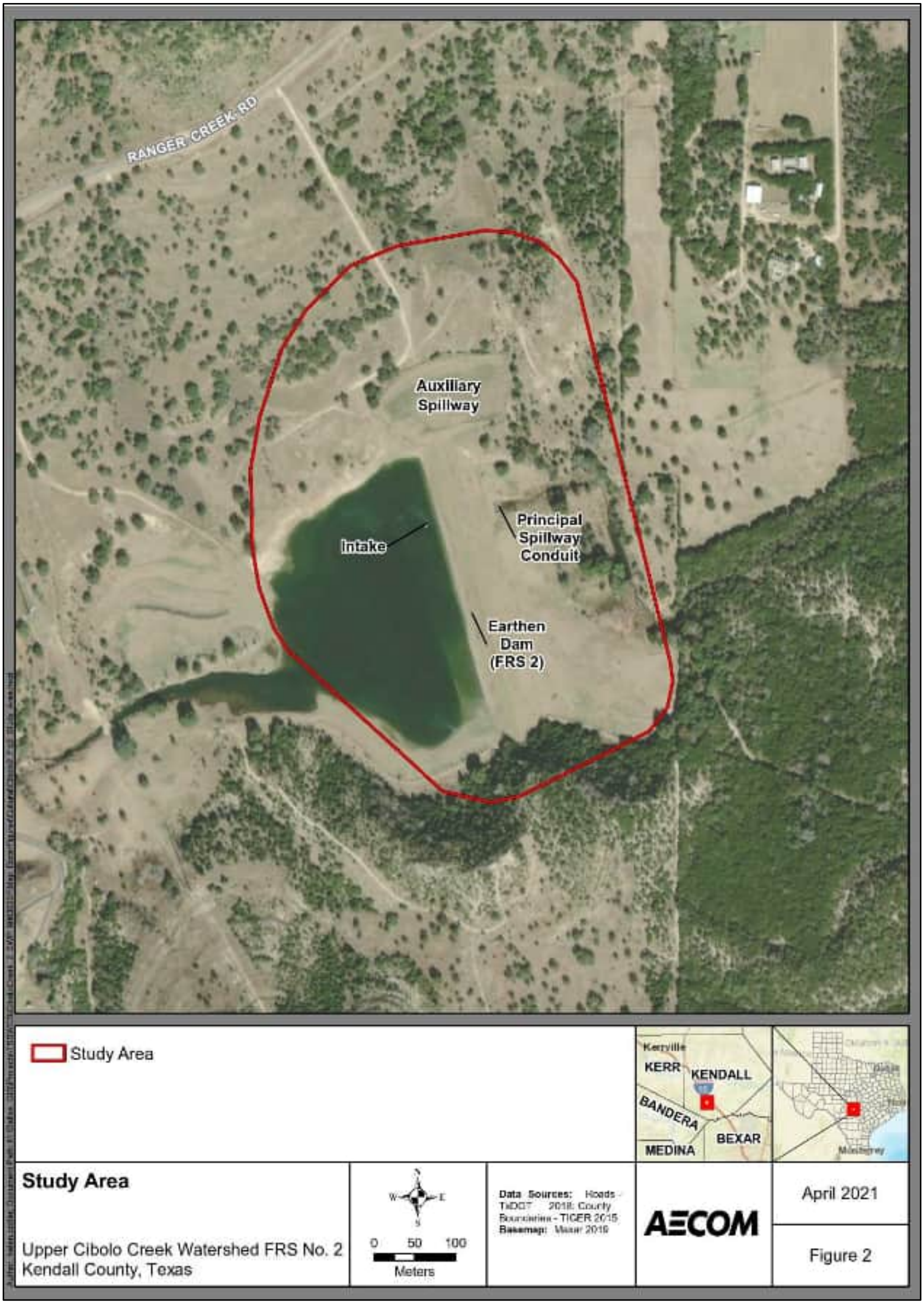

Figure 2. Project Study Area

The SWP will be prepared in accordance with standard engineering principles that comply with Natural Resources Conservation Service (NRCS) programmatic requirements. In addition, the SWP will be reviewed, concurred, and approved by NRCS. Consequently, the project falls under the purview of Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. In accordance with Advisory Council on Historic Preservation regulations pertaining to the protection of historic properties (36 Code of Federal Regulations [CFR] 800), federal agencies are required to assess the effects of their undertakings on historic properties prior to issuing permits or funding. Historic properties are defined as those properties that are included in, or are eligible for inclusion in, the National Register of Historic Places (NRHP). The project will be reviewed by the State Historic Preservation Office (SHPO), which is the Texas Historical Commission (THC).

The project will be located on lands owned or controlled by the project sponsors, including the TSSWCB, the Kendall County Soil and Water Conservation District, Kendall County, and the City of Boerne, which are political subdivisions of the State of Texas. As such, it falls within the purview of the Antiquities Code of Texas (Texas Natural Resource Code, Title 9, Chapter 191). Regulations pertaining to the code can be found within Title 13, Part 2, Chapter 26 of the Texas Administrative Code (TAC). The code requires the THC to review actions that have the potential to disturb prehistoric and historic sites within the public domain of Texas. The THC issues Antiquities Permits that stipulate the conditions under which survey, discovery, excavation, demolition, restoration, or scientific investigations can occur.

AECOM conducted a cultural resources survey of the Study Area on April 13-14, and 20, 2021 and required approximately 58 person hours to complete. Steve Ahr served as Principal Investigator and supervised the field investigations. Survey work was carried out primarily by Jonathan Stroik and Lucy Harrington, who were also assisted by Amanda Hargrave. Architectural Historian Beth Reed performed an architectural survey of the Study Area. Helen Potter and Albert Fraley maintained the GIS data and prepared project maps. Shelley Hartsfield conducted the historic artifact analysis and reviewed earlier drafts of this report.

2 Environmental Setting

2.1 Physiography

The Study Area is located within the Edwards Plateau physiographic region, which has shallow soils covering limestone bedrock. The Balcones Escarpment allows stream erosion along the natural faults, forming the Hill Country of Central Texas (Bureau of Economic Geology [BEG] 1996). Typical vegetation consists of tall grass prairie with oak-historic forests of post oak, blackjack oak, and hickory along stream edges. Fauna in the region include white-tailed deer, wild turkeys, mourning doves, eastern cottontails, eastern fox squirrels, bullfrogs, Virginia opossum, and striped skunk (Telfair 1999).

2.2 Topography

The Study Area is located within the USGS Ranger Creek topographic quadrangle in Kendall County, Texas. It ranges in elevation from 1,700 ft above mean sea level (amsl) within the upland margins, to approximately 1,580 ft amsl within the Ranger Creek channel.

2.3 Geology

Bedrock geology of the Study Area consists of the lower Cretaceous Glen Rose Formation (Kgr), which is characterized by alternating dolomite and marl beds that are differentially eroded, resulting in a stair-stepped pattern (BEG 1974). The upper part of this formation is thinner bedded and more dolomitic and less fossiliferous. The lower part is more massive and contains more fossils. Late Quaternary landforms, including Pleistocene and Holocene terraces, are present within the incised stream valley of Ranger Creek, though neither are shown on current geologic maps.

2.4 Soils

Four NRCS soil mapping units comprise 81.4 percent of the Study Area. The remaining 18.6 percent of the Study Area is occupied by water (**Table 1; Figure 3**). A total of 38.6 percent of the Study Area consists of soils mapped on uplands and include the Brackett-Real association, 10 to 30 percent slopes, and the Doss-Brackett association, undulating (NRCS 2021). The soils within these associations are located on the shoulders, backslopes, footslopes, and sideslopes of ridges and plains and are well drained, shallow to very shallow over bedrock. These soils formed within residuum weathered from the underlying limestone bedrock. As such, these soils exhibit low potential to contain buried and intact archeological sites. The remaining 42.8 percent of the Study Area is mapped as Krum soils, which are located on terrace treads above streams and are very deep and well drained soils that formed in alluvium. Depending on the thickness of these terrace deposits within the Study Area, potential exists for archeological burial and preservation within the Krum soils. The deep archeological potential of the Study Area is discussed in detail in Section 5.3 of this report.

Table 1. Soils within the Study Area

Map Unit Symbol	Map Unit Name	Series Description/Typical Pedon	Percent of Study Area	Landform Setting/ Position	Parent Material
5	Brackett-Real association, 10 to 30 percent slopes	Brackett: well drained and shallow soils (36 cm) over bedrock / A-Bk-Cr Real: well drained and very shallow soils (33 cm) over bedrock / A-Ak-Cr	24.5	Ridges / shoulder, backslope, footslope, sideslope	Residuum
9	Doss-Brackett association, undulating	Doss: well drained and shallow soils (48 cm) over bedrock / A-Bk-Cr Brackett: well drained and shallow soils (36 cm) over bedrock / A-Bk-Cr	14.1	Ridges and Plains / shoulder, sideslopes	Residuum
12	Krum silty clay, 1 to 3 percent slopes	Very deep well drained soils that formed in alluvium; located on treads of stream terraces / Ap-A-Bw-Bk1-Bk2	15.1	Stream terraces	Alluvium
13	Krum silty clay, 3 to 5 percent slopes	Very deep well drained soils that formed in alluvium; located on treads of stream terraces / Ap-A-Bw-Bk1-Bk2	27.7	Stream terraces	Alluvium
W	Water	Water	18.6	N/A	N/A

Source: NRCS (2021)

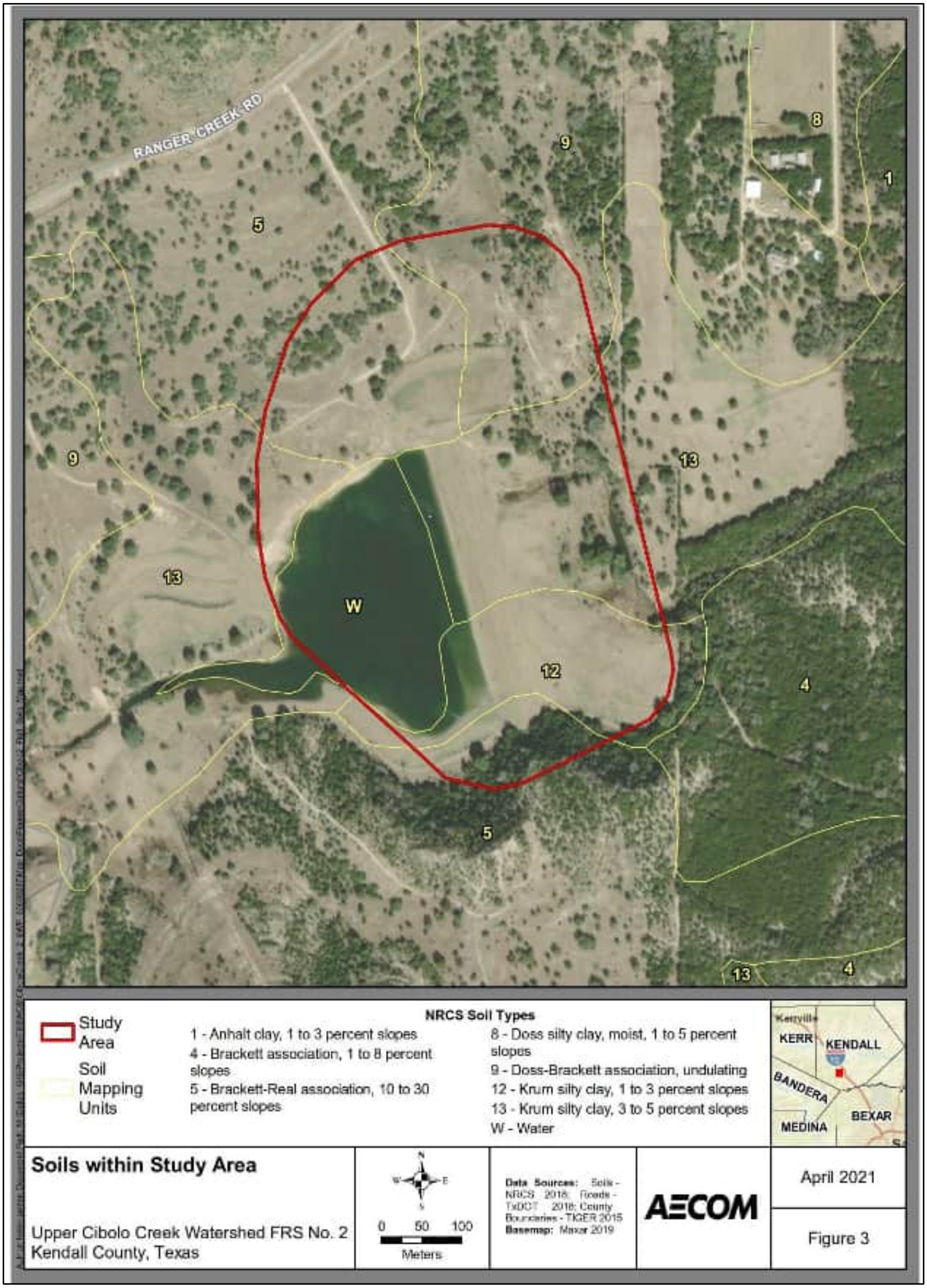

Figure 3. Soils within the Study Area

3 Cultural History

3.1 Paleoindian Period (11,500 – 8800 Years Before Present [B.P.])

The conventional interpretation of the Paleoindian Period is that it ranges from approximately 11,500 to 8800 B.P. and represents the earliest known human occupation in North America. Two main Paleoindian periods have been extensively documented and include Early Paleoindian, represented largely by Clovis points, and Late Paleoindian, represented by Folsom points. Early Paleoindian Clovis cultures were characterized by highly mobile big game hunters consisting of small bands. Notable cases of these occupations within the Central Texas region have been reported at the Gault Site (41BL323) in Bell County, the Buttermilk Creek Site in Williamson County, Kincaid Rockshelter (41UV2) on the southern margin of the Edwards Plateau in Uvalde County, and the Pavo Real Site (41BX42) in Bexar County. The Late Paleoindian Period is represented by Folsom artifacts, which appear to have been more closely aligned to hunting bison and included a much more diverse subsistence base than the preceding period (Collins 1995). During this Late Pleistocene-Early Holocene transition, the climate is thought to have been much cooler and wetter, though it was becoming increasingly dry and warm. Small, isolated occurrences of Late Paleoindian sites are common in upland settings in Central Texas, while larger, deeply buried, and intact occupations are less well documented. Those sites that weren't eroded away during Late Pleistocene stream erosional events are likely buried deeply in alluvial deposits and still await detection. Those that have been found and fully investigated include the Wilson-Leonard Site (41WM235) in Williamson County and suggest a much wider range of subsistence activities than previously thought (Collins 1998). Recent investigations at the Buttermilk Creek Site and the Gault Site in Central Texas are providing new insights into potential pre-Clovis occupations that date as far back as 15,500 B.P. (Collins and Brown 2000; Waters et al. 2011). These discoveries are challenging long-held notions about the timing of the entrance of humans into North America and Texas.

3.2 Archaic Period (8800 – 1300 B.P.)

The Early Archaic Period (8800 – 6000 B.P.) is one of increasingly warmer and drier climate conditions than had existed previously, and one in which subsistence strategies were necessarily broadened to include a much more diverse array of plant and animal resources. Sites from this period tend to be small and contain diverse tool assemblages. Consequently, greater hunter-gatherer mobility and lower population densities are attributed to this period (Prewitt 1981). Increased reliance on floral remains and hot-rock cooking technology and more diverse lithic technology are also indicated, with sites tending to be concentrated along the eastern and southern Edwards Plateau margins (Black 1995; Johnson and Goode 1994). In South Texas, a greater emphasis on gathering and exploitation of riparian environments is observed (Black 1986), while in Central Texas, burned rock middens begin to emerge (Hester 1991; Prewitt 1981). Diagnostic projectile points from this time include Gower, Hoxie, Wells, Bell-Andice, Uvalde, and Martindale types (Hester 1980; Turner and Hester 1985).

The Middle Archaic Period (6000 – 4000 B.P.) is generally recognized as a period of population increase, with a concomitant increase in the number and diversity of archeological site types (Collins 1995; Hall et al. 1986; Turner and Hester 1985). Climate during this time in Central Texas is believed to have been significantly warmer and drier than today because of the mid-Holocene Altithermal. Climate conditions coupled with a reduction in bison populations resulted in greater exploitation of richer environments such as natural springs. The number and sizes of campsites and burned rock middens increased during this period, though there was still a strong reliance on game hunting (Hall et al. 1986; Prewitt 1981). Greater use of cemeteries also occurred across the region during this time (Bement 1994; Taylor and Highley

1995). Common diagnostic projectile points for this period include Carrollton and Nolan types (Collins 1995; Turner and Hester 1985).

During the Late Archaic Period (4000 – 1300 B.P.), climate is thought to have returned to cooler and moister conditions (Collins 1995). Bison returned in greater numbers than had been present during the Middle Archaic Period, and population densities are thought to have increased substantially (Prewitt 1981). Burned-rock middens are currently believed to have increased in number during the Late Archaic and are represented by abundant fire-cracked rock features, such as hearths and earth ovens. Use of cemeteries continued from the previous period, and defined territories and trade networks emerged (Collins 1995; Hall 1981; Hester 1995; Story 1985). Diagnostic projectile points for this period include Pedernales, Bulverde, and Marcos types, though the relatively low densities of such points in site assemblages may indicate that hunting was of lesser importance than gathering (Prewitt 1981).

3.3 Late Prehistoric Period (1300 – 300 B.P.)

The Late Prehistoric Period in Central Texas is marked by the introduction of small, stemmed projectile points for use with the bow and arrow. Two main periods are recognized in Central and South Texas and include the Austin and Toyah Phases (Collins 1995; Hester 1995). The Austin Phase (1300 – 650 B.P.) is marked by the introduction of the bow and arrow. This period is represented by diagnostic Scallorn arrow points and other side-notched points (Black 1989). Other common artifacts at Austin Phase sites include bifaces, gouges, scrapers, and grinding stones; cemeteries continued to be used as well. Subsistence was broad-based and included hunting deer, exploiting freshwater fish resources, and gathering (Collins 1995; Prewitt 1981; Hester 1995). The Toyah Phase (650 – 300 B.P.) is perhaps the better known of the two Late Prehistoric Periods. It is distinct from the preceding Austin Phase and is marked by the introduction of contracting-stem Perdiz arrow points, bone-tempered pottery, beveled-edge bifacial knives, perforators, and end-scrapers (Black 1986, 1989; Creel 1991; Hester 1980; Johnson 1994; Kelley 1986; Prewitt 1981). The Toyah material culture is arguably geared toward extensive bison exploitation and mobility, and extensive trade relationships likely existed that focused on the exchange of bison hides and other commodities (Creel 1991).

3.4 Historic Period (Post-300 B.P.)

Kendall County is in south-central Texas, 170 miles inland from the Gulf of Mexico, and is bordered by Gillespie, Blanco, Comal, Bexar, Bandera, and Kerr counties. Boerne, the county seat, is situated thirty miles northwest of San Antonio. Kendall County comprises roughly 663 square miles of rolling to hilly terrain in the Edwards Plateau region, with elevations ranging from 1,000 to 2,000 ft amsl. The Guadalupe River, which crosses the county from west to east, the Blanco River in the north, and Cibolo Creek in the south are important waterways (Smyrl 2021a).

The Lipan Apache, Kiowa, and Comanche tribes were dominant in the region prior to white settlement and remained in the area through the nineteenth century. During the Spanish-colonial era of settlement (c 1521-1821) of Texas there were virtually no Spanish settlements within the Kendall County area and no Spanish land grants were recorded in the area. After the establishment of Mexican rule in 1821, only one land grant was issued on future Kendall County lands. With the establishment of the Republic of Texas in 1836, land grants were slowly issued. However, many original landowners did not live on the land, possibly due to the threat of Indian attacks.

Between 1844 and 1847, thousands of Germans immigrated to the area (Kendall County Historical Commission [KCHC] 2021; Texas Genealogy Trails 2021). In 1847, the Meusebach-Comanche Treaty was signed and provided for white settlement in Indian territory and allowed for Indians to enter the settlements. Early communities established by German immigrants included Sisterdale in 1847, Tusculum (Boerne) in 1849, Curry's Creek in 1850, and Comfort in 1854. In 1852, Gustav Theissen and

John James laid out a townsite and changed the name to Boerne in honor of Ludwig Boerne, a German author and publicist. A post office was established in 1856 (KCHC 2021).

In 1836, the Republic of Texas was established and the area that is now Kendall County was then part of Bexar County. Later Kendall County lands were assigned at different points to Comal, Kerr and Blanco counties. The residents were dissatisfied with the constant change in counties and petitioned the legislature for a county of their own. They succeeded in convincing the Texas legislature to create a new county and in 1862, Kendall County was created. The community of Boerne was chosen as the county seat and a courthouse was built in 1870. Boerne developed a reputation as a health resort and by 1884, the town had five hotels and 250 residents (KCHC 2021).

Kendall County's economy was based on agriculture with most of the land devoted to ranching. Sheep ranching was introduced to the area by George W. Kendall in the 1850s and was the county's main industry. The remainder of the land was devoted to the cultivation of field crops such as cotton, corn, and wheat. Cotton remained the principal crop in the county from the 1880s through the 1920s. The economy of Kendall County declined following the Civil War and throughout the Reconstruction period. Between 1864 and 1866 county property tax receipts declined 52 percent, the majority due to the decline in farm acreage and livestock value. By 1870, economic recovery in Kendall County was evident and the population increased from 1,536 to 2,763 by 1880. The number of farms also increased during this period, from 197 to 419, and the amount of improved land rose from 3,617 acres to 22,452 acres. The economy benefited from the arrival of multiple railroads through the county. In 1877, the Galveston, Harrisburg and San Antonio Railway to San Antonio and the San Antonio and Aransas Pass Railway to Boerne provided improved transport of goods to market (Smyrl 2021a, 2021b).

By 1900, the population of the county had increased to 4,103. There were 542 farms, and average farm size increased from 367 to 626 acres. Ranching remained the principal industry with an increase in cattle over sheep raising. There were approximately 20,000 cattle and 8,600 sheep in the county in 1900. The number of goats increased from 2,048 in 1900, to 13, 626 in 1920, and supported an industry processing wool and mohair (Smyrl 2021a).

Kendall County experienced economic decline during the 1930s because of the Great Depression. Cotton cultivation declined and businesses closed leaving some residents to move to find work. The population of Boerne fell from an estimated 2,000 in 1928 to 1,117 in 1931. By the 1940s the population had only risen to 1,271. Tenant farming increased during this period and crops such as corn and oats also increased (Smyrl 2021b).

The economy improved during World War II when the war brought new businesses and industries to neighboring Bexar County. Several military bases in San Antonio provided jobs for Kendall County residents. Through the 1950s, Kendall County residents continued to find employment in Bexar County and San Antonio. During the 1950s, the economy of Kendall County continued to rely on agriculture and ranching. The average farm size rose to 562 acres, as smaller farms were consolidated, and farming became mechanized and commercialized. The percentage of county residents living in rural areas shifted and more people moved to towns. Before 1940, residents of Kendall County's two larger towns, Boerne and Comfort, comprised less than 40 percent of the total population. Most county residents lived in small rural communities or on farms. By 1960, the number of residents living in the towns of Boerne and Comfort rose to 5,889 and represented approximately 60 percent of the county population (Smyrl 2021b).

The population of Kendall County continued to increase between the 1960s and 1980s because of development in northern Bexar County and increased job availability. An increase in the population of the southern part of Kendall County also occurred as a result of increased subdivision construction and an influx of new residents from Bexar County. The construction of the San Antonio Medical Center and the University of Texas at San Antonio in Bexar County during the 1960s, as well as the completion of

Interstate Highway 10 through the region resulted in a population increase in Kendall County. Commuters from Boerne to Bexar County also increased. The population of Kendall County was 10,635 in 1980 and represented a 52 percent increase over the population of 6,964 in 1970 (Smyrl 2021a, 2021b).

In the early 1980s, 86 percent of Kendall County consisted of farms and ranches, but only five percent of the land was under cultivation. Cattle, milk, sheep, wool, angora goats, mohair, and hogs were the primary agricultural products. By 1990, the population of Kendall County was 14,589. In 2002, the county had 967 farms and ranches covering 326,926 acres with cattle, sheep, meat goats, Angora goats, hay, and small grains as the most important agricultural products. The population of Kendall County in 2014 was 38,880 people (Smyrl 2021a).

4 Methods

4.1 Antiquities Permit

A Texas Antiquities Permit application and research design was submitted to the THC prior to fieldwork. The THC approved the application and issued Antiquities Permit No. 30077 on March 25, 2021. Steve Ahr served as Principal Investigator.

4.2 Background Review

Prior to fieldwork, AECOM conducted an archeological background review of the Texas Archeological Sites Atlas (TASA 2021) to identify previously recorded archeological sites, cemeteries, and previous surveys within 1,000 meters (m) of the Study Area.

AECOM architectural historian Beth Reed conducted a historic resources background review of the Texas Historic Sites Atlas (THSA 2021) and the Texas Department of Transportation's (TxDOT's) Historic District and Properties GIS layer to identify properties listed in, or eligible for listing in, the NRHP, National Historic Landmarks (NHLs), State Antiquities Landmarks (SALs), Recorded Texas Historic Landmarks (RTHLs), and Official Texas Historical Markers (OTHMs) within 1,300 ft of the Study Area.

4.3 Archeological Survey

AECOM conducted an intensive archeological survey of the Study Area in conformance with the Council of Texas Archeologists' (CTA) *Intensive Terrestrial Survey Guidelines*. The objectives of the survey were to identify and record archeological and historic resources within the Study Area, evaluate their eligibility for inclusion in the NRHP and for designation as SALs, and determine whether additional investigations were warranted. All work was supervised by AECOM cultural resources staff meeting the United States Secretary of the Interior's *Professional Qualification Standards for Archeology and Historic Preservation* (Title 36 CFR Part 61), and Texas' professional qualification requirements for Principal Investigator (13 TAC 26.4).

All exposed ground surfaces within the Study Area were systematically examined for archeological materials. CTA standards were applied to the 66-acre Study Area, which require two shovel tests per acre for the first 25 acres, then one shovel test for each additional 5 acres. Shovel tests were 30 centimeters (cm) in diameter and were dug in 20-cm levels. In depositional areas, shovel tests were dug either to the bottom of the Holocene deposits, to 80 cm below surface, or to a restrictive layer. In upland areas, shovel tests were dug to subsoil or bedrock. Excavated soils were screened through ¼-inch mesh unless high clay or water content required that they be troweled through. All shovels tests were backfilled upon completion. Shovel testing was precluded in upland or erosional settings with exposed bedrock; on slopes greater than 20 percent; and areas with significant ground disturbance. For each shovel test, the location, depth, soil description, and the presence/absence of cultural materials were recorded. The Study Area was also assessed in terms of its geomorphology and geoarcheological potential to determine whether deeply buried and intact cultural materials could be impacted by the project. The assessment investigated the soil-geomorphic setting and depositional environments, the age and lithology of the soil parent materials, the types of active pedogenic site formation processes, and the anticipated depth of impacts from the project.

4.4 Site Recording and Assessment

A site was defined by the presence of at least five or more artifacts. Isolated farm/ranch equipment was not considered as sites. Cultural materials greater than 50 years of age were minimally designated as isolated finds. All artifact scatters were delineated as sites through shovel testing and field observations. Positive shovel tests were excavated in a cruciform pattern at intervals no greater than 15 m until two negative shovel tests were found in each direction, or until topographic limits (e.g., landform boundaries, streams) were reached. A site boundary was established at the location of the first negative shovel test past the last positive shovel test. Each site was photographed from a minimum of two angles. All cultural features and natural features of interest were also photographed, along with representative overviews of the Study Area. Site boundaries and the locations of all subsurface excavations, cultural features, photographs, individual artifacts or artifact clusters, and other relevant natural or landscape features (e.g., roads, buildings) were recorded with a handheld GPS.

No artifacts were collected during the survey. For all sites identified during the survey, the quantities of artifacts or estimates of materials in surface scatters were recorded and the locations of artifact concentrations were plotted on site maps. Artifacts from shovel tests or other sub-surface investigations were photographed. In addition, all non-collected diagnostic artifacts and a representative sample of non-diagnostic materials from the surface were documented in the field. TexSite forms for the new site was prepared and submitted to the Texas Archeological Research Laboratory (TARL) for assignment of a permanent trinomial designation.

All cultural resources sites were assessed for their eligibility for listing in the NRHP according to the National Register criteria for evaluation (36 CFR Part 60.4 [a-d]), which states that "[t]he quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:

a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
b) that are associated with the lives of persons significant in our past; or
c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
d) that have yielded, or may be likely to yield, information important in prehistory or history.

All cultural resource sites were also assessed for SAL eligibility. Under 13 TAC 26.10, an archeological site under the ownership or control of the State of Texas may merit official designation as a SAL if one of the following criteria applies:

1. The site has the potential to contribute to a better understanding of the prehistory and/or history of Texas by the addition of new and important information;
2. The site's archeological deposits and the artifacts within the site are preserved and intact, thereby supporting the research potential or preservation interests of the site;
3. The site possesses unique or rare attributes concerning Texas prehistory and/or history; or
4. The study of the site offers the opportunity to test theories and methods of preservation, thereby contributing to new scientific knowledge.

4.5 Curation

The survey employed a non-collection strategy. Pursuant to 13 TAC 26.17, correspondence, field records, and photographs generated during the investigation were prepared for permanent curation at TARL.

4.6 Historic Resources Methods

Historic resources refer to any buildings, structures, objects, sites, and potential historic districts that are, or will be, 45 years of age or older at the time of the anticipated project letting date for construction, which currently is estimated to be 2021. Therefore, buildings, structures, objects, sites, or potential historic districts dating to 1976 or earlier were evaluated as historic resources.

A historic resources reconnaissance survey was conducted on April 13, 2021 by AECOM Architectural Historian, Beth Reed. Historic-age resources within 150 ft of the Study Area were identified, documented with digital photography, and evaluated for NRHP eligibility.

5 Results

5.1 Background Review Results

The background review revealed that two previous archeological surveys have taken place within 1,000 m of the Study Area (**Table 2**). The survey conducted by the Soil Conservation Service in 1975 overlaps with approximately 27 percent of the current Study Area (**Figure 4**).

Table 2. Previous Archeological Investigations within 1,000 m of the Study Area

Type	Atlas ID	Date	Antiquities Permit	Agency
Survey	8500002844	1975	-	Soil Conservation Service
Survey	8500011945	2020	3890	Lower Colorado River Authority

Source: TASA (2021)

Three previously recorded prehistoric archeological sites are located within 1,000 m of the Study Area (**Table 3**). No sites are inside the Study Area. No cemeteries are located within 1,000 m of the Study Area. Based on the historic resources background review, no properties listed in, or eligible for listing in, the NRHP or designated NHLs, SALs, RTHLs, or OTHMs are recorded within 1,300 ft of the Study Area (TASA 2021; THSA 2021).

Table 3. Previously Recorded Archeological Sites within 1,000 m of the Study Area

Site Number	Cultural Period	Site Type	Designation Status	Relationship to Study Area
41KE38	Prehistoric	Lithic scatter containing chert flakes and burned rock	Undetermined	[redacted]
41KE39	Prehistoric	Lithic scatter containing chert flakes, scrapers, burins, and projectile point fragment	Undetermined	[redacted]
41KE47	Prehistoric	Lithic scatter containing a crude biface cobble	Undetermined	[redacted]

Source: TASA (2021)

[redacted]

Figure 4. Previously recorded sites and surveys

5.2 Survey Results

The FRS No. 2 Study Area was surveyed April 13-14, and 20, 2021 and required approximately 58 person hours to complete. The FRS No. 2 Study Area consists of relatively open range land used to support exotic game. The existing FRS facilities include the earthen dam, auxiliary spillway, the drainage outlet and impact basin, and contoured flood control berms below the dam (**Figures 5-12**). Prior impacts exist from construction and continued use of the dam complex, as well as natural erosional processes to the surrounding area.

The survey crew excavated 76 shovel tests within the Study Area, which included 58 survey shovel tests and 18 site delineation shovel tests. The maximum shovel test depth was 50 cm, with an average depth of 18 cm before encountering bedrock, upland subsoil, or a restrictive layer (**Appendix A**). Ground surface visibility was approximately 80 percent over most the Study Area. Shovel test excavations within the lower elevation areas revealed dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) silty clays containing common concretions of secondary calcium carbonates up to 5 mm in diameter.

Within the high terrace north of Ranger Creek, shovel tests typically encountered a thin veneer of dark grayish brown (10YR 4/2) silty clay containing angular fragments of weakly cemented limestone, overlying a strongly developed and indurated calcic horizon. Upland soils were patchy across the Study Area, with sparse vegetation, and were characterized by loose, weathered residuum and degraded limestone fragments.

One previously unrecorded prehistoric archeological site (41KE294) and one prehistoric isolated find (IF-1) were identified and documented during the survey (**Figure 13**). In addition, one historic age resource (Resource 001) was recorded, which was identified as a small concrete dam located 260 m downstream from the FRS No. 2 outlet pipe. Each cultural resource identified within the Study Area is discussed below.

Figure 5. Overview of FRS No. 2 dam, facing north

Figure 6. Upland area on north side of pond, facing southwest

Figure 7. Erosion along high terrace scarp located north of Ranger Creek, facing southeast

Figure 8. Uplands and weathered limestone on south end of Study Area, facing west

Figure 9. Overview from upland edge toward Ranger Creek, facing south

Figure 10. View of FRS No. 2 outlet pipe and plunge basin, facing east

Figure 11. View of intake structure and impound area west of FRS No. dam, facing southwest

Figure 12. View of FRS No. 2 auxiliary spillway, facing north

[redacted]

Figure 13. Map of shovel tests and newly recorded cultural resource sites

41KE294

Site 41KE294 was recorded during the current survey and consists of a scatter of prehistoric lithic materials and historic artifacts. The site measures 250 m north-south by 100 m east-west and lies within an area comprised of mixed woodlands and grassy rangeland (**Figure 14**). The site is situated on an upland edge and high terrace on the north and east side of Ranger Creek, at an elevation of 1,590 ft amsl. Overall, the site area exhibits at least 75 percent ground surface visibility. Soils on the terrace surface are mapped as Krum silty clay, 3 to 5 percent slopes, which is present as a thin (~15 cm) veneer of silt loam. The upland edge lacks soil material and consist of weathered limestone (**Figures 15-16**).

Site artifacts are distributed across the surface of the terrace and the adjacent uplands (see **Figure 14**). The site yielded a surface scatter of at least 77 chert flakes, 10 cores, 7 bifaces, one stemmed Pedernales-like projectile point base fragment, and seven unifacially flaked or retouched flakes (**Figures 17-28**). A total of 21 shovel tests (5 survey shovel tests and 16 site delineation tests) were excavated within the site, which averaged 12 cm in depth before encountering bedrock or caliche (**Table 4**). Three of these shovel tests yielded seven chert flakes within the upper 15 cm of deposits. Except for the single stemmed projectile point base, which resembles the common Pedernales base type, no definitive temporally diagnostic artifacts were found. Approximately 94 percent of the site was found resting on the indurated surface of the Pleistocene-age terrace and the highly weathered and weakly cemented upland bedrock surface. The remaining six percent of the site components were recovered from shovel tests excavated within the thin (<30 cm) silt loam veneer (possible slopewash) that mantles portions of the ancient terrace tread. Based on field investigations, the lithic artifact assemblage appears to represent a variety of activities, including lithic procurement (primary flakes and debitage), tool reduction (flakes, cores), and processing (bifaces, unifacially retouched flakes, and possible projectile point fragment). The bifaces and unifaces recorded at the site are crude and most likely represent significantly reduced cores and/or expedient-use tools. All photographed artifacts from this site are illustrated in **Appendix B**.

Several historic-age artifacts were distributed across the central part of the site (see **Figure 14**), including whiteware/pearlware “flow blue” rim and body sherds, a whiteware base sherd, a stoneware sherd with greenish-yellow slip, a “Hopkins Square” colorless bottle base with Owens Ring (ca. post-1903 [Intermountain Antiquities Computer System 1992]), an Owens-Illinois Glass Company “LYRIC” colorless glass embossed medicine bottle base, ca. 1915-1929 (Toulouse 2001), a ceramic caster wheel, and a main plate with crown wheel and attached ratchet wheel from a pocket watch (**Figures 29-34**). These artifacts are likely early twentieth century in age. A review of historic aerial photographs (1955-2016), topographic maps (1956-2019), and deed research of Texas General Land Office (GLO) records and the Kendall County Appraisal District (KCAD) did not yield any information about the presence of any structures in this vicinity. No foundations or other evidence of a former structure was observed. Finally, the landowner did not recall there was ever a structure present in the vicinity of the site.

The site is limited to the surface of the Pleistocene terrace, the highly weathered and weakly cemented upland bedrock surface, and to thin sediments that overlie the terrace surface that are likely derived from slopewash. While the possible Pedernales base fragment suggests a Middle Archaic (2500-3500 B.P.) cultural timeframe (Turner and Hester 1985), the landscape is such that the artifacts lie within a lag, or palimpsest setting wherein multiple cultural components tend to be highly compressed within the same geomorphic setting. The site area exhibits on-going natural upland soil erosion and weathering processes. Other impacts include brush clearing and vehicular traffic along two-track roads. No areas of the site exhibit the potential for containing deep soils and as such, no backhoe trenches are required to delineate the vertical depths of the site deposits. Given the absence of features, the surficial setting of artifacts, the lack of definitive diagnostics, and the on-going natural erosion and site formation processes, site 41KE294 is not likely to yield information important to prehistory or history. Therefore, site 41KE294 is recommended as Not Eligible for listing in the NRHP. It is also recommended that the site does not merit designation as a SAL. No further investigations are recommended for this site.

[redacted]

Figure 14. 41KE294 site map

Figure 15. North overview of site 41KE294 situated on high terrace above Ranger Creek

Figure 16. 41KE294 site overview, facing southwest

Figure 17. Possible Pedernales point base (41KE294)

Figure 18. Biface fragment (41KE294)

Figure 19. Bifaces (41KE294)

Figure 20. Patinated biface (41KE294)

Figure 21. Proximal end of unifacial scraper (41KE294)

Figure 22. Biface (41KE294)

Figure 23. Utilized/retouched flake (41KE294)

Figure 24. Core (41KE294)

Figure 25. Biface fragment (41KE294)

Figure 26. Biface fragment (41KE294)

Figure 27. Biface (41KE294)

Figure 28. Biface (possible projectile point) fragment (41KE294)

Table 4. Shovel test data for site 41KE294

Shovel Test	Depth (cm)	Matrix Description	Cultural Materials
17	11	0-11 cm: 10YR4/2 silt loam over bedrock	-
22	8	0-8 cm: 10YR7/2 loamy sand over bedrock	-
27	14	0-14 cm: 10YR3/4 sandy loam over bedrock	-
27E15	20	0-10 cm: 10YR4/3 clay loam 10-20 cm: 10YR3/6 gravelly clay with CaC03 nodules 2-5 mm in size	-
27E30	20	0-10 cm: 10YR4/3 clay loam 10-20 cm: 10YR3/6 gravelly clay with CaC03 nodules 2-5 mm in size	-
27N15	7	0-7 cm: 10YR6/2 clay loam over bedrock; very calcareous; at junction of high terrace and uplands	-
28	25	0-13 cm: 10YR3/1 silty clay loam 13-25 cm: 10YR4/6 clay loam	-
28N15	10	0-10 cm: 10YR6/2 silty clay over bedrock/caliche zone	1 flake at 10 cm
28N15E5	5	0-5 cm: 10YR6/2 silty clay over bedrock/caliche zone	-
28N15W15	5	0-5 cm: Caliche surface on high terrace near upland contact	-
28N30	10	0-10 cm: 10YR6/2 silty clay over bedrock/caliche zone	-
28N45	0	Weathered bedrock surface; no soil	-
34N30	10	0-10 cm: 10YR3/6 silty clay loam over bedrock/caliche	-
35	20	0-20 cm: 10YR3/3 silt loam over bedrock	1 flake 10-15 cm
35N15	20	0-20 cm: 10YR2/2 silt loam over bedrock	-
35E15	10	0-10 cm: 10YR2/1 silt loam over bedrock	-
35N30	30	0-15 cm: 10YR2/1 clay loam 15-30 cm: 10YR3/2 clay loam	-
35N30E15	10	0-10 cm: 10YR32 silt loam over bedrock/ located in disturbed and cleared setting	-
35W15	8	0-8 cm: 10YR3/3 silt loam over bedrock	-
35W30	5	0-5 cm: 10YR2/2 silt loam over bedrock	-
35S15	9	0-9 cm: 10YR3/2 silt loam over bedrock	5 flakes 0-9 cm

Figure 29. Whiteware flow blue sherds (41KE294)

Figure 30. Pocket watch main plate with crown wheel and ratchet wheel attached (41KE294)

Figure 31. Ceramic caster wheel (41KE294)

Figure 32. Stoneware sherd with greenish-yellow slip (41KE294)

Figure 33. Owens-Illinois Glass Company "LYRIC" colorless embossed medicine bottle (ca. 1915-1929) (Toulouse 2001) (41KE294)

Figure 34. "Hopkins Square" colorless bottle base with Owens Ring, ca. post-1903 (IMACS 1992) (41KE294)

IF-1

IF-1 included two tertiary chert flakes (see **Figure 13**). The flakes were observed in an eroded upland area consisting of highly weathered and eroded limestone bedrock (**Figure 35**). Close ground surface inspection and surrounding shovel tests failed to identify additional cultural materials. IF-1 is recommended as Not Eligible for listing in the NRHP and does not merit designation as a SAL. No further investigations are recommended for IF-1.

Figure 35. IF-1 overview, facing southwest

Historic Resource 001

Historic Resource 001 is a small concrete dam structure spanning a section of Ranger Creek and is located approximately 600 ft east of the FRS No. 2 dam (see **Figure 13**). The concrete dam is oriented northeast to southwest and is approximately 15 ft wide and five ft tall (**Figures 36-37**). A small square opening in the concrete at the center of the base of the dam presumably functions as an outlet. A hand-drawn inscription is carved in the concrete on the southeast side of the dam and appears to read ‘M A PARE’ (**Figure 38**).

Deed research reveals that Resource 001 is on a land parcel that is part of an original land grant to N.J. Boyd (**Figure 39**) (GLO 2021a). The resource is situated in Survey/Block/Township 827. The Ben Ficklin Irrigation and Manufacturing Company (B.F.I. Co.) was granted 640 acres on August 16, 1876 after constructing 3½ miles of ditch of fourth class, ‘under the provisions of “An act to encourage the construction of Canals and Ditches for Navigation and Irrigation” (GLO 2021a). The Ficklin Company promptly transferred ownership of the 640 acres to Mr. N. J. Boyd on August 22, 1876 for $120.00. Boyd patented the land under Patent Number 427 on January 25, 1878. Research shows the 43.64-acre land parcel on which Resource 001 is located is currently privately owned and intersects KCAD land parcel 299982 (KCAD 2021).

The dam is visible in aerial photography from 1955 and 1963. Based on design, materials, and workmanship, as well as photographic evidence, the resource is greater than 45 years of age and the date of construction is estimated to be around 1950. Based on this information, Resource 001 meets the age requirement for NRHP eligibility consideration and was evaluated for NRHP eligibility based on criteria presented in 36 CFR Part 63 [a–d]. Resource 001 does not appear to have been altered, and the surrounding landscape has remained undeveloped. Therefore, the resource has retained integrity of location, design, materials, workmanship, setting, feeling, and association. Although the resource retains integrity, its association with flood control development or agriculture in the Cibolo Creek Watershed is not sufficient for NRHP-listing as there are other examples of these types of resources in Kendall County, with similar historical context. The resource is also not associated with a pattern of development in Kendall County. Resource 001 fails to illustrate any known association with significant historical events or a significant pattern of development in Kendall County, and does not qualify for NRHP eligibility under Criterion A. The resource is also not associated with significant persons in history and lacks engineering design merit to qualify for NRHP eligibility under Criteria B or C. Finally, the resource is not likely to yield information important to history or prehistory, and does not qualify for NRHP eligibility under Criterion D. Therefore, Resource 001 is recommended not eligible for listing in the NRHP. Furthermore, Resources 001 does not merit SAL designation.

Figure 36. View of Resource 001 concrete dam, facing northeast

Figure 37. View of Resource 001 showing concrete outlet opening in base of southeast side of dam, looking northeast

Figure 38. Detail View of Resource 001 showing inscription in concrete base

Figure 39. Part of 1862 map showing Abstract 827 (GLO 2021b)

5.3 Geomorphological Assessment

A geomorphological assessment was performed on April 20, 2021 to develop an initial stratigraphic and pedologic framework for evaluating potential archeological deposits within the Study Area. Investigations included field observations and recording of alluvial stratigraphic units, construction of a geomorphic map and alluvial stratigraphic cross section, and reconstructing the alluvial history of the Study Area.

Methods

A geomorphic map of the Study Area was prepared to differentiate the geomorphic surfaces (e.g., terraces, floodplains, uplands) in order to facilitate geoarcheological interpretation. The geomorphic map was developed based on field observations, USGS topographic maps, aerial photographs, Geologic Atlas of Texas sheets from the BEG, and NRCS soil data for Kendall County. Field observations included detailed measurements of terrace heights above the low-water level of Ranger Creek, cutbank profile observations, and soils data from shovel testing. A generalized soil-stratigraphic column and valley cross-section showing the stratigraphic and chronological relationships between alluvial units, soils/paleosols, and any archeological deposits, was also developed. Aided by alluvial-geomorphological and pedological attributes and correlations with previous studies, sediments in the study area were subdivided into informal alluvial stratigraphic units (e.g., allostratigraphic units) on the basis of bounding disconformities or buried soils, as defined in the North American Stratigraphic Code (North American Commission on Stratigraphic Nomenclature 2005). No deep testing (e.g., backhoe trenching) was conducted at this stage of the project, and deeper deposits could not be examined in detail. Thus, each alluvial unit described below is assumed to be comprised of a relatively continuous depositional sequence that lack unconformities or discontinuities.

Alluvial Stratigraphy

Four late Quaternary geomorphic surfaces are mapped in the Study Area, including a Pleistocene terrace (T-2) comprised of Unit 1 fill, a Holocene terrace (T-1) comprised of Unit 2 fill, a Holocene floodplain (T-0a) comprised of Unit 3 fill, and a modern incipient floodplain (T-0b) comprised of Unit 4 fill. Each is described below, from oldest to youngest (**Figures 40 – 41**).

<u>T-2 Terrace</u>

The T-2 terrace is the oldest terrace identified in the Study Area and is mapped on the north side of Ranger Creek. The T-2 terrace rises approximately 9 m above the low-water channel and is non-paired. The T-2 alluvial deposits, herein designated as Unit 1, rest unconformably on a bedrock strath cut approximately 1 to 2 m above the Ranger Creek low water channel (**Figure 42**). Field observations indicate that the lower Unit 1 fill contains channel gravel facies that fine upwards into the yellowish red calcified loams. Shovel tests on the T-2 terrace tread revealed a thin (<15 cm), patchy calcareous zone of silt loam slopewash resting unconformably over a highly weathered and indurated terrace surface. Based on the soil morphology and stratigraphic position of the T-2 terrace, the alluvial unit beneath the T-2 terrace correlates with the late Pleistocene Jackson alluvium previously identified along Henson Creek and Cowhouse Creek at Fort Hood, Texas (**Figure 43**). Deposition of the Jackson alluvium ceased sometime between 15,000 and 10,000 B.P. (Nordt 1995, 2004).

[redacted]

Figure 40. Geomorphic map of the Study Area

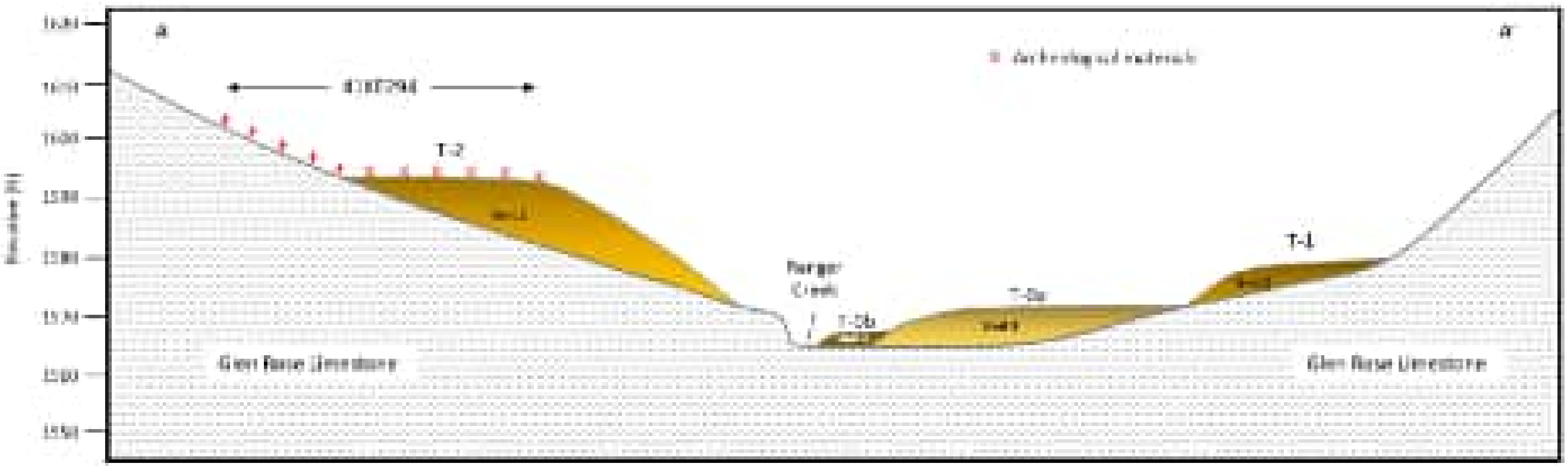

Figure 41. Generalized alluvial stratigraphic cross-section of the Study Area

Figure 42. View toward T-2 terrace, facing north

T-1 Terrace

The T-1 terrace is on the south side of the alluvial valley and rises approximately 5 m above the lower water channel of Ranger Creek (**Figure 44**). This unpaired terrace occupies a relatively small percentage of the Study Area (see **Figure 40**). Shovel tests on the T-1 terrace tread revealed a dark grayish brown (10YR 3/2) clay loam A horizon over an extremely compact, highly calcareous reddish yellow (7.5YR 6/6) and strongly cemented calcic Bk horizon. The T-1 terrace in the Study Area is broadly correlated to the T-1 terrace at Henson Creek (Nordt 1995) and portions of the T-1 terrace at Cowhouse Creek, both located in Central Texas. At Henson and Cowhouse Creeks, there are two alluvial stratigraphic units beneath the T-1 terrace (see **Figure 43**). The oldest unit, the Georgetown alluvium (or equivalent), consists of well sorted and cross bedded channel gravels overlain by yellowish brown loam. The Royalty paleosol caps this alluvial unit and is truncated in places where subsequent channel erosion and downcutting took place (Nordt 1995, 2004). The Royalty paleosol and Georgetown alluvium are overlain by a second, younger unit, the Fort Hood alluvium, which consist of horizontally interbedded gravels and loams that grade down to thick and massive channel gravels (Nordt 1995, 2004). In the Study Area the T-1 deposits were not investigated through mechanical trenching so the thickness of T-1 is unknown. It is also not known whether the T-1 deposits in the Study Area represent a single stratigraphic unit or if they exist as more complex cut-and-fill sequences like those observed in other areas of Central Texas. For now, the T-1 terrace fill is assumed to be comprised of a single continuous alluvial deposit defined as Unit 2. Future investigations may help to differentiate the deposits and refine these correlations. Assuming a valid correlation exists with the alluvial basins described herein, Unit 2 in the Study Area may have begun to aggrade as early as 11,000 B.P., like the onset of the Georgetown alluvium, or possibly later during the deposition of the Fort Hood alluvium beginning around 7000 B.P. Radiocarbon dating would be needed to provide a definitive start date for the Unit 2 deposition. Nonetheless, it is likely that Unit 2 ceased to aggrade by around 4800 – 5000 B.P. This was followed by a period of channel erosion. Widespread channel erosion and downcutting has been widely reported for numerous alluvial valleys across South and Central Texas at this time, following a major climate shift from warm and dry conditions to cooler and wetter conditions (Ahr 2014).

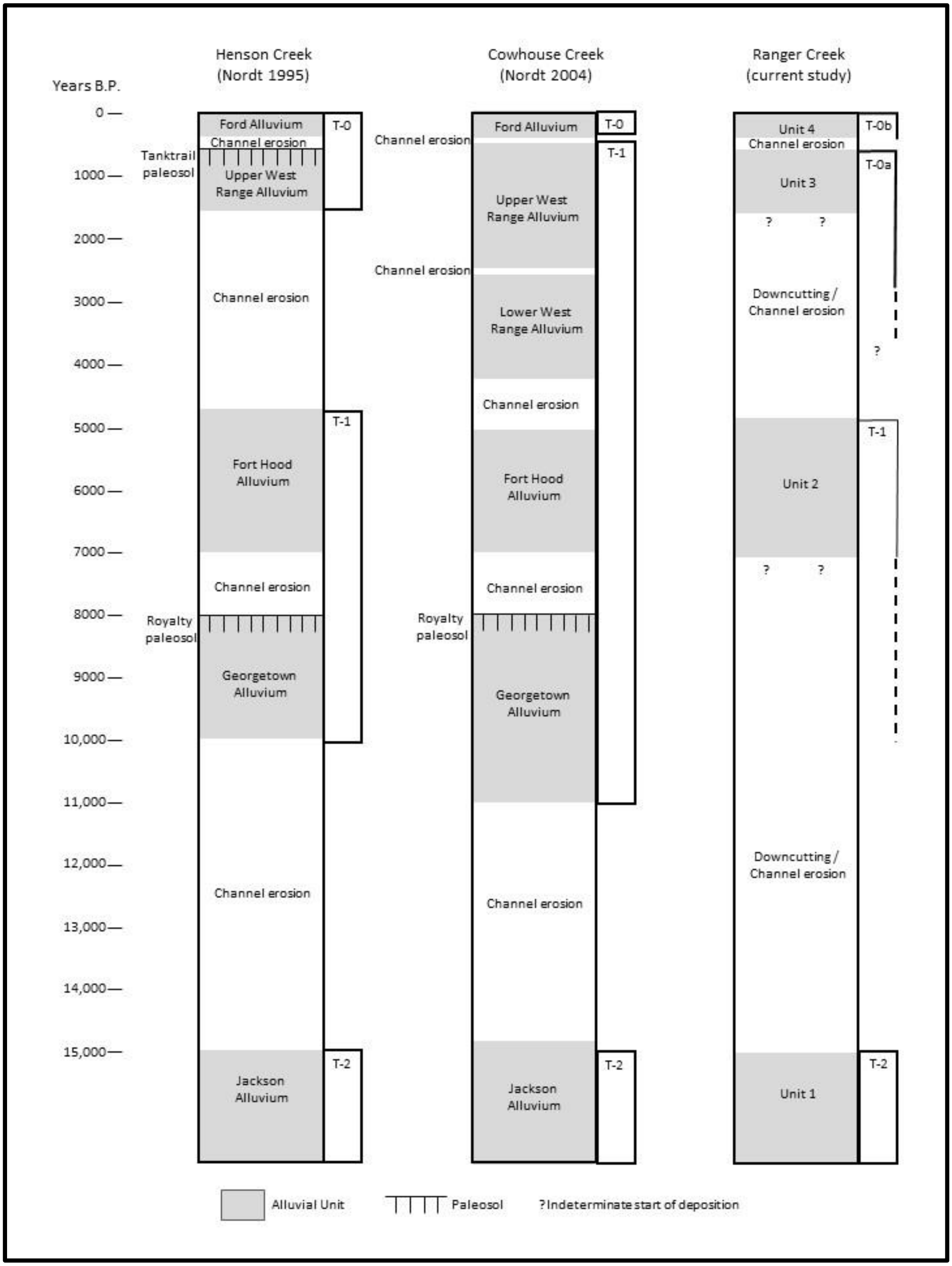

Figure 43. Correlation of late Quaternary alluvial sequences at Ranger Creek, Cowhouse Creek, and Henson Creek

Figure 44. Overview of T-1 terrace, facing south from top of dam

T-0 Floodplain

Two distinct floodplain surfaces are present within the Study Area and are designated as T-0a and T-0b. The T-0a surface is on the south side of Ranger Creek and rises approximately 2.4 m above the low water channel (see **Figure 44**). Shovel tests revealed very dark grayish brown (10YR 3/2) silt loam and clay loam over dark grayish brown (10YR 4/2) silt loam. Because no deep testing was conducted, thickness of T-0a was not determined, and the lower deposits were not examined. The T-0a fill is presumed to be comprised of a single alluvial unit, defined as Unit 3. The base of these deposits is likely comprised of horizontally bedded gravels, as evidenced by the numerous gravels eroding from the base of the T-0a scarp (**Figure 45**). These gravels are overlain by fine grained vertical accretion deposits which also contain numerous rock inclusions, as seen in profile in an erosional gully incised into the T-0a surface (**Figure 46**). Based on the soil morphology, the stratigraphic position of T-0a, and the height of this geomorphic surface above the low water channel, Unit 3 is correlated with the Late Holocene alluvial fill at Henson Creek, which consists of horizontally bedded channel gravels that are overlain by dark grayish brown and grayish brown silt loams. This unit is dated as having begun to aggrade around 1650 B.P. (Nordt 1995). This fill is also correlated with the Upper West Range alluvium at Cowhouse Creek. It is unclear how long Unit 3 aggraded in the Study Area prior to dam construction.

A new floodplain designated as T-0b has begun to form below the small concrete dam. This geomorphic surface is underlain by Unit 4, which rests directly on bedrock and is inset to T-0a. Total thickness of T-0b is approximately 20 to 30 cm (**Figure 47**). Shovel tests revealed very dark grayish brown (10YR 3/2) and gleyed saturated clay that is relatively unaltered by pedogenesis. Small springs were also observed seeping from this unit. Deposition of Unit 4 in the Study Area might have occurred concurrently with the deposition of the Ford alluvium at Henson and Cowhouse Creeks, which began sometime between 600 and 420 B.P., following a period of channel incision (Nordt 1995, 2004). However, Unit 4 in the Study Area and the Ford alluvium are lithologically dissimilar; the latter being comprised of stratified loamy flood deposits. Given the minimal thickness and degree of pedogenesis, it is possible that Unit 4 in the Study Area began to aggrade in response to altered hydrological conditions following construction of the concrete dam in the 1950s.

Figure 45. Gravels eroded from base of the T-0a scarp, facing south

Figure 46. Fine grained vertical accretion deposits (Unit 3) with rock fragments in upper part of T-0a

Figure 47. Overview of T-0b floodplain deposits

Late Quaternary Alluvial History

Based on regional correlations, the deposition of Unit 1 and construction of the T-2 terrace in the Study Area terminated during the late Pleistocene. Following a period of channel downcutting and lateral channel erosion, deposition once again resumed and Unit 2 began to be deposited, resulting in construction of the T-1 terrace. Given the absence of radiometric ages from the Study Area, the timing of this renewed deposition is currently unknown. However, based on regional correlations, deposition of Unit 2 may have begun as early as 11,000 B.P., or as late as 7000 B.P. In either case, Unit 2 likely ceased to aggrade sometime around 4800 – 5000 B.P. Sometime after 5000 B.P. another period of channel incision ensued, followed by the deposition of Unit 3 and construction of the T-0a surface. Deposition of Unit 3 likely began no later than 1650 B.P., with the lateral and vertical accretion of horizontally bedded gravels overlain by fine grained vertical accretion deposits. It is not known if construction of T-0a continued into historic/modern times, prior to construction of the FRS No. 2 dam, but it is likely that this surface would have been flooded during large meteorological events. Unit 4 and the T-0b surface might correlate with the Ford alluvium and therefore could have aggraded sometime between 600 and 420 B.P. However, because these deposits are lithologically dissimilar, and given the relatively weak soil development of the massive clayey deposits of Unit 4 in the Study Area, it is more likely these are modern deposits that aggraded in response to altered hydrological conditions resulting from construction of the concrete dam in the 1950s.

Geoarcheological Potential

Four geomorphic surfaces (T-2, T-1, T-0a, and T-0b) are recorded in the Study Area. Based on initial field investigations, these are underlain by four alluvial stratigraphic units, designated from oldest to youngest, as Units 1 through 4. **Table 5** below is based on the foregoing discussion and summarizes the estimated age correlations and geoarcheological potential of each alluvial unit, along with management recommendations.

Table 5. Alluvial stratigraphic units and archeological potential in Study Area

Geomorphic Surface	Alluvial Unit	Age Estimate	Basis	Archeological Periods	Management Recommendations
T-2	Unit 1	>15,000 B.P.	Correlation with Jackson alluvium[1]	All cultural periods on terrace surface only	Surface survey only
T-1	Unit 2	11,000/7000 to 5000/4600 B.P.	Correlation with Fort Hood alluvium[1]	Paleoindian through Middle Archaic	Backhoe trenching if deep impacts will occur
T-0a	Unit 3	1650 B.P. to historic	Correlation with Upper West Range alluvium[1]	Late Archaic through Late Prehistoric and/or Historic	Backhoe trenching if deep impacts will occur
T-0b	Unit 4	Modern	Field observations	Modern	No further work

[1]See Nordt (1995, 2004)

6 Summary and Recommendations

AECOM conducted a cultural resources survey in support of the SWP for the rehabilitation of the Upper Cibolo Creek Watershed FRS No. 2, located in Kendall County, Texas. The survey was carried out April 13-14, and 20, 2021, under Texas Antiquities Permit No. 30077 within a 66-acre Study Area that was presumed to be equivalent to the APE for cultural resources. The pedestrian survey was supplemented with the excavation of 76 shovel tests and resulted in the identification and documentation of one previously unrecorded prehistoric archeological site (41KE294), one prehistoric isolated find (IF-1), and one historic age (ca. 1950) concrete dam (Resource 001).

Site 41KE294 consists of a large scatter of prehistoric lithic materials and historic artifacts situated atop a Pleistocene terrace. IF-1 contains two chert flakes in an eroded, upland setting. Artifacts at 41KE294 and IF-1 are within an upland setting lacking vertical separate of components. Given the surficial setting of artifacts, the absence of features, the lack of definitive diagnostics, and on-going natural erosion and site formation processes, site 41KE294 and IF-1 are not likely to yield information important to prehistory or history. Therefore, 41KE294 and IF-1 are recommended as Not Eligible for listing in the NRHP or for designation as a SAL. No further investigations are recommended for either site. Following review by a qualified architectural historian, historic age Resource 001 (concrete dam) was assessed as failing to meet the NRHP criteria of eligibility and is therefore recommended Not Eligible for listing in the NRHP.

A geomorphic assessment determined that the Study Area exhibits variable potential for containing buried and intact archeological deposits. Four geomorphic surfaces (T-2, T-1, T-0a, and T-0b) were identified within the Study Area, which are underlain by four alluvial stratigraphic units, designated from oldest to youngest as Units 1 through 4. The greatest potential for deep artifact burial and preservation exists within T-1 (Unit 2) and T-0a (Unit 3). Based on correlations with other alluvial chronologies in Central Texas, Unit 2 could contain Paleoindian through Middle Archaic archeological materials in stratified context. Unit 3 could contain Late Archaic through Late Prehistoric and possibly historic archeological materials in a stratified context. T-2 (Unit 1) and T-0b (Unit 4) were found to be too old and too young, respectively, to exhibit archeological relevance.

Based on the results of the investigations and our understanding of the nature of the proposed rehabilitation measures, AECOM recommends that the rehabilitation of FRS No. 2 should have No Effect on properties included in, or eligible for inclusion in, the NRHP, or that merit designation as SALs, and that construction can proceed without further investigations. This recommendation is made on the assumption that deep impacts will not occur within any previously undisturbed areas that were assessed as having potential for containing buried and preserved archeological deposits. In other words, no deep impacts will occur within undisturbed deposits associated with T-1 (Unit 2) or T-0a (Unit 3). However, if the scope of the Project change such that deep impacts to T-1 (Unit 2) or T-0a (Unit 3) are anticipated, additional archeological investigations such as exploratory backhoe trenching may be necessary.

In the event that previously undiscovered sites are found during construction, appropriate actions should be taken in accordance with the Prototype Programmatic Agreement between the United States Department of Agriculture, Texas NRCS State Office, and the Texas SHPO, as well as the National Programmatic Agreement among NRCS, the National Conference of SHPOs, and the Advisory Council on Historic Preservation, and NRCS General Manual 420, Part 401 guidance.

If any unmarked prehistoric or historic human remains or burials are encountered at any point during the project, the area of the remains is considered a cemetery under current Texas law and all construction activities must cease immediately to avoid impacting the remains. The THC must be notified immediately by contacting the Archeology Division at (512) 463-6096. All cemeteries are protected under State law and cannot be disturbed. Further protection is provided in Section 28.03(f) of the Texas Penal Code, which provides that intentional damage or destruction inflicted on a human burial site is a state jail felony.

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APPENDIX A

SHOVEL TEST DATA

APPENDIX A: SHOVEL TEST DATA

Shovel Test	Depth (cm)	Matrix Description	Date	Site No.	Cultural Materials
1	11	0-11 cm: 10YR3/3 silt loam over bedrock	4/14/21	-	-
2	27	0-15 cm: 10YR3/1 silt loam 15-27 cm: 10YR4/1 silt loam	4/14/21	-	-
3	28	0-17 cm: 10YR2/1 silt loam 17-28 cm: 10YR4/2 clay loam	4/14/21	-	-
4	27	0-15 cm: 10YR3/1 silt loam 15-27 cm: 10YR4/1 silt loam	4/14/21	-	-
5	28	0-28 cm: 10YR2/1 clay loam	4/14/21	-	-
6	10	0-10 cm: 10YR2/2 silt loam over bedrock	4/14/21	-	-
7	28	0-28 cm: 10YR4/2 silt loam over bedrock	4/14/21	-	-
8	13	0-13 cm: 10YR3/1 silt loam over bedrock	4/14/21	-	-
9	20	0-9 cm: 10YR4/2 silt loam 9-20 cm: 10YR4/3 silt loam	4/14/21	-	-
10	6	0-6 cm: 10YR5/2 silt loam over bedrock	4/14/21	-	-
11	41	0-41 cm: 10YR3/4 sandy clay loam over bedrock	4/14/21	-	-
12	13	0-13 cm: 10YR3/4 sandy loam over bedrock	4/14/21	-	-
13	29	0-17 cm: 10YR4/2 sandy loam 17-29 cm: 10YR7/2 sandy loam	4/14/21		
14	35	0-24 cm: 10YR4/2 sandy loam 24-35 cm: 10YR7/2 sandy loam	4/14/21	-	-
15	9	0-9 cm: 10YR5/2 sandy loam over bedrock	4/14/21	-	-
16	3	0-3 cm: 10YR5/2 silt loam over bedrock	4/14/21		
17	11	0-11 cm: 10YR4/2 silt loam over bedrock	4/14/21	41KE294	-
18	20	0-17 cm: 10YR3/2 sandy clay loam 17-20 cm: 10YR3/2 sandy loam over bedrock	4/14/21	-	-
19	8	0-8 cm: 10YR3/2 sandy loam over bedrock	4/14/21	-	-
20	26	0-14 cm: 10YR4/2 sandy loam 14-26 cm: 10YR7/2 sandy loam	4/14/21	-	-

Shovel Test	Depth (cm)	Matrix Description	Date	Site No.	Cultural Materials
21	8	0-8 cm: 10YR4/4 sandy loam over bedrock	4/14/21	-	-
22	8	0-8 cm: 10YR7/2 loamy sand over bedrock	4/14/21	41KE294	-
23	26	0-20 cm: 10YR5/2 sandy loam 20-26 cm: 10YR4/2 sandy loam over bedrock	4/14/21	-	-
24	27	0-27 cm: 10YR6/2 sandy loam over bedrock	4/14/21	-	-
25	29	0-10 cm: 10YR6/1 sandy loam 10-29 cm: 10YR4/2 sandy loam over bedrock	4/14/21	-	-
26	0	Strongly sloping hill – soils eroded to bedrock	4/14/21	-	-
27	14	0-14 cm: 10YR3/4 sandy loam over bedrock	4/14/21	41KE294	-
27E15	20	0-10 cm: 10YR4/3 clay loam 10-20 cm: 10YR3/6 gravelly clay with CaC03 nodules 2-5 mm in size	4/20/21	41KE294	-
27E30	20	0-10 cm: 10YR4/3 clay loam 10-20 cm: 10YR3/6 gravelly clay with CaC03 nodules 2-5 mm in size	4/20/21	41KE294	-
27N15	7	0-7 cm: 10YR6/2 clay loam over bedrock; very calcareous; at junction of high terrace and uplands	4/20/21	41KE294	-
28	25	0-13 cm: 10YR3/1 silty clay loam 13-25 cm: 10YR4/6 clay loam	4/14/21	41KE294	-
28N15	10	0-10 cm: 10YR6/2 silty clay over bedrock/caliche zone	4/20/21	41KE294	1 flake at 10 cm
28N15E5	5	0-5 cm: 10YR6/2 silty clay over bedrock/caliche zone	4/20/21	41KE294	-
28N15W15	5	0-5 cm: Caliche surface on high terrace near upland contact	4/20/21	41KE294	-
28N30	10	0-10 cm: 10YR6/2 silty clay over bedrock/caliche zone	4/20/21	41KE294	-
28N45	0	Weathered bedrock surface; no soil	4/20/21	41KE294	-
29	30	0-20 cm: 10YR4/2 sandy clay loam 20-35 cm: 10YR4/4 sandy clay loam	4/14/21	-	
30	25	0-13 cm: 10YR7/2 sandy loam 13-25 cm: 10YR6/2 sandy loam	4/14/21		
31	11	0-11 cm: 10YR7/2 loamy sand over bedrock	4/14/21		
32	5	0-5 cm: 10YR5/6 silt loam over bedrock	4/13/21	-	-

Shovel Test	Depth (cm)	Matrix Description	Date	Site No.	Cultural Materials
33	0	Strongly sloping hill – soils eroded to bedrock			
34	0	Strongly sloping hill – soils eroded to bedrock			
34N15	2	0-2 cm: 10YR5/4 silt loam over gravel and bedrock surface (slope wash)	4/20/21	-	-
34N30	10	0-10 cm: 10YR3/6 silty clay loam over bedrock/caliche	4/20/21	41KE294	-
34N30W15	5	0-5 cm: 10YR5/4 clay loam with 2-5 mm CaCO3 nodules; rocks on surface	4/20/21	-	-
35	20	0-20 cm: 10YR3/3 silt loam over bedrock	4/13/21	41KE294	1 flake 10-15 cm
35N15	20	0-20 cm: 10YR2/2 silt loam over bedrock	4/14/21	41KE294	-
35E15	10	0-10 cm: 10YR2/1 silt loam over bedrock	4/14/21	41KE294	-
35N30	30	0-15 cm: 10YR2/1 clay loam 15-30 cm: 10YR3/2 clay loam	4/14/21	41KE294	-
35N30E15	10	0-10 cm: 10YR32 silt loam over bedrock/ located in disturbed and cleared setting	4/20/21	41KE294	-
35W15	8	0-8 cm: 10YR3/3 silt loam over bedrock	4/14/21	41KE294	-
35W30	5	0-5 cm: 10YR2/2 silt loam over bedrock	4/14/21	41KE294	-
35S15	9	0-9 cm: 10YR3/2 silt loam over bedrock	4/14/21	41KE294	5 flakes 0-9 cm
36	35	0-22 cm: 10YR4/2 sandy clay loam 22-35 cm: 10YR3/4 sandy clay loam	4/14/21	-	-
37	15	0-15 cm: 10YR5/8 silt loam over gravel and bedrock on high terrace; abundant CaCO3	4/13/21	-	-
38	5	0-5 cm: 10YR5/8 thin silt loam over caliche and bedrock surface	4/13/21	-	-
39	42	0-32 cm: 10YR3/2 silt loam 32-42 cm: 10YR4/2 silt loam	4/13/21	-	-
40	27	0-14 cm: 10YR3/2 silt loam 14-27 cm: 10YR4/2 silt loam	4/13/21	-	-
41	5	0-5 cm: 10YR5/8 calcareous gravelly terrace	4/13/2	-	-
42	35	0-16 cm: 10YR4/2 silt loam 16-35 cm: 10YR4/2 silt loam	4/13/21	-	-
43	25	0-25 cm: 10YR2/1 clay loam	4/13/21	-	-

Shovel Test	Depth (cm)	Matrix Description	Date	Site No.	Cultural Materials
44	35	0-30 cm: 10YR3/2 very calcareous clay loam 30-35 cm: 10YR4/2 calcareous clay loam compact subsoil	4/13/21	-	-
45	5	0-5 cm: 7.5YR caliche and gravels over bedrock on high terrace	4/13/21	-	-
46	30	0-17 cm: 10YR4/2 silt loam 17-30 cm: 7.5YR5/4 clay loam	4/13/21	-	-
47	40	0-40 cm: 10YR3/2 mottled clay with heavily oxidized gravels over dense clay subsoil	4/13/21	-	-
48	30	0-30 cm: 10YR3/2 (saturated) clay over gleyed clay; very sticky; bedrock at 30 cm	4/13/21	-	-
49	37	0-15 cm: 10YR3/2 silt loam 15-37 cm: 10YR4/2 loam	4/13/21	-	-
50	15	0-15 cm: 10YR3/2 silt loam over bedrock	4/13/21	-	-
51	35	0-20 cm: 10YR3/2 clay loam; calcareous 20-35 cm: Compact 7.5YR6/6 clay loam; very calcareous	4/13/21	-	-
52	30	0-30 cm: 10YR3/2 clay loam over compact 7.5YR6/6 Bk horizon	4/13/21	-	-
53	40	0-30 cm: 10YR3/2 clay loam; calcareous 30-40 cm: Compact 7.5YR6/6 clay loam; very calcareous	4/13/21	-	-
54	50	0-20 cm: 10YR3/2 silt loam 20-30 cm: 10YR4/2 silt loam	4/13/21	-	-
55	0	Strongly sloping hill – soils eroded to bedrock	4/13/21	-	-
56	13	0-13 cm: 10YR3/2 sandy loam over bedrock	4/13/21	-	-
57	0	Strongly sloping hill – soils eroded to bedrock	4/13/21	-	-
58	0	Strongly sloping hill – soils eroded to bedrock	4/13/21	-	-

APPENDIX B

ARTIFACT PHOTOS

41KE294 Prehistoric Artifacts


IMG_2790.JPEG


IMG_2791.JPEG

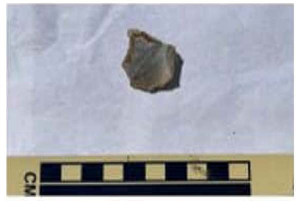

IMG_2794.JPEG


IMG_2795.JPEG


IMG_2798.JPEG


IMG_2799.JPEG


IMG_2802.JPEG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IMG_2814.JPEG


IMG_2815.JPEG


IMG_2816.JPEG


IMG_2818.JPEG


IMG_2819.JPEG


IMG_2823.JPEG


IMG_2824.JPEG


P4140563.JPG


P4140564.JPG


P4140587.JPG


P4140589.JPG


P4140590.JPG


P4140592.JPG


P4140595.JPG


P4140597.JPG


P4140599.JPG


P4140600.JPG


P4140602.JPG


P4140604.JPG


P4140606.JPG


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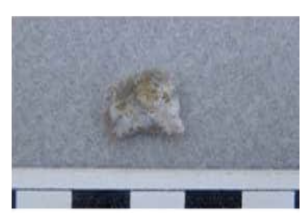
P4140610.JPG


P4140612.JPG


P4140614.JPG


P4140616.JPG


P4140617.JPG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41KE294 Prehistoric Artifacts


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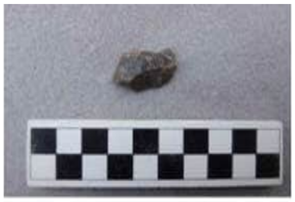
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P4140646.JPG


P4140648.JPG


P4140649.JPG


P4140652.JPG


P4140654.JPG


P4140656.JPG


P4140658.JPG


P4140660.JPG


P4140661.JPG


P4140671.JPG


P4140673.JPG


P4140675.JPG


P4140678.JPG


P4140681.JPG


P4140684.JPG


P4140685.JPG


IMG_2758 - Copy.JPEG


IMG_2762 - Copy.JPEG


IMG_2762.JPEG


IMG_2763.JPEG


IMG_2769 - Copy.JPEG


IMG_2774.JPEG


IMG_2775.JPEG


IMG_2777.JPEG


IMG_2778.JPEG


IMG_2779.JPEG


IMG_2780.JPEG

41KE294 Prehistoric Artifacts

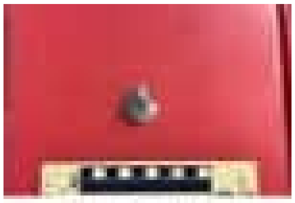

IMG_2781.JPEG


IMG_2782.JPEG


IMG_2783.JPEG


IMG_2784.JPEG


IMG_2785.JPEG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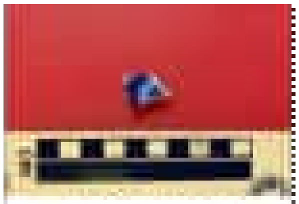
41KE294 Historic Artifacts


IMG_2813.JPEG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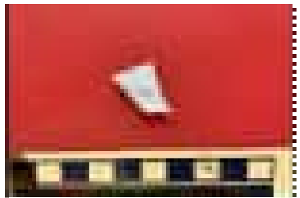
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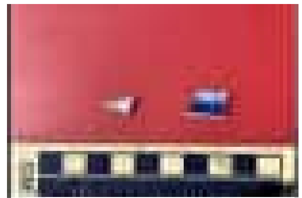
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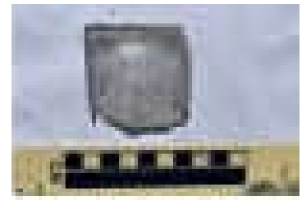
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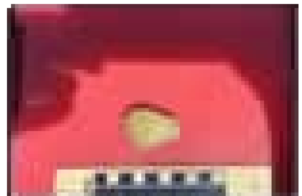
IMG_2796.JPEG


IMG_2797.JPEG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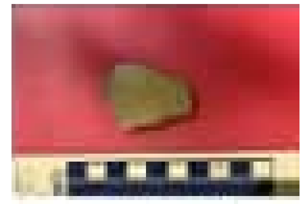
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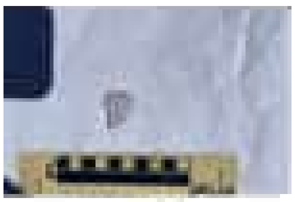
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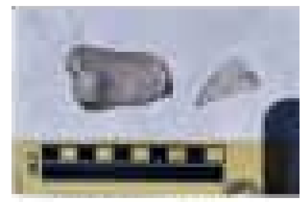
IMG_2804.JPEG


IMG_2805.JPEG


IMG_2809.JPEG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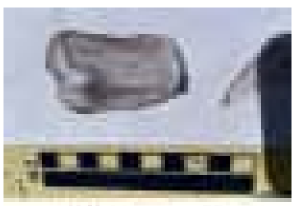
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