United States Department of Agriculture

Natural Resources Conservation Service

SUPPLEMENTAL WATERSHED PLAN NO. IV and Environmental Assessment for the Rehabilitation of Floodwater Retarding Structure No. 4 of the Comal River Watershed Comal County, Texas

Prepared By:
U.S. Department of Agriculture - Natural Resources Conservation Service
Texas State Soil and Water Conservation Board

In Cooperation With:
Comal-Guadalupe Soil and Water Conservation District
Comal County Commissioners Court
City of New Braunfels
Edwards Aquifer Authority

June 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. 4 is authorized under Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. Sections 1001 to 1008, 1010, and 1012).

Abstract

Historical floods in the past 57 years since FRS No. 4 was constructed have caused the auxiliary spillways to function on at least two occasions on FRS No. 4. This FRS was originally constructed as a low hazard potential dam. Residential development has occurred downstream of the dam and an increase in traffic has occurred downstream of FRS No. 4. These factors have caused concerns regarding the hydraulic capacity of the dam and human health and safety. As a result, FRS No. 4 has been reclassified as a high hazard potential dam. The dam does not comply with current high hazard potential dam safety and performance criteria and has been prioritized for Rehabilitation. The proposed rehabilitation of FRS No. 4 will allow the dam to comply with current performance and safety standards and maintain the present level of flood control benefits. The preferred rehabilitation of FRS No. 4 will include raising both auxiliary spillways 1.5 feet, widening the left auxiliary spillway channel to a 310-foot-wide earthen auxiliary spillway, constructing a 250-foot wide Roller Compacted Concrete (RCC)-step auxiliary spillway over the existing embankment which discharges into a concrete stilling basin, replacing the rock blanket on the 2.5:1 embankment slope, replacing the existing principal spillway inlet tower, and replacing the existing principal spillway conduit with a 54-inch-diameter pipe. Total project installation cost for FRS No. 4 is estimated to be $15,919,500, of which $11,245,500 will be paid from the Small Watershed Rehabilitation funds and $4,674,000 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 at the following:

Mark Northcut
NRCS Texas State Office
101 South Main Street
Temple, Texas 76501

Or email to mark.northcut@usda.gov.

Non-Discrimination Statement

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.

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COMAL RIVER WATERSHED
SUPPLEMENTAL WATERSHED PLAN AGREEMENT NO. IV

between the

Comal-Guadalupe Soil and Water Conservation District (SWCD)
Sponsoring Local Organization

Comal County Commissioners Court (County)
Sponsoring Local Organization

City of New Braunfels
Sponsoring Local Organization

Edwards Aquifer Authority
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 the Comal River Watershed, State of Texas, executed by the Sponsors named therein and the NRCS, became effective on the 28th day of May 1970; and

Whereas, the Supplemental Watershed Work Plan Agreement for the Comal River Watershed, State of Texas, executed by the Sponsors named therein and NRCS, became effective on the 10th day of October 1971; and

Whereas, the Supplemental Watershed Work Plan Agreement No. II for the Comal River Watershed, State of Texas, executed by the Sponsors named therein and NRCS, became effective on the 13th day of December 1978; and

Whereas, the Supplemental Watershed Work Plan Agreement No. III for the Comal River Watershed, State of Texas, executed by the Sponsors named therein and NRCS, became effective on an unknown month and day in 1993; 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 FRS No. 4 in the Comal River 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. IV and Environmental Assessment for works of improvement for the rehabilitation of FRS No. 4 of the Comal River 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 (104 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 (O&M) 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 Code of Federal Regulations [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	Percent	Cost[1/]	Percent	Cost[1/]	Cost[1/]
Rehabilitation of FRS No. 4	65%	$8,289,000	35%	$4,448,300	$12,737,000
Sponsor Project Admin		N/A	100%	$15,000	$15,000
Subtotal: Cost-Shareable Costs	65%	8,289,000	35%	$4,463,300	$12,752,300
Non-Cost-Shareable Items [2/]					
NRCS Technical Assistance/ Engineering and Admin	100%	$2,956,500		N/A	$2,956,500
Federal, State, and Local Permits		N/A	100%	$210,700	$210,700
Subtotal: Non-Cost-Share Costs	93%	$2,956,500	7%	$210,700	$3,167,200
Total:	71%	$11,245,500	29%	$4,674,000	$15,919,500

1/ All costs rounded to nearest $100.

2/ If actual non-cost-sharable item expenditures vary from these figures, the responsible party will bear the change.

3/ 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 sponsor is 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 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.

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    By signing this agreement, the recipient assures the USDA 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 are 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 (EPA), 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 EPA 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, EPA, 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 assure and certify that they are 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 Comal River Watershed Supplemental Watershed Work Plan No. IV-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.

Comal-Guadalupe Soil and Water Conservation District
Local Organization

By _____
Russell K. Bading, Chairman

Title _____

Date _____

The signing of this agreement was authorized by a resolution of the governing body of the Comal-Guadalupe Soil and Water Conservation District adopted at a meeting held on _____ _____.

_____
Guy W. Anderson Secretary, Comal-Guadalupe Soil and Water Conservation District

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Comal County Commissioners Court
Local Organization

By _____
Sherman Krause, Comal County Judge

Title _____

Date _____

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

_____
Bobbie Koepp, County Clerk, Comal County

City of New Braunfels
Local Organization

The City of New Braunfels will not be responsible for the obligation of funds for cost-share, operation, and maintenance within the Comal River Watershed.

The signing of this agreement was authorized by a resolution of the governing body of the City of New Braunfels and adopted at an official meeting held on

_____, 2023 at New Braunfels, Texas.

By _____
Robert Camareno, City Manager

Date _____

Edwards Aquifer Authority
Local Organization

By _____
Enrique Valdiva, Board Chair

Title _____

Date _____

The Edwards Aquifer Authority will not be responsible for the obligation of funds for cost-share, operation, and maintenance within the Comal River Watershed.

The signing of this agreement was authorized by a resolution of the governing body of the Edwards Aquifer Authority adopted at a meeting held on _____.

_____
Benjamin Youngblood III, Secretary

Natural Resources Conservation Service
United States Department of Agriculture

Approved By _____
Kristy Oates, State Conservationist

Date _____

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Acronyms, Abbreviations, and Short-Forms

AEP	Annual Exceedance Probability
APE	Area of Potential Affects
BIA	Bureau of Indian Affairs
BFE	Base Flood Elevation
BLE	Base Level Engineering
BMP	Best Management Practice
CFR	Code of Federal Regulations
CNMS	Coordinated Needs Management Strategy DEM Digital Elevation Model
EA	Environmental Assessment
EAP	Emergency Action Plan
EOR	Element of Occurrence Record
EPA	U.S. Environmental Protection Agency
FBH	Freeboard Hydrograph
FEMA	Federal Emergency Management Agency
FFE	Finished Floor Elevation
FIS	Flood Insurance Study
FRS	Flood Retarding Structure
FRT	Federally Recognized Tribe
FWFI	Future with Federal Investment
FWOFI	Future without Federal Investment
IPaC	Information for Planning and Consultation
LOD	Limit of Disturbance
LOMR	Letter of Map Revision
MBTA	Migratory Bird Treaty Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NOAA	National Atmospheric and Oceanographic Administration
NOMM	National Operation and Maintenance Manual
NOT	Notice of Termination
NPS	National Parks Services
NRCS	Natural Resources Conservation Service

NRHP	National Register of Historic Places
NWPM	National Watershed Program Manual
O&M	Operations and Maintenance
OMB	Office of Management and Budget
PAR	Population at Risk
Plan-EA	Plan Environmental Assessment
PMP	Probable Maximum Precipitation
PPA	Prototype Programmatic Agreement
PSH	Principal Spillway Hydrograph
RCC	Roller Compacted Concrete
RCP	Reinforced Concrete Pipe
SCS	Soil Conservation Service
SHPO	State Historic Preservation Officer
SSA	Sole Source Aquifer
SWCD	Soil and Water Conservation District
SWPPP	Storm Water Pollution Prevention Plan
TCEQ	Texas Commission on Environmental Quality
TDAT	Tribal Directory Assessment Tool
THC	Texas Historical Commission
THPO	Tribal Historic Preservation Office
TNRIS	Texas Natural Resource Information System
TPWD	Texas Parks and Wildlife Department
TSSWCB	Texas State Soil and Water Conservation Board
TXNDD	Texas Natural Diversity Database
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

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

SUPPLEMENTAL WATERSHED PLAN NO. IV – ENVIRONMENTAL ASSESSMENT for the Rehabilitation of Floodwater Retarding Structure No. 4 of the Comal River Watershed Comal 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 FRS No. 4 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 Comal-Guadalupe Soil and Water Conservation District (SWCD), the Comal County Commissioners Court, City of New Braunfels, and the Edwards Aquifer Authority.

S.3 Proposed Action

The proposed action is the rehabilitation of FRS No. 4 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

There is need for continued flood protection in the Comal River Watershed and to meet current safety standards. The original purpose of the Comal River Watershed Work Plan was watershed protection and flood prevention. The purpose for federal action is to meet current safety and performance standards and to continue the original purpose of flood prevention to a level commensurate with current needs and which maximizes public benefits with appropriate consideration of costs.

FRS No. 4 was designed as a low-hazard dam and has since been reclassified as a high-hazard dam due to downstream development. Therefore, the dam does not meet NRCS or Texas Commission on Environmental Quality (TCEQ) dam safety standards. The authorized purpose for this Plan-EA is for watershed structure rehabilitation of Comal River Watershed FRS No. 4 to meet current performance standards while continuing to provide downstream flood protection in a manner that takes into consideration economic, social, and environmental goals. Based on HEC-RAS breach modeling, there are 34 residential structures (32 homes and two mobile homes) identified within the breach extent of FRS No. 4. The Population at Risk (PAR) for FRS No. 4 is estimated to be 116 based on the number of impacted residential and commercial structures and the overtopping of 13 private and public roads.

S.5 Description of Preferred Alternative

The recommended plan will rehabilitate FRS No. 4 to meet current safety and performance standards for a high hazard potential dam, will provide 100 years of submerged sediment storage after construction, and to maintain a level of flood protection that minimizes changes to present conditions downstream.

Measures for the high hazard potential rehabilitation of FRS No. 4 include:

- Remove the existing principal spillway system consisting of:
  - A drop inlet riser with debris guard and crest at elevation 763.75 feet, and
  - 30-inch-diameter prestressed, concrete lined, steel cylinder pipe discharging into a plunge pool.

- Install a new principal spillway system consisting of:
  - A standard covered riser,
  - Crest at elevation 759.0 feet (4.25 feet lower than existing), and
  - 54-inch-diameter Reinforced Concrete Pipe (RCP) conduit discharging into the RCC-step stilling basin.

- Install a 250-foot-wide RCC-step structural spillway over the existing embankment with crest set above the 2% AEP PSH elevation at 798.2 feet and discharging into a concrete stilling basin,
- Regrade the inlet and outlet channels of the existing left vegetated auxiliary spillway, widen crest from 190 feet to 310 feet, and raise crest to the 1% Annual Exceedance Probability (AEP) Principal Spillway Hydrograph (PSH) elevation of 800.7 feet (1.5 feet raise),
- Regrade the inlet and outlet channel of the existing right vegetated auxiliary spillway, keep crest at 190 feet wide, and raise crest to the 1% AEP PSH elevation of 800.7 feet (1.5 feet raise),
- Retain top of dam elevation at 806.55 feet, and
- Replace rock blanket on 2.5:1 embankment slope.

S.6 Resource Information

FRS No. 4 is located in southcentral Comal County, Texas on Bear Creek, a tributary of Dry Comal Creek, a tributary of the Comal River, and a tributary to the Guadalupe River, located approximately 9 miles west and 3 miles south of New Braunfels, Texas.

FRS No. 4 was designed and constructed in 1965 to be a multi-purpose, low hazard potential dam. The embankment is single zone, compacted earthfill dam. A cutoff trench with 1:1 side slopes that varies in bottom width from 12 feet to 80 feet was constructed at the centerline of the dam. The dam is approximately 72 feet tall and 2,000 feet long. The upstream and downstream slopes of the embankment have a slope of approximately 2.5:1 (horizontal:vertical) and both have rock blankets that have a minimum horizontal thickness of 10 feet. The top width of the structure is approximately 14 feet. The land upstream of FRS No. 4 is predominantly private ownership.

Climate:

- Temperature: The average coolest month is January with temperatures ranging from 38 degrees Fahrenheit (ºF) to 51 ºF. The average warmest month is August with temperatures ranging from 72°F to 95°F.
- Precipitation: Total annual precipitation is approximately 33.3 inches. The wettest month of the year is June, averaging 4.8 inches. The driest months of the year are January and April, both averaging 2.0 inches.
- Topography: FRS No. 4 is located within the Bat Cave Quadrangle from the U.S. Geological Survey (USGS) 7.5-minute topographic map series. The elevations in the Quadrangle range from approximately 1,238 to 800 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. 4 and the land use upstream from FRS No. 4.

Table S-1-1. Resource Information

Resource	Description	
Latitude / Longitude	29.6512º / -98.2774º	
Hydrologic Unit Code	12100202	
Hydrologic Unit Code Name	Middle Guadalupe River Watershed	
Watershed Size (square miles)	12.56	
Land Use (acres)	Barren Land	4.6
	Deciduous Forest	1,008.0
	Developed, Open Space	487.6
	Developed, Low Intensity	189.6
	Developed, Medium Intensity	33.5
	Developed, High Intensity	2.8
	Evergreen Forest	3,788.3
	Mixed Forest	24.3
	Shrub/Scrub	2,171.6
	Herbaceous	328.0
	Open Water	1.6
	Woody Wetlands	0.2
	Emergent Herbaceous Wetlands	--
	Hay/Pasture	--
	Cultivated Crops	--
	Total	**8,040.1**

S.7 Population and Demographics

Table S-2 provides population and demographics characteristics for the affected census tracts, Comal County, and Texas.

Table S-1-2. Population and Demographics Characteristics

	Census Tracts						County	State
Characteristic	**3101**	**3103.01**	**3103.02**	**3104.01**	**3108.01**	**3108.03**	**Comal**	**Texas**
Population	3,514	3,529	5,218	5,241	6,774	5,242	148,921	28,635,442
Median Age	39.2	37.6	45.9	37.9	49.7	42.1	42.1	34.8
Median Household Income	$65,095	$91,250	$46,402	$42,317	$128,194	$89,033	$80,781	$63,826
Poverty Rate (all people)	13.2%	9.1%	9.6%	11.8%	2.2%	7.6%	7.7%	14.2%
Unemployment Rate	4.7%	0.0%	3.4%	0.5%	2.2%	2.2%	4.0%	5.3%

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

S.8 Scoping Concerns

Relevant resource concerns identified through scoping process include:

- Prime and Unique Farmlands
- Erosion and Sediment
- Floodplain Management
- Sole Source Aquifers (SSAs)
- Streams, Lakes, and Wetlands
- Water Quality
- Woodland Vegetation/Forest Resources
- Invasive Species - Plants
- Threatened and Endangered Species – Plants and Animals
- Fish and Wildlife
- Migratory Birds/Bald and Golden Eagles
- Environmental Justice
- Land Use
- Local and Regional Economy
- Public Health and Safety
- Social Issues/Community Cohesion

S.9 Alternative Plans Considered

Alternatives that were analyzed in detail for FRS No. 4 include the No Federal Action, Decommission with Federal Assistance, and a High Hazard Potential Rehabilitation Alternative.

Alternative 1 – No Action/Future without Federal Investment: Since the Sponsors do not currently have the resources allocated to bring FRS No. 4 into compliance with current dam safety regulations for a high hazard potential dam, it is anticipated that the local Sponsors' course of action would be to continue to maintain the dam in its current configuration until they have resources available and specifically allocated to perform a local decommissioning of the dam to remove the risk of failure and comply with Federal and State requirements. 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. The current level of flood protection would remain, though the overtopping risk associated with the dam not passing the State and Federal requirements would also remain. As it is unknown when the Sponsors would have the resources available to locally decommission the dam or when and if TCEQ would require that the dam be modified or removed, the potential for dam failure prior to that time was also considered as part of the analysis. In the event that dam failure does occur, it is assumed that a local decommission would occur following the breach to stabilize the site.

The future local decommissioning removes the ability of the dam to impound water and reconnects and stabilizes the stream and floodplain functions. Channel work would be performed to reconnect the stream channel through the sediment pool. A grade stabilization structure would be installed to prevent head cutting and sediment movement to the downstream areas. Exposed areas within the sediment pool would be vegetated for erosion and sediment control. Partial removal of the embankment would consist of excavating a breach in the dam (66.1 feet bottom width) to safely pass the 1% AEP, 24-hour flood event and some of the principal spillway components would also be removed. The downstream flooding conditions would be similar to those that existed prior to the construction of the dam. The number of residential and nonresidential structures inundated above the finished floor elevation (FFE) during the modeled 1% AEP, 24-hour storm event would increase to six structures. Floodwaters from a 1% AEP storm event would cause induced flooding on 15 road segments downstream. No mitigation for induced flooding is included with this alternative.

Alternative 2 – Decommission (FWFI): This alternative removes the ability of the dam to impound water and reconnects, restores, and stabilizes the stream and floodplain functions. Channel work would be performed to reconnect the stream channel through the sediment pool and riparian vegetation would be established along the stream channel. A grade stabilization structure would be installed to prevent head cutting and sediment movement to the downstream areas. Exposed areas within the sediment pool would be vegetated for erosion and sediment control. Partial removal of the embankment would consist of excavating a breach in the dam (66.1 feet bottom width) to safely pass the 1% AEP, 24-hour flood event

and some of the principal spillway components would also be removed. The remaining portion of the embankment and land currently covered by the sediment pool would be maintained as a greenbelt area.

Downstream flooding conditions would be similar to those that existed prior to construction of the dam. The number of residential and nonresidential structures inundated above the FFE during the modeled 1% AEP, 24-hour storm event would increase to six structures. To mitigate for induced flooding, three structures would be dry floodproofed. Floodwaters from a 1% AEP, 24-hour flood would cause induced flooding on 15 road segments. To mitigate these impacts, six road segments would have flood warning systems installed that include barricades with flood warning lights that are activated when there is water over the road. Further downstream through the City of New Braunfels, an additional estimated 26 structures and 273 structures would be inundated above the FFE during the 1% AEP and 0.2% AEP, 24-hour storm events, respectively.

Alternative 3 - High Hazard Potential Rehabilitation: The measures for the high hazard potential rehabilitation of FRS No. 4 include raising both auxiliary spillways 1.5 feet, widening the left auxiliary spillway channel to a 310-foot-wide earthen auxiliary spillway, constructing a 250-foot wide RCC-step auxiliary spillway over the existing embankment and discharging into a concrete stilling basin, replacing the rock blanket on the 2.5:1 embankment slope, replacing the existing principal spillway inlet tower, replacing the existing principal spillway conduit with 54-inch-diameter pipe discharging into the RCC-step stilling basin, retaining the existing top of the dam elevation, and replacing the rock blanket on the 2.5:1 embankment slope.

Table S-1-3. Project Costs (Dollars)

Project Costs	PL-83-566 Funds[1]		Other Funds[1]		Total Dollars
	Dollars	%	Dollars	%	
FRS No. 4					
Construction	$8,289,000	65%	$4,448,000	35%	$12,737,000
NRCS Technical Assistance/ Engineering and Admin	$2,956,500	100%	$0	0%	$2,956,500
Local Project Administration	$0	0%	$15,000	100%	$15,000
Federal, State, and Local Permits	$0	0%	$210,000	100%	$210,700
TOTAL COSTS	$11,245,500	71%	$4,674,000	29%	$15,919,500

[1] Price Base: 2022 dollars

S.10 Project Benefits

Rehabilitation reduces the potential for loss of life and maintains protection of existing infrastructure downstream of the dam. Net average annual equivalent benefits between the No Federal Action and the recommended plan is -$414,000.

Number of Direct Beneficiaries/Population at Risk FRS No. 4: On-Site -116 (PAR), Offsite – N/A

Other Beneficial Effects:

- Comply 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 Sponsor's liability associated with continuing to operate a noncompliant dam;
- Preserves incidental Edwards Aquifer recharge benefits;
- Continues to provide flood protection for downstream agricultural lands, houses, and infrastructure;

- Protects real estate values by continuing to provide downstream flood protection; and
- Extends the service life of FRS No. 4 for 100 years.

Benefit-to-Cost Ratio (discount rate of 2.5%): 0.08 for FRS No. 4

National Economic Benefits: -$414,000 for FRS No. 4

S.11 Funding Schedule

- Federal Funds - Year 0 (budget year): $853,500
- Federal Funds - Year 1: $853,500
- Federal Funds - Year 2: $4,769,250
- Federal Funds - Year 3: $4,769,250
- Federal Funds - Year 4: $0
- Non-Federal Funds - Year 0 (budget year): $0
- Non-Federal Funds - Year 1: $0
- Non-Federal Funds - Year 2: $2,337,000
- Non-Federal Funds - Year 3: $2,337,000
- Non-Federal Funds - Year 4: $5,000
- 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. 4 was analyzed for an evaluation period of 100 years following the 4-year design and construction period. Therefore, the period of analysis was 104 years.

S.13 Project Life

FRS No. 4: 100 years

S.14 Environmental Impacts

Temporary and minor adverse impacts associated with the construction phase of the preferred alternative for FRS No. 4 are provided in **Table S-4**.

Table S-1-4. Summary of Environmental Effects for the Preferred Alternative

ITEM/CONCERN	FRS NO. 4 - SUMMARY OF EFFECTS OF HIGH HAZARD POTENTIAL REHABILITATION ALTERNATIVE
Provisioning Services - Tangible goods provided for direct human use (e.g., timber, food, fiber, water)	
Prime and Unique Farmland	No impacts to prime and unique farmlands are anticipated within the FRS No. 4 Limit of Disturbance (LOD). Would continue to provide similar level of flood protection for prime and unique farmlands. The estimated annual agricultural damages of actively farmed crops that would be avoided total $1,000.
Streams, Lakes, and Wetlands	No potentially jurisdictional waters of the U.S. associated with FRS No. 4 were observed during field investigations; therefore, no impacts to streams, lakes, or wetlands are anticipated. Results in a maintained aquatic function due to continued impoundment.
Regulating Services - Maintains the world we live in and is regulated (e.g., flood control, erosion, water quality, crop pollination)	
Erosion and Sediment	The increase in conduit flow will cause an initial period of streambank erosion during routine storm events until the streambanks stabilize. Would continue to allow the dam to collect and retain sediment, would provide an additional 100-years of sediment capacity, and would reduce the downstream erosion potential by safely passing controlled storm flows through the new conduit.

ITEM/CONCERN	FRS NO. 4 - SUMMARY OF EFFECTS OF HIGH HAZARD POTENTIAL REHABILITATION ALTERNATIVE
Floodplain Management	Would continue to provide flood protection benefits and would have minimal impacts on the downstream floodplain. Flood warning systems on two roadway segments are recommended to mitigate induced flooding impacts. The upstream floodplain elevation would decrease 1.6 ft due to the lower water surface in the reservoir.
Sole Source Aquifer	Would continue to provide similar recharge benefits to the Edwards Aquifer.
Water Quality	Minor, temporary impacts to water quality during construction. Sedimentation would be managed through a Storm Water Pollution Prevention Plan (SWPPP). No significant impact on the bacterial impairment.
Invasive Species - Plants	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.
Woodland Vegetation/Forest Resources	Would result in the removal of approximately 5.0 acres of vegetation including trees.
Threatened and Endangered Species - Plants	Based on USFWS species list for the project, there are no federally listed plant species with the potential to occur within the project.
Threatened and Endangered Species – Animals	Suitable habitat is present for the federally endangered golden-cheeked warbler. However, based on presence/absence surveys completed during the 2023 breeding season, the species was determined to be absent for 2023. Based on the presence of suitable habitat but absence of individuals, the effect determination for the golden-cheeked warbler would be may effect, not likely to adversely affect. The project is anticipated to participate in the Comal County Habitat Conservation Plan as directed by the USFWS. In addition, based on communication with the USFWS in April 2023, there are not enough project details (design) to complete a Biological Assessment/Biological Opinion at this time; therefore, consultation/coordination cannot be completed until the project is further into design. Suitable habitat is not present for any additional federally listed animal species. Suitable habitat is present for the federally proposed endangered tricolored bat. However, no action is required at this time as this species is not currently afforded statutory protection under the Endangered Species Act.
Fish and Wildlife	Would maintain the existing terrestrial wildlife and their habitat in the long term. Downstream aquatic and terrestrial wildlife and habitat would continue to be maintained and protected by controlling the stream flow. Minor, temporary impacts to terrestrial habitat may occur during construction. Less-mobile species may be lost due to equipment during construction.
Migratory Birds/Bald Eagle	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.
Cultural Services – Makes the world a place people want to live (e.g., recreation, spiritual, aesthetics)	
Environmental Justice	Would allow flood protection benefits to continue and would avoid potential negative impacts to minority and low-income populations.
Land Use	Minimal changes to land use and vegetation cover due to the widening of the left existing auxiliary spillway and installation of the overtopping spillway.
Local and Regional Economy	Would result in a temporary positive impact on the local economy during construction and would continue to provide flood protection for downstream developed areas, infrastructure, and agricultural areas.
Public Health and Safety	Would maintain the current flood protection benefits. Upstream of the dam, the 1% AEP flood pool will be 1.3 feet lower than the existing condition. The downstream water surface elevation during the 1% AEP 24-hour storm event will be similar to the current condition (maximum increase 0.29 feet). The threat to loss of life from failure of the dam would be greatly reduced.

ITEM/CONCERN	FRS NO. 4 - SUMMARY OF EFFECTS OF HIGH HAZARD POTENTIAL REHABILITATION ALTERNATIVE
Cultural Resources/ Historic Properties	NRCS determined that no historic properties are present or affected. Texas SHPO concurred on June 26, 2021. Cultural resources are not anticipated to be impacted by this alternative. NRCS consultation with relevant tribes was initiated on July 6, 2022 and was completed on March 7, 2023.
Community Cohesion	No impacts to community cohesion anticipated.

S.15 Major Conclusions

The High Hazard Potential Rehabilitation Alternative will bring FRS No. 4 into compliance with both NRCS safety and performance standards for a high hazard potential dam. This alternative has a benefit-to-cost ratio of 0.08. This alternative is the Preferred Alternative and will be implemented with federal assistance.

S.16 Areas of Controversy and Issues to be Resolved

Controversial Issues: None identified to date.

Issues to be Resolved: The anticipated issues to be resolved for the rehabilitation of FRS No. 4 include:

- A new O&M Agreement will be developed with Comal-Guadalupe SWCD, the Comal County Commissioners Court, City of New Braunfels, and the Edwards Aquifer Authority for the 100-year project life of FRS No. 4. 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 SWPPP in place at least 48 hours prior to and during construction of the proposed project and filing Notice of Intent with the TCEQ 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.
- Coordination with the U.S. Army Corps of Engineers (USACE) will be required during the design phase of this project.
- Continued coordination with the U.S. Fish and Wildlife Service (USFWS) and Texas Parks and Wildlife Department (TPWD) will be required throughout the design phase of this project.

This Plan recommends to maintain the backwater easement of 606.55 feet for FRS No. 4.

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. IV and Environmental Assessment formulated, evaluated, and resolved alternatives for the rehabilitation of Comal River Watershed FRS No. 4, located within the Bear Creek Watershed, a subwatershed of the Comal River, in Comal County, Texas (see Project Map in **Appendix B**).

FRS No. 4 was designed and constructed as a low hazard potential class structure with a primary purpose of flood prevention. Groundwater recharge does not appear to have been a primary or secondary purpose considered in the design of the structure and groundwater recharge benefits are considered incidental. The classification of FRS No. 4 was changed to a high hazard potential class structure due to the presence of downstream development and roads that would be impacted in the event of a dam failure. FRS No. 4 does not meet current NRCS and State of Texas Dam Safety Program dam design and safety criteria and performance standards for high hazard potential class dams.

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 Comal River Watershed and complied with the requirements of the 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 (NWPM) (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

Construction of two Comal River Watershed dams was completed in 1957 and 1965 for FRS No. 5 and FRS No. 4, respectively, under agreement between the Comal County Commissioners Court and the SCS. FRS No. 4 is also known as Herman Blank Site and Eikel Blank Dam. Following the Agreement, the Comal River Watershed Work Plan was prepared, and additional works of improvement were installed under the authority of the Watershed Protection and Flood Prevention Act Public Law 566, 83rd Congress, 68 Stat. 666), as amended and supplemented. The original watershed work plan was developed in 1968 and incorporated the two original Comal River Watershed FRS. Construction of additional Comal River Watershed FRS were completed in Comal County between 1974 and 1981. The evaluated life of the project was 100 years.

United States Department of Agriculture (USDA)-Natural Resources Conservation Service (NRCS) completed an assessment of FRS No. 4 in July 2014 which concluded that the dam did not meet current USDA-NRCS engineering standards for a high hazard potential dam. The Dam Assessment indicates that the dam does not meet the 10-day drawdown requirement, that the auxiliary spillways would be engaged during the 1% AEP storm, and that the dam would be overtopped in the Probable Maximum Precipitation (PMP) event.

1.3 Purpose and Need for Action

There is need for continued flood protection in the Comal River Watershed and to meet current safety standards. The original purpose of the Comal River Watershed Work Plan was watershed protection and flood prevention. The purpose for federal action is to meet current safety and performance standards and to continue the original purpose of flood prevention to a level commensurate with current needs and which maximizes public benefits with appropriate consideration of costs.

FRS No. 4 was designed as a low-hazard dam and has since been reclassified as a high-hazard dam due to downstream development. Therefore, the dam does not meet NRCS or TCEQ dam safety standards. The authorized purpose for this Plan-EA is for watershed structure rehabilitation of Comal River Watershed FRS No. 4 to meet current performance standards while continuing to provide downstream flood protection in a manner that takes into consideration economic, social, and environmental goals. Based on HEC-RAS breach modeling, there are 34 residential structures (32 homes and 2 mobile homes) identified within the breach extent of FRS No. 4. The PAR for FRS No. 4 is estimated to be 116 based on the number of impacted residential and commercial structures and the overtopping of 13 private and public roads.

1.4 Opportunities

The following is a general list of opportunities that will be recognized by implementation of an alternative for FRS No. 4 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 NRCS and TCEQ dam safety and performance standards.
- Reduce the potential for loss of life by reducing the possibility of a dam failure.
- Reduce Sponsor liability associated with operation of a noncompliant, outdated dam.
- Preserve incidental Edwards Aquifer recharge benefits.
- Continue to provide flood protection for downstream agricultural lands, houses, and infrastructure.
- Protect downstream real estate values by continuing to provide flood protection.

2.0 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

On August 5, 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 Comal-Guadalupe SWCD Board, Comal County, the City of New Braunfels, 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 Sponsor, (2) the relevant issues associated with FRS No. 4, 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?		RATIONALE
	YES	NO	
SOILS			
Prime and Unique Farmland	X		There are areas of Prime farmland downstream of FRS No. 4 that are potentially at risk of flooding from Dry Comal Creek should FRS No. 4 be removed. Agricultural flood damages to these areas must be considered.
Erosion and Sediment	X		The impact of sediment accumulation in FRS No. 4 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 dam.
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 it is expected that this will continue in the future.
Coastal Zone Management Plans		X	The project is not located in an area subject to Coastal Zone Management Act requirements, so this is not considered to be relevant to the proposed action.
Potable Water Supply/Regional Water Management Plans/Water Resources		X	FRS No. 4 is not used for water supply, so this is not considered relevant to the proposed action. While the dam may provide incidental groundwater recharge benefits, flood prevention is the only stated purpose in original design.

ITEM/CONCERN	Relevant to the Proposed Action? YES	NO	RATIONALE
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. 4 is located within the Edwards Aquifer SSA Recharge Zone. Potential impacts to the SSA must be considered.
Streams, Lakes, and Wetlands/ Waters of the U.S.	X		Bear Creek, an ephemeral tributary to Dry Comal Creek, flows through FRS No. 4. No open water or other wetlands have been identified in the project area. Potential impacts to Bear Creek and Dry Comal Creek must be considered.
Water Quality	X		Dry Comal Creek (located 0.34 miles downstream of FRS No. 4) is currently listed as being impaired for bacteria. In addition, construction activities and the resulting modifications could have impacts to downstream water quality.
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 segments of the Guadalupe River (from headwaters of Canyon Lake upstream to headwaters near Kerrville) are outside of the area of effects of the proposed action. This item is not considered to be relevant to the proposed action.
AIR			
Air Quality / Clean Air Act		X	The project is located in an attainment/ unclassifiable county (Comal) for National Ambient Air Quality Standards, so this 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		Based on USFWS species list for the project, there are no federally listed plant species with the potential to occur within the project.
Woodland Vegetation/Forest Resources	X		Woodland vegetation is present in the project area. Potential impacts 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. Efforts should be made to ensure invasive species are not introduced to or from the project area. Potential impacts 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	No riparian areas were identified within the project area, so this item is not considered to be relevant to the proposed action.

ITEM/CONCERN	Relevant to the Proposed Action? YES	NO	RATIONALE
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 habitat for the federal endangered golden-cheeked warbler was identified within the project area. Formal consultation with USFWS will be required and potential impacts to this species must be considered. Suitable habitat is not present for any additional federally listed animal species. Suitable habitat is present for the federally proposed endangered tricolored bat. However, no action is required at this time as this species is not currently afforded statutory protection under the Endangered Species Act.
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		It is unlikely that FRS No. 4 provides habitat for fish as the dam does not impound water consistently throughout the year, but it does provide habitat for other wildlife. Potential impacts to wildlife must be considered.
Invasive Species		X	It is not anticipated that modifications to FRS No. 4 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 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 must be considered.

ITEM/CONCERN	Relevant to the Proposed Action? YES	NO	RATIONALE
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. 4.
Cultural Resources/Historic Properties		X	Three previously unrecorded prehistoric archeological sites and two historic-age resources were documented within the FRS No. 4 Area of Potential Effects (APE). NRCS determined that no historic properties are present or affected. Coordination was completed with the Texas State Historic Preservation Officer (SHPO) and concurrence was received on June 26, 2021. NRCS consultation with relevant tribes was completed on March 7, 2023.
Drought		X	FRS No. 4 does not impound water consistently throughout the year nor is the dam a water supply source, 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. 4 and must be considered.
Land Use	X		Potential impacts to downstream land use resulting from modifications to FRS No. 4 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. 4.
Park Lands, Scenic Areas		X	FRS No. 4 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. 4 is classified a high hazard potential dam and in its existing condition is a risk to the public.
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. 4 is not located within an area that has been identified as an area of scenic beauty and is not visible from private residences or public access locations. The project would not degrade scenic beauty of the general landscape or viewsheds, and may protect and/or contribute to it. 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 community cohesion could result from modifications to FRS No. 4 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 Comal River Watershed can be found in the Watershed Work Plan. Existing conditions that are specific to FRS No. 4 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. 4:

- 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 watershed hydrologic models for FRS No. 4 and the aggregate watershed of Dry Comal Creek for 8 statistical storms: 50% AEP through 0.2% AEP flood;
- Development of HECRAS 1-D model for Bear Creek, from the FRS No. 4 outlet to the confluence with Dry Comal Creek, and for Dry Comal Creek from the confluence with Bear Creek to a location approximately 4,330 feet downstream of Krueger Canyon Road;
- Use of a HECRAS 1-D Base Level Engineering (BLE) Model for Dry Comal Creek below Krueger Canyon Road through the City of New Braunfels;
- Development of a HECRAS 2-D model for Bear Creek, from the FRS No. 4 outlet to the confluence with Dry Comal Creek, and for Dry Comal Creek from the confluence with Bear Creek to a location approximately 4,110 feet downstream of Krueger Canyon Road;
- Development a Water Resources Site Analysis Program (SITES) and WinDAM models for FRS No. 4, to include development of NRCS design floods per TR-210-60 (USDA NRCS, 2019);
- Development of a HEC-FDA model to assess the flood damages and benefits of the alternatives; 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. 4 is located in southcentral Comal County, Texas approximately 9 miles west and 3 miles south of New Braunfels, Texas. The FRS is located on Bear Creek, a tributary of Dry Comal Creek, a tributary of the Comal River, and a tributary to the Guadalupe River. The project location is depicted in **Appendix B**, on **Figure B-1**.

3.2.2 Topography

FRS No. 4 is located within the Bat Cave Quadrangle from the USGS 7.5-minute topographic map series. The elevations in the Quadrangle range from approximately 1,238 to 800 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 Comal and Hays Counties, Texas* (Batte, 1984), the Edwards Plateau (which encompasses FRS No. 4) is characterized by undulating to hilly topography, and is underlain by geology consisting of limestone and limestone with interbedded clay and marl. In contrast, the Blackland Prairies (located immediately south and east of FRS No. 4) are characterized by gently undulating to gently rolling topography, and the underlying subsurface geology consists of relatively erodible chalk and clay shale. The predominant soil associations within the vicinity of the dam site are summarized below.

Orif Unit
Orif soils, 0 to 3 percent slopes (Or): Deep, well drained, nearly level to gently sloping loamy soils. Soils formed in recently deposited gravelly alluvium and water erosion is a significant hazard. This association is primarily encountered on flood plains of large creeks and rivers. Typical depth to bedrock in this soil association is reported to exceed 6 feet.

Comfort Unit
Comfort-Rock outcrop complex (CrD): Shallow, clayey soils, and rock outcrops on side slopes and hill tops. Typically, the stratigraphy consists of dark brown to dark reddish brown, stony clay that is mildly alkaline and non-calcareous. Soils are well drained with low permeability. Rock outcrop is typically dolomitic limestone. This association is present on uplands in the Edwards Plateau physiographic region. Typical depth to bedrock in this soil association is reported as about 1 foot below ground surface.

Eckrant Unit
Eckrant-Rock outcrop complex (ErG): Shallow, clayey soils that are moderately alkaline and non-calcareous as well as rock outcrops. The surficial layer is generally very dark gray, stony clay underlain by indurated fractured limestone. Soils are well drained with moderately slow permeability. Rock outcrops consist of barren exposures of indurated limestone. This association is present on uplands in the Edwards Plateau physiographic region. Typical depth to bedrock in this soil association is reported as about 1 foot below ground surface.

Rumple Unit
Rumple-Comfort Association (RUD): Shallow, moderately deep, well drained soils with moderately slow permeability. Near surface, soils are dark reddish brown, cherty clay loam; at deeper depths, stony clays with indurated limestone fragments are observed. Soils are non-calcareous and mildly alkaline throughout. This association is present on uplands in the Edwards Plateau physiographic region. Typical depth to bedrock in this soil association is reported as about 2 feet below ground surface.

3.2.4 Regional Geology

According to the Physiographic Map of Texas (Wermund, 1996), the northern and western portions of Comal County are located within the Edwards Plateau physiographic province of Texas, while the southern and eastern portions of the County are located within the Blackland Prairies. The Balcones Escarpment marks the contact between the two physiographic regions within Comal County. The FRS No. 4 dam site is located within the Edwards Plateau according to published mapping (Batte,1984), approximately 1 to 2 miles south and east of the boundary with the Blackland Prairies.

The Edwards Plateau is primarily represented by the Hill Country, an area sculpted by stream erosion of the fault escarpment. The Edwards Plateau is capped by hard, Cretaceous-age limestones with abundant solutioning features (i.e. sinkholes, caves) that form a network of caverns. A stairstep topography is characteristic of this physiographic region due to differential weathering of the alternating hard and soft marly limestone of the Glen Rose Formation. Local streams incise the plateau as much as 1,800 feet vertically over typical distances of about 15 miles. The upper drainages of these streams consist of waterless draws that open into box canyons where springs provide consistent groundwater flows (Wermund, 1996).

The Blackland Prairies physiographic region, which is a sub province of the Gulf Coast Plains, is characterized by its low rolling terrain with geologic beds tilted south and east. This region has a gentle undulating surface cleared of most natural vegetation, making it ideal for cultivated crops. The bedrock of the Blackland Prairies is described as mostly Upper Cretaceous marine chalks, marls, limestones, and shales. The bedrock weathers to form characteristic deep, black, fertile, calcareous clay soils (Wermund, 1996).

Geologic mapping in the vicinity of the dam, located in the southernmost portion of Comal County, indicates the area is primarily underlain by Cretaceous-age Edwards limestone (Ked), Georgetown limestone (Kgt) and, less predominantly, by Buda limestone (Kbu) and Del Rio Clay (Kdr). Pecan Gap Chalk, Austin Chalk, and gravels of the Leona Formation are also mapped in the vicinity.

Quaternary

Local Pleistocene age terrace deposits are generally comprised of calcareous silt to coarse gravel in various proportions, primarily along wide terraces of the Nueces and Leona Rivers. The thickness of these deposits is variable. The Leona formation is mapped primarily east of the project site.

Cretaceous

The Comal River Watershed is primarily underlain by Cretaceous deposits of Edwards limestone, with a thin cover of Georgetown limestone on top in localized areas. The Edwards limestone in this area is typically medium gray to grayish brown, fine to coarse grained, and contains abundant chert, fossils, and shell fragments. Solution zones and collapsed breccia are also common. Thicknesses range from 300 to 500 feet in the vicinity of the project site (Brown et al., 1983).

Buda limestone and Del Rio clay are also mapped in the vicinity of the project site. These units are primarily observed in the upland area at the left abutment beyond the left auxiliary spillway of FRS No. 4, but are also located 1 to 1.5 miles upstream of the dam. The Buda limestone is generally hard, massive, poorly bedded to nodular and it is commonly glauconitic. The Del Rio clay is blocky and calcareous, commonly containing gypsum and pyrite. The latter is known to weather near the surface into highly plastic fat clays with significant potential for vertical movement as a result of changes in soil moisture content.

Further west and southwest, the Austin Chalk is mapped about 2.5 to 3 miles upstream of the FRS No. 4 dam site. This formation is primarily composed of chalk and marl with nearly 85 percent calcium carbonate content. The Austin Chalk is generally observed as ledge forming, grayish white to white rock with medium gray bentonitic seams and pyrite nodules (Brown et al., 1983).

Pecan Gap Chalk is mapped to the south of the FRS No. 4 dam site, about 1.5 miles right of the embankment. While this formation is not commonly exposed near the surface, it is normally observed as very light yellow to yellowish brown chalk and chalky marl.

Occurrence of Groundwater

The *Aquifers of Texas* Report No. 380 (George et al., 2011) developed by the Texas Water Development Board describes the Edwards (Balcones Fault Zone) Aquifer as a major aquifer extending across much of the south-central portion of the state of Texas. Outcrops of this aquifer are observed in the southeastern region of Comal County, near the FRS of interest for this project. While the lateral and vertical composition of the aquifer are heterogeneous, it is predominantly composed by karstic limestone, primarily of the Edwards formation in the vicinity of the project site. The Edwards Formation is porous and karstic which creates highly permeable zones that allow for the movement of groundwater through faults, fractures, and conduits. In Comal County, the aquifer feeds Comal Springs, the largest spring in the State, which had an historical average discharge of approximately 287 cfs between the years of 1928 and 2002 (George et al., 2011). Recharge occurs primarily from losing streams in the outcrop area and, to a lesser extent, from rainfall. Because rainfall is highly variable, recharge amounts change from year to year. The location of the contributing watershed to FRS No. 4 in relation to the Edwards Aquifer zones (TCEQ, 2005) is provided on **Figure C-1**.

The Edwards (Balcones Fault Zone) Aquifer is designated as an SSA and has thickness ranging from 200 to 600 feet and freshwater saturated thickness averages about 560 feet (George et al., 2011). Groundwater present at shallow depths is mainly used for municipal supply, irrigation, and recreational purposes. Water quality is generally fresh despite the water being characterized as hard. Total dissolved solids concentration of less than 500 milligrams per liter is reported (George et al., 2011). The fresh to moderately saline water found at shallow depths occurs under both water-table and artesian conditions. The aquifer is primarily artesian with the pressurized zone being confined between the Del Rio clay (on top) and the Glen Rose limestone (bottom). At deeper depths, groundwater becomes more mineralized due to lower permeability of the formation and, consequently, higher residence times and greater dissolution of mineral solids contained within the bedrock matrix.

The *Aquifers of Texas* Report No. 380 (George et al., 2011) also highlights the presence of outcrops of a second aquifer, the Trinity aquifer, in the northern portion of Comal County, further away from the project site. 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 northern portion of Comal County 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.

While the Trinity aquifer recharges slowly, largely by direct infiltration of rainfall in the Glen Rose member, it contributes significantly to recharge of the Edwards aquifer. 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. 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.

3.2.5 Local Geology

The FRS No. 4 dam site is primarily underlain by Cretaceous age Edwards limestone. Buda limestone and Del Rio clay are also mapped at the left abutment above the elevation of the left auxiliary spillway. The Edwards limestone is typically medium gray to grayish brown, fine to coarse grained and contains abundant chert, fossils, and shell fragments. Solution zones and collapsed breccia are also common. Thicknesses range from 300 to 500 feet in the vicinity of the project site (Brown et al., 1983). The Buda

limestone is generally hard, massive, poorly bedded to nodular and it is commonly glauconitic. The Buda limestone in the vicinity of the project site is further described as light gray to pale orange with disseminated pyrite and burrows filled with chalky marl (Brown et al., 1983). This formation typically weathers dark gray to brown and has thicknesses ranging from 60 to 100 feet. The Del Rio clay, observed less predominantly than the aforementioned formations, is blocky and calcareous, commonly containing gypsum and pyrite. The Del Rio Clay is typically observed in the field as medium gray with thin lenses of highly calcareous siltstone and abundant marine megafossils (Brown et al., 1983).

Based on stick logs from historical boreholes drilled during the original site investigation, which are presented in the as-built plans (USDA SCS, 1964), the embankment is primarily underlain by limestone of the Edwards formation. A few of the pre-construction borings along the dam centerline located in the lower stream valley encountered up to 8 feet of soil overburden. The soil overburden appears to have been partially removed as part of dam construction based on the as-built profile of the embankment cutoff trench, but may still be present under the dam shell zones. The logs on the as-built drawings are relatively poor resolution and details were difficult to discern, but the soil overburden along the dam centerline (where present) appears to consist of gravelly clay and/or clayey gravel with cobbles and some boulders. The logs describe the underlying limestone along the embankment centerline alignment as thickly bedded, slightly fractured, cherty, and slightly vuggy. Vugs and voids, likely resulting from solutioning of the limestone bedrock, were identified and were often filled with clay. Loss of coring fluid circulation ("H_20 loss") was noted in boreholes No. 303 and 2003, and was specifically noted as "constant" loss in borehole 2003 which indicates one or more highly permeable bedrock zones likely associated with karst solutioning. Medium to severe coring fluid loss was also noted in borehole No. 5.

The as-builts (USDA SCS, 1964) appear to indicate the presence of two normal faults which intersect the embankment centerline alignment near Stations 9+00 and 12+30; the fault near Station 12+30 is nearly coincident with a portion of the original stream alignment. Both faults depicted are approximately parallel to each other, oriented in a northeast/southwest direction consistent with general fault trends in the area associated with the Balcones Escarpment. The down-thrown side of both faults is to the interior, appearing to form a graben between the two faults in the area of the existing principal spillway conduit. In general, the oblique orientation of these faults relative to the embankment centerline alignment is adverse from the perspective of seepage hazards; however, AECOM is not aware of any prior reports of seepage at the downstream toe of the dam. The as-builts (USDA SCS, 1964) indicate a toe drain was installed on the downstream toe of the dam.

Subsurface conditions along the existing principal spillway alignment (located at Sta. 10+25 along the centerline of the dam) were described on the original stick logs as a thin layer of soil overburden underlain by medium hard, thickly bedded limestone. The soil overburden appears to consist of clayey gravel and/or gravelly clay with slight cobbles. The limestone bedrock was described as slightly vuggy and fractured with a few clay filled voids along the bedding planes. The limestone was identified between El. 744 and 738 (NGVD29), approximately 0 to 7 feet below original grade. Loss of coring fluid circulation was recorded in boreholes No. 301, 303, and 2301, which is typically indicative of voids and/or highly fractured bedrock. Construction of the principal spillway conduit appears to have involved excavation of the soil overburden to bedrock based on the geologic profiles on the as-builts. The as-builts (USDA SCS, 1964) indicate a toe drain was installed on the downstream toe of the dam. Seven anti-seep collars (at 200 feet center-to-center spacing) were also installed along the principal spillway conduit.

The relatively poor resolution of the borings and test pit stick logs on the as-built drawings precluded detailed analysis of site-specific stratigraphy underlying the left and right auxiliary spillways, but it appears that shallow bedrock with a local surficial veneer of soil overburden were encountered in both spillways. The soil overburden appears to consist of a mixture of clayey gravel and/or gravelly clays with cobbles and some boulders. The underlying limestone was described as hard, thickly bedded, slightly

cherty, slightly fractured, and slightly to moderately vuggy. The geologic plan sheet in the as-builts indicates limestone bedrock was observed to be at-grade upstream of the control section in much of the footprints for the left and right auxiliary spillway channels. A void was noted in boring No. 207 (right spillway) as evidence by a severe loss of coring fluid accompanied by a drop of the drilling bit.

Five borrow areas within the present-day reservoir and auxiliary spillways were investigated as potential sources of borrow material during original construction of the dam. According to the stick logs presented on the as-built drawings (USDA SCS, 1964), Borrow Area No. 1 was composed by slightly calcareous weathered limestone cobbles underlain by limestone with gypsum lenses. Borrow Area No. 2 was depicted in the stick logs as containing slightly calcareous gravel and cobbles underlain by shale with gypsum inclusions and limestone. Borrow Area No. 3 was described as containing slightly calcareous gravel and shale with gypsum lenses. Borrow Area No. 4 was underlain by a thin layer of calcareous gravel followed by shaley, soft to hard limestone with gypsum lenses. Borrow Area No. 5 consisted of clayey to silty and sandy gravel followed by cobbles and boulders which were underlain by hard, slightly fractured to fractured limestone. The as-built drawings (USDA SCS, 1964) further detailed that materials from supplemental Borrow Area No. 3 were to be used only when other sources were exhausted.

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 storm 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. Additionally, neither the original Geologic Investigation Report nor the original Soil Mechanics Report were available for review. Therefore, limited existing geologic information from the as-built drawings, 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 (K_h) 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 summarized in **Table 3-1**. Detailed discussion of the analysis assumptions, methodology, and results is provided in **Appendix E**, Geotechnical Recommendation for SITES Parameters. 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 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
Left Auxiliary Spillway								
Imported Fill	TBD	CL, CH	Unfavorable	90	35	40	0.005	0.06
			Favorable	100	20	20	0.015	0.09
Residuum	1.0	GC	Unfavorable	110	30	20	75.0	0.09
		CH	Favorable	95	45	40	5.00	0.11
Edwards Limestone [a]	>10	n/a	Unfavorable	140	--	--	--	135
			Favorable	150	--	--	--	620
Right Auxiliary Spillway								
Imported Fill	TBD	CL, CH	Unfavorable	90	35	40	0.005	0.06
			Favorable	100	20	20	0.015	0.09
Residuum	2.0	GC	Unfavorable	110	30	20	75.0	0.09
		CH	Favorable	95	45	40	5.00	0.11
Edwards Limestone [a]	>10	n/a	Unfavorable	140	--	--	--	159
			Favorable	150	--	--	--	728

a. The D75 for Edwards Limestone in SITES was applied as 152 mm (D_{50}) or 6 inches.

3.2.7 Climate

According to New Braunfels, Texas Monthly Weather at The Weather Channel, accessed November 29, 2020, the average annual precipitation at New Braunfels is approximately 33.3 inches. The wettest month of the year is June, averaging 4.78 inches. The driest months of the year are January and April, averaging 1.95 to 2.03 inches, respectively. The coolest month is January with average temperatures ranging from 38 degrees Fahrenheit (ºF) to 51°F. The warmest month is August with average temperatures ranging from 72°F to 95°F. Historical extreme (record) temperatures range from 2°F to 112°F.

3.3 Land Use

3.3.1 Watershed Land Use

The total drainage area above FRS No. 4 is 8,040 acres. The drainage area was derived using ArcMap 10.8 (ESRI, 2020), the Arc Hydro tool, and LiDAR topography (TNRIS, 2017 and Federal Emergency Management Agency [FEMA], 2011). Automatic ArcMap delineations were checked and edited as necessary against the LiDAR topography. The land use/land cover data were extracted from the 2016 National Land Cover Dataset (NLCD) (2019) and then hand edited to reflect recent and/or missing development within the study area. **Table 3-2** lists the land uses in the watershed area upstream of FRS No. 4, as well as in the breach inundation zone below FRS No. 4. Located approximately 10 miles from New Braunfels, TX, land use in the watersheds is slowly transitioning from agriculture to low-density residential development. Based on a review of aerial imagery for the years of 2010 and 2018 (USDA FSA, 2010 and 2018), there has been noticeable residential development in the watershed upstream of FRS No. 4 and also in the watershed contributing to the breach inundation zone from FRS No. 4. There has also been significant expansion activity in the quarry adjacent to and upstream of FRS No. 4. It has been confirmed, through site observations and discussions with the quarry site manager, that the quarry is not part of the contributing watershed. **Appendix C** contains land use maps of the upstream contributing watershed and the downstream sunny day breach zone.

Table 3-2. Existing Land Use

Land Cover Type	Controlled Drainage Area Above FRS No. 4		Breach Inundation Zone Below FRS No. 4	
	(acres)	(%)	(acres)	(%)
Barren Land	4.6	0.06%	--	--
Deciduous Forest	1,008.0	12.54%	142.6	10.98%
Developed, Open Space	487.6	6.06%	78.9	6.08%
Developed, Low Intensity	189.6	2.36%	17.2	1.32%
Developed, Medium Intensity	33.5	0.42%	5.2	0.40%
Developed, High Intensity	2.8	0.03%	0.9	0.07%
Evergreen Forest	3,788.3	47.12%	88.5	6.81%
Mixed Forest	24.3	0.30%	21.3	1.64%
Shrub/Scrub	2,171.6	27.01%	633.1	48.77%
Herbaceous	328.0	4.08%	5.4	0.42%
Open Water	1.6	0.02%	--	--
Woody Wetlands	0.2	0.00%	168.6	12.99%
Emergent Herbaceous Wetlands	--	--	3.0	0.23%
Hay/Pasture	--	--	6.8	0.53%
Cultivated Crops	--	--	126.6	9.75%
Total	**8,040.1**	**100%**	**1,298.2**	**100%**

[a] Acreages were estimated below FRS No. 4 from the structure to the downstream limit of the sunny day breach zone as depicted on **Figure C-3**.

3.3.2 Quarry

FRS No. 4 is included within the facility boundaries of Hanson Aggregates – Servtex Quarry (Hanson Servtex). The quarry presently encroaches the south and western limits of the dam. Located at 21303 FM 2252, Garden Ridge, Texas, the limestone quarrying and crushing operations have been active since 1936. The quarry includes approximately 2,000 acres with over half of it developed as a limestone quarry. Review of aerial images available on Google Earth indicate that until the mid-1990's to early 2000's, the quarry encompassed only an area south of FRS No. 4. Starting in the early 2000s, the quarry has continually expanded with boundaries presently located within approximately one-half mile of the dam embankment centerline. Aerial imagery (USDA FSA; 2010, 2012, 2014, and 2018) of the recent quarry expansion is shown on **Figure C-4** in **Appendix C**.

Quarry operations were discussed with a site manager from Hanson Servtex during a site visit in December 2020. According to the site manager, it is not anticipated that the quarry will expand in the direction of FRS No. 4 beyond its current boundary. While on-site, it was also observed that the boundary between the quarry and the flood pool for FRS No. 4 (i.e. the study watershed southern boundary) is an elevated road that is approximately 5.8 feet higher than the effective top of dam elevation (Figure C-4). With this current elevation difference, it is unlikely that the water surface elevation within FRS No. 4 could exceed the elevation of the road and impact quarry operations. Water does not enter the active quarry area from the contributing area to FRS No. 4 and vice versa.

3.4 Prime and Unique Farmland

According to the USDA 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, the land in the immediate vicinity of the FRS No. 4 embankment and floodpool has not been identified as prime farmland, unique farmland, or farmland of statewide importance. There are areas located adjacent to Dry Comal Creek farther downstream of FRS No. 4 that have been identified as prime farmland and farmland of statewide importance that appear to be actively being farmed. The nearest such area is approximately 2 river miles downstream of FRS No. 4. A map of farmland designations is provided as **Figure C-5** in **Appendix C**.

Agricultural Census data were reviewed for Comal County to identify crops grown and their percent of total agricultural land in the study area. Crops in the study area include corn, forage, oats, and winter wheat. Yields per acre were obtained from the Texas A&M Agricultural Extension's Costs and Estimated Returns per Acre as well as the National Agricultural Statistics Services State Agriculture Overview. Average production value per year per acre for all crops in the study area total $1,952.

3.5 Woodland Vegetation/Forest Resources

Woodland vegetation is present surrounding FRS No. 4. Dominant species include live oak (*Quercus fusiformis*), Ashe juniper (*Juniperus ashei*), honey mesquite (*Prosopis glandulosa*), hackberry (*Celtis laevigata*), and cedar elm (*Ulmus crassifolia*).

3.6 Invasive Species

Invasive plant species have the potential to occur throughout Texas and have 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. 4 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)

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 include:

- Armored Catfishes (*Hypostomus plecostomus*, *Pterygoplichthys* spp.)
- Asian clam (*Corbicula fluminea*)
- Blue Tilapia (*Oreochromis aureus*)
- Zebra Mussel (*Dreissena Polymorpha*)
- European Starling (*Sturnus vulgaris*)
- Quilted Melania (*Tarebia granifera*)
- Red imported fire ants (*Solenopsis invicta*)
- Feral pig (*Sus scrofa*)
- 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. 4 site. Information was obtained from TPWD's Texas Natural Diversity Database (TXNDD) (TPWD, 2023) and USFWS's Information for Planning and Consultation (IPaC) database (USFWS, 2023) concerning the occurrence of state and federally listed wildlife and plant species in and surrounding FRS No. 4.

According to TPWD and USFWS, there are 25 federal and/or state listed wildlife and plant species/subspecies that have potential to or have historically occurred within Comal County. Federally listed species include the following:

- Golden-cheeked warbler (*Setophaga chrysoparia*), 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;
- San Marcos salamander (*Eurycea nana*), Federal Threatened/State Threatened;
- Texas blind salamander (*Eurycea rathbuni*), Federal Endangered/State Endangered;
- Fountain darter (*Etheostoma fonticola*), Federal Endangered/State Endangered;
- False spike (*Fusconaia mitchelli*), Federal Proposed Endangered;
- Guadalupe orb (*Cyclanaias necki*), Federal Proposed Endangered;
- Monarch butterfly (*Danaus plexippus*), Federal Candidate;
- Guadalupe fatmucket (*Lampsilis bergmanni*), Federal Proposed 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;
- Tricolored bat (*Perimyotis subflavus*), Federal Proposed Endangered; and
- Texas wild-rice (*Zizania texana*), Federal Endangered.

State listed threatened species include the following:

- Cascade Caverns salamander (*Eurycea latitans*);
- Texas salamander (*Eurycea neotenes*);
- White-faced ibis (*Plegadis chihi*);
- Wood stork (*Mycteria americana*);
- Guadalupe darter (*Percina apristis*);
- 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 July 18, 2022, there are no EORs within or adjacent to FRS No. 4 and three EOs for the disc cavesnail (*Phreatodrobia plana*), plateau milkvine (*Matelea edwardsensis*), and a bat roost were reported within five miles of the FRS No. 4.

Field investigations occurred on July 21, 2020 and July 6, 2022 to assess the potential for suitable habitat at FRS No. 4. 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. 4 totaling approximately 25 acres. In addition, suitable habitat was determined to be present for the tricolored bat. The tricolored bat is currently proposed to be federally endangered; therefore, is not currently afforded statutory protection under the Endangered Species Act. Based on presence/absence surveys completed during the 2023 breeding season for the golden-cheeked warbler, the suitable habitat was determined to be unoccupied for the 2023 breeding season.

No suitable nesting or stopover habitats for the piping plover, red knot, and whooping crane were identified within or adjacent to FRS No. 4.

Based on a Geologic Assessment (**Appendix E**), no suitable habitat for karst or salamander species was determined to be present. No suitable habitat was determined to be present for the remaining federal or state listed species.

Golden-Cheeked Warbler
The GCWA (*Setophaga* [=*Dendroica*] *chrysoparia*) is listed by both USFWS and TPWD as federally and state endangered in Texas and is known to occur in Comal 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).

Tricolored Bat
The tricolored bat (*Perimyotis subflavus*) is currently a federal proposed endangered species for listing by USFWS. This species is known to occur within Comal County and faces extinction due to the impacts of white-nosed syndrome. During the non-hibernating season, tricolored bats primarily roost among leaf

clusters of live or recently dead deciduous hardwood trees. According to USFWS, female tricolored bats exhibit high site fidelity, returning year after year to the same summer roosting locations, and form maternity colonies which can switch roost trees regularly. Construction activities, such as tree clearing, not only have the potential to destroy an occupied roost but can also alter microclimates (e.g., humidity and temperature) in and around roost sites, expose bats to greater temperature extremes, and thereby cause site abandonment or other adverse effects (Erdle and Hobson, 2001). A final decision for listing will be announced within 12 months of the proposal date (September 13, 2022).

3.8 Cultural Resources/Historic Properties

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/Texas Historical Commission (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 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. 4 was defined as a 51-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. 4. 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 26, 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 Comal River Watershed FRS No. 4 APE was completed on April 16, 2021, under Texas Antiquities Permit No. 30091. The survey resulted in the identification of three previously unrecorded prehistoric archeological sites. In addition, two historic-age resources were identified and recorded, which included the FRS No. 4 dam structure and one historic-age structure located within 150 feet of the APE.

Based on the results of the background review and survey, NRCS determined that there are no properties included in or eligible for inclusion in the NRHP within the APE of the alternative resulting in the rehabilitation of FRS No. 4. SHPO/THC concurred with the no effect determination on June 26, 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. 4 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 Comal County, Texas. These include: the Comanche Nation of Oklahoma; the Apache Tribe of Oklahoma; the Coushatta Tribe of Louisiana; the Tonkawa Tribe of Indians of Oklahoma; and the Wichita and Affiliated Tribes (Wichita, Keechi, Waco, and Tawakonie) of Oklahoma. NRCS initiated consultation with each of these tribes by letter on July 12, 2022 (**Appendix E**) and completed consultation on March 7, 2023.

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 Comal 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.

3.9 Water Quality

The 2020 305(b)/303(d) Integrated Water Quality Assessment and Impaired Waters Report (TCEQ, 2020) did not identify Bear Creek as being an impaired stream but did identify a segment of Dry Comal Creek as being impaired for bacteria in water. The segment was first listed as being impaired in 2010. The segment of Dry Comal Creek that is listed as being impaired is the portion of Dry Comal Creek from the confluence of the Comal River in New Braunfels in Comal County to the upstream perennial portion of the stream southwest of New Braunfels in Comal County. Due to the impairment, the segment does not support the contact recreation use designation. The potential source of the impairment is listed as unknown. Note the confluence of Bear Creek with Dry Comal Creek is approximately 0.34 miles downstream of FRS No. 4.

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

FRS No. 4 was surveyed for streams, lakes, and wetlands on April 5, 2023. Based on desktop review, two NHD mapped features, Bear Creek and an unnamed tributary, were determined to be potentially present within FRS No. 4. However, based on field investigations, no potentially jurisdictional streams, lakes, or wetlands were observed within FRS No. 4.

3.11 Migratory Birds

Migratory bird pathways, and stopover, wintering, and breeding habitats, including disturbed areas, may be present within and/or adjacent to FRS No. 4, and may be associated with fallow fields, grasslands, and woodlands identified in the FRS No. 4 field investigations study area. If construction or clearing would take place during the migratory bird nesting season (March 1 to August 31), a qualified biologist will conduct nest presence/absence surveys to identify any active nests within the site to ensure compliance with the Migratory Bird Treaty Act (MBTA).

3.12 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 analyses are delineated by Census Tracts 3101, 3103.01, 3103.02, 3104.01, 3108.01 and 3108.03 (hereafter, affected census tracts), the census tracts the Project is located within and adjacent to (**Figure C-6** 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, Comal County, and the state of Texas.

Comal County is part of the San Antonio-New Braunfels Metropolitan Statistical Area and has an approximate population of 148,900 (U.S. Census Bureau). **Table 3-3** provides relevant information regarding the Project beneficiary profile for the affected census tracts, Comal County, and Texas.

Table 3-3. Project Beneficiary Profile

	Census Tracts						County	State
Beneficiary	**3101**	**3103.01**	**3103.02**	**3104.01**	**3108.01**	**3108.03**	**Comal**	**Texas**
Population	3,514	3,529	5,218	5,241	6,774	5,242	148,921	28,635,442
Median Age	39.2	37.6	45.9	37.9	49.7	42.1	42.1	34.8
Total Number of Households	1,433	1,253	2,440	1,872	2,503	2,055	54,586	9,906,070
Median Value of Owner-Occupied Housing Units	$295,000	$349,000	$307,600	$98,900	$500,000	$390,300	$293,600	$187,200

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

3.12.1 Agriculture Statistics

According to the USDA's 2017 Census of Agriculture, harvested cropland in Comal County was dominated by winter wheat (for grain), corn (for grain), and Oats (for grain). **Table 3-4** lists 2017 statistical data on agricultural land and products for Comal County that were obtained from the USDA 2017 Census of Agriculture.

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

Statistic	2017
Number of farms	1,068
Land in farms	206,493 acres
Average size of farm	193 acres
Market value of products sold	$9,611,000
Average per farm	$8,999

Source: USDA 2017 Census of Agriculture

3.12.2 Population

Table 3-5 breaks down age and gender characteristics of the affected census tracts, Comal County, and Texas. The shares of selected population characteristics as a percent of the populations in the study area are provided in parenthesis.

Table 3-5. Population Characteristics

Socioeconomic Criteria		Census Tracts						County	State
		3101	3103.01	3103.02	3104.01	3108.01	3108.03	Comal	Texas
Total Population		3,514	3,529	5,218	5,241	6,774	5,242	148,921	28,635,442
Gender	Male	1,586 (45.1%)	1,529 (43.3%)	2,079 (39.8%)	2,798 (53.4%)	3,571 (52.7%)	2,330 (44.4%)	73,619 (49.4%)	14,221,720 (49.7%)
	Female	1,928 (54.9%)	2,000 (56.7%)	3,139 (60.2%)	2,443 (46.6%)	3,203 (47.3%)	2,912 (55.6%)	75,302 (50.6%)	14,413,722 (50.3%)
Age	Under 18	926 (26.4%)	935 (26.5%)	824 (15.8%)	1,076 (20.5%)	1,472 (21.7%)	1,064 (20.3%)	33,601 (22.6%)	7,381,482 (25.8%)
	18 & over	2,588 (73.6%)	2,594 (73.5%)	4,394 (84.2%)	4,165 (79.5%)	5,302 (78.3%)	4,178 (79.7%)	115,320 (77.4%)	21,253,960 (74.2%)
	20-24	131 (3.7%)	136 (3.9%)	117 (2.2%)	534 (10.2%)	274 (4.0%)	437 (8.3%)	7,973 (5.4%)	2,000,883 (7.0%)
	25-34	427 (12.2%)	378 (10.7%)	575 (11.0%)	752 (14.3%)	304 (4.5%)	363 (6.9%)	16,739 (11.2%)	4,210,488 (14.7%)
	35-44	618 (17.6%)	219 (6.2%)	661 (12.7%)	786 (15.0%)	625 (9.2%)	761 (14.5%)	18,221 (12.2%)	3,888,044 (13.6%)
	45-54	217 (6.2%)	460 (13.0%)	984 (18.9%)	652 (12.4%)	1036 (15.3%)	794 (15.1%)	19,961 (13.4%)	3,542,967 (12.4%)
	55-59	352 (10.0%)	228 (6.5%)	253 (4.8%)	254 (4.8%)	699 (10.3%)	234 (4.5%)	10,273 (6.9%)	1,702,570 (5.9%)
	60-64	170 (4.8%)	352 (10.0%)	242 (4.6%)	304 (5.8%)	757 (11.2%)	341 (6.5%)	11,588 (7.8%)	1,512,413 (5.3%)
	65 & over	637 (18.1%)	622 (17.6%)	1,411 (27.0%)	821 (15.7%)	1,455 (21.5%)	1,111 (21.2%)	27,189 (18.3%)	3,593,369 (12.5%)

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

3.12.3 Race and Ethnicity

Race and ethnicity data for the affected census tracts, Comal 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 the affected census tracts and Comal County than of Texas at large, with the exception of tract 3104.01. As shown in **Table 3-7**, the affected census tracts and Comal

County have a higher percentage of white and a lower percentage of all other races (combined) than Texas does at large.

Table 3-6. Population by Ethnicity

	State							
	Census Tracts						County	State
Ethnicity	**3101**	**3103.01**	**3103.02**	**3104.01**	**3108.01**	**3108.03**	**Comal**	**Texas**
Hispanic or Latino	988 (28.1%)	708 (20.1%)	1,475 (28.3%)	3,491 (66.6%)	1,286 (19.0%)	806 (15.4%)	41,293 (27.7%)	11,294,257 (39.4%)
Not Hispanic or Latino	2,526 (71.9%)	2,821 (79.9%)	3,743 (71.7%)	1,750 (33.4%)	5,488 (81.0%)	4,436 (84.6%)	107,628 (72.3%)	17,341,185 (60.6%)

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

Table 3-7. Population by Race

	Census Tracts						County	State
Race	**3101**	**3103.01**	**3103.02**	**3104.01**	**3108.01**	**3108.03**	**Comal**	**Texas**
White	3,122 (88.8%)	3,463 (98.1%)	4,347 (83.3%)	4,608 (87.9%)	5,253 (77.5%)	4,481 (85.5%)	129,711 (87.1%)	19,805,623 (69.2%)
African American	48 (1.4%)	0 (0.0%)	34 (0.7%)	28 (0.5%)	716 (10.6%)	271 (5.2%)	3,236 (2.2%)	3,464,424 (12.1%)
American Indian and Alaska Native	20 (0.6%)	38 (1.1%)	15 (0.3%)	25 (0.5%)	0 (0.0%)	0 (0.0%)	376 (0.3%)	137,921 (0.5%)
Asian	0 (0.0%)	0 (0.0%)	0 (0.0%)	11 (0.2%)	106 (1.6%)	143 (2.7%)	1,739 (1.2%)	1,415,664 (4.9%)
Native Hawaiian and other Pacific Islander	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	11 (0.2%)	65 (<0.1%)	25,328 (0.1%)
Some other race	47 (1.3%)	28 (0.8%)	70 (1.3%)	223 (4.3%)	24 (0.4%)	307 (5.9%)	4,654 (3.1%)	1,788,398 (6.2%)
Two or more races	277 (7.9%)	0 (0.0%)	752 (14.4%)	346 (6.6%)	675 (10.0%)	29 (0.6%)	9,140 (6.1%)	1,998,084 (7.0%)

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

3.12.4 Employment and Income

Table 3-8 summarizes labor force characteristics of the affected census tracts, Comal County, and Texas. The affected census tracts and Comal County have lower unemployment than Texas at large.

Table 3-8. Labor Force

Characteristic	Census Tracts						County	State
	3101	3103.01	3103.02	3104.01	3108.01	3108.03	Comal	Texas
Population 16 years and older	2,636	2,725	4,567	4,250	5,652	4,363	119,443	22,078,090
Civilian labor force	1,628	1,453	2,009	2,621	3,258	2,794	71,671	14,214,242
Civilian labor force participation rate	61.8%	53.3%	44.0%	61.7%	57.6%	64.0%	60.0%	64.4%
Employed	1,552	1,453	1,941	2,609	3,185	2,733	68,783	13,461,358
Employment rate	95.3%	100.0%	96.6%	99.5%	97.8%	97.8%	96.0%	94.7%
Unemployed	76	0	68	12	73	61	2,888	752,884
Unemployment rate	4.7%	0.0%	3.4%	0.5%	2.2%	2.2%	4.0%	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 industries in the affected census tracts are as follows: educational services, and health care and social assistance; arts, entertainment, and recreation, and accommodation and food services; and construction.

Table 3-9. Employment by Industry

Industry Sector	Census Tracts						County	State
	3101	3103.01	3103.02	3104.01	3108.01	3108.03	Comal	Texas
Agriculture, forestry, fishing and hunting, and mining	17	22	30	16	40	32	1,158	382,157
Construction	100	86	179	497	401	307	6,801	1,162,805
Manufacturing	40	38	60	343	189	418	5,114	1,136,354
Wholesale trade	59	18	23	82	140	18	2,519	376,139
Retail trade	128	60	152	390	380	45	8,202	1,511,963
Transportation and warehousing, and utilities	64	13	339	157	156	194	3,493	808,075
Information	66	19	84	6	10	100	1,325	227,404
Finance and insurance, and real estate and rental and leasing	91	53	257	65	247	50	4,741	911,531
Professional, scientific, and management, and administrative and waste management services	166	67	234	154	413	193	7,636	1,576,600
Educational services, and health care and social assistance	400	545	265	349	798	933	15,041	2,932,061
Arts, entertainment, and recreation, and accommodation and food services	191	355	220	349	100	345	6,675	1,212,944

Industry Sector	Census Tracts						County	State
	3101	3103.01	3103.02	3104.01	3108.01	3108.03	Comal	Texas
Other services, except public administration	122	163	50	124	101	58	2,978	680,503
Public administration	108	14	48	77	210	40	3,100	542,822

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

Income statistics for the affected census tracts, Comal County, and Texas are provided in **Table 3-10**. As shown in **Table 3-10**, median household income, mean household income, and per capita household income in the affected census tracts and Comal County are higher than those of Texas at large, with the exception of tracts 3103.02 and 3104.01.

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

Characteristic	Census Tracts						County	State
	3101	3103.01	3103.02	3104.01	3108.01	3108.03	Comal	Texas
Median Household Income	$65,095	$91,250	$46,402	$42,317	$128,194	$89,033	$80,781	$63,826
Mean Household Income	$109,570	$107,210	$81,925	$57,649	$161,975	$112,724	$105,813	$89,506
Per Capita Income	$43,237	$37,984	$40,494	$22,441	$59,996	$45,070	$39,942	$32,177

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

3.12.5 Poverty

Poverty Statistics are provided in **Table 3-11**. As shown in **Table 3-11**, the majority of the affected census tracts and Comal County have a lower percent of all 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. Census tracts 3101 and 3104.01 had a notably higher incidence of families living in poverty than Texas at large.

Table 3-11. Poverty Rates

Characteristic	Census Tracts						County	State
	3101	3103.01	3103.02	3104.01	3108.01	3108.03	Comal	Texas
Percent all people living below poverty level	13.2%	9.1%	9.6%	11.8%	2.2%	7.6%	7.7%	14.2%
Percent people living below poverty level (between 18-64)	11.1%	6.4%	9.9%	12.9%	2.5%	7.1%	7.8%	12.5%
Percent people living below poverty level (65 and over)	3.1%	7.6%	10.9%	8.4%	3.6%	3.2%	5.4%	10.7%
Percent families living below poverty level	14.5%	3.2%	2.7%	15.9%	0.0%	3.0%	5.1%	10.9%

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

3.12.6 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.

The majority of affected census tracts have a smaller share of residents identifying as Hispanic or Latino compared to the entire state of Texas. However, Census Tract 3104.01 had a notably higher share of Hispanic or Latino residents, at 66.6%, than the state of Texas at 39.4%.

The majority of affected census tracts have a similar or 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, Census tracts 3101 and 3104.01 had a notably higher incidence of families living in poverty than Texas at large.

3.13 Description of Existing Dam

The below record of the existing conditions of FRS No. 4 is a compilation of the *Dam Assessment Report* (NRCS, 2014), the *Dam Safety Inspection Report* (NRCS, 2018), bi-annual inspection reports performed by Comal County for the years of 2015-2020 (Comal County, 2015-2020), and the FRS No. 4 As-Built (USDA SCS, 1964), in addition to observations made during site visits associated with this Supplemental Watershed Plan effort.

3.13.1 Current Condition of the Dam

FRS No. 4 is located approximately 9 miles west and 3 miles south of New Braunfels, Texas and outflows to Bear Creek, Dry Comal Creek, the Comal River, and then the Guadalupe River. FRS No. 4 is a typical NRCS earthen embankment dam with storage allocated for sediment storage and flood control. The *Dam Safety Inspection Report* (NRCS, 2018) classifies the dam as Not Unsafe and is in overall good condition. Observations from the *Dam Safety Inspection Report* (NRCS, 2018) are included below.

- The embankment appeared to be in good condition with rock blankets on both front and back slopes. Areas of small woody plants were growing on both slopes.
- Seep water was observed at the front (upstream) toe of the dam in a small pool, located approximately 20 feet upstream of the inlet riser (directly over the pipe going to the inlet filter house).
- The concrete principal spillway inlet riser and visible portion of the conduit appeared to be in good condition. There was some moderate corrosion observed on the steel trash bars on the inlet riser, but it was noted that they are still fully functional.
- Both left and right auxiliary spillways appeared to be in good dimensional condition and clear of obstructions.
- A gully in the left auxiliary spillway exit section was observed. It was noted that the gully is currently stable and should not erode into the control section of the auxiliary spillway during normal operation due to a rock outcropping that would likely prevent it.
- The downstream channel was observed to be in good condition with no deficiencies.
- The reservoir area was dry at the time of inspection and no deficiencies were observed.

The Sponsor is 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.

3.13.2 Potential Dam Safety Deficiencies

FRS No. 4 was designed and constructed in 1965 to be a multi-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. In addition, the dam does not meet the 10-day drawdown requirement and engages the auxiliary spillway during the PSH event.

3.13.3 As-Built Dam Specifications

The dam was constructed in 1965 and "As-Built" drawings are available. The original as-built elevations were based on NGVD29 vertical datum and were converted to NAVD88 vertical datum for this project using a conversion factor of +0.354 feet. The embankment is single zone, compacted earthfill dam. A cutoff trench with 1:1 side slopes that varies in bottom width from 12 feet to 80 feet was constructed at the centerline of the dam.

The dam is approximately 72 feet tall and 2,000 feet long. The upstream and downstream slopes of the embankment have a slope of approximately 2.5:1 (horizontal:vertical) and both have rock blankets that have a minimum horizontal thickness of 10 feet. The top width of the structure is approximately 14 feet. **Table 3-12** summarizes as-built and existing structural data for FRS No. 4.

3.13.4 Principal Spillway

The principal spillway inlet structure is a drop inlet (30 inches x 100 inches x 20 feet, 5 inches tall) with a steel debris guard and crest of 763.75 feet. There are two low-level ports on one side of the riser (8 inches tall x 10 inches wide each) at elevation 759.85 feet. The conduit is 340 feet of 30-inch-diameter prestressed, concrete lined, steel cylinder pipe with seven anti-seep collars. The spillway is generally in good condition. Rusted metal on the inlet structure is monitored and should be repaired as needed. Photographs of the existing principal spillway system are provided in **Figure 3-1**.

Inlet Structure (2020)

Inlet Structure with Low Level Ports (2020)

Outlet Pipe and Plunge Pool (2020)

Outlet Pipe (2020)

Figure 3-1. FRS No. 4 Principal Spillway Inlet and Outlet

3.13.5 Auxiliary Spillways

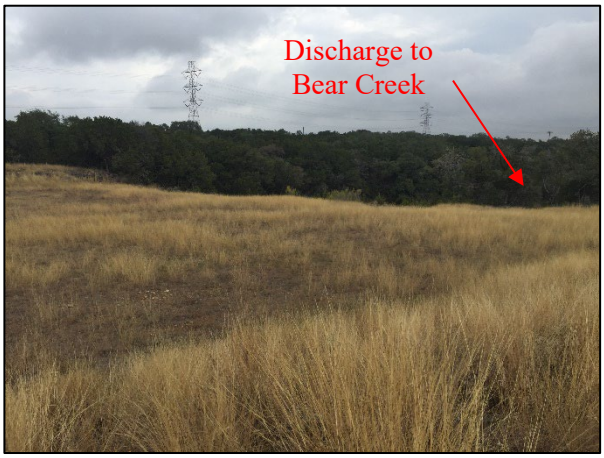
Two 190-foot-wide, grass-lined auxiliary spillways were excavated over erosion resistant rock at the left and right abutments, respectively. The auxiliary spillways have experienced flows on at least two occasions, including the 1998 and 2002 storm events.

The as-built drawings show the left auxiliary spillway as having a grassed inlet section sloping at a mild 0.2% up to the control section, a 50-foot-long control section at elevation 799.15 feet, and an exit section at a 2.1% slope for a distance of about 30 feet before transitioning back to the original ground. During the most recent site visit, it was observed that the vegetation is not consistent throughout the left auxiliary spillway, but because the spillway was excavated into erosion resistant rock, this inconsistency is not considered a major concern. A gully in the left auxiliary spillway exit section was also observed during the 2018 NRCS Dam Safety Inspection (NRCS, 2018). It was noted that the gully is currently stable and should not erode back into the control section of the auxiliary spillway due to a rock outcropping that would likely prevent an extensive headcut during normal operation.

The as-built drawings show the right auxiliary spillway as having a grassed inlet section sloping at a mild 0.75% up to the control section, a 50-foot-long control section at elevation 799.15 feet, and an exit section at a 6.7% slope for a distance of about 210 feet before transitioning back to the original ground. Similar to

the left spillway, during the most recent site visit, it was observed that the vegetation is not consistent throughout the right auxiliary spillway, but because the spillway was excavated into erosion resistant rock, this inconsistency is not considered a major concern. Auxiliary spillway photos are provided in **Figure 3-2**.

Left Auxiliary Spillway Inlet Channel / Control Section (2020)



Left Auxiliary Spillway Downstream of Control Section (2020)

Right Auxiliary Spillway Inlet Channel (2020)

Right Auxiliary Spillway Downstream of Control Section with Rock Outcrop (2020)

Figure 3-2. FRS No. 4 Auxiliary Spillway Condition

3.13.6 Embankment

The upstream and downstream embankments were found to be in good condition during the most recent NRCS Dam Safety Inspection (NRCS, 2018). Areas of small woody vegetation were noted on both embankments and treatment was recommended. One area of potential seepage was noted at the upstream toe, approximately 20 feet upstream of the inlet riser, directly over the pipe going to the inlet filter house. Seepage on the upstream toe between the filter house and the inlet structures needs to be monitored. Embankment photos are provided in **Figure 3-3**.

Upstream Embankment Showing Rock Blanket (2020)

Downstream Embankment (2020)

Figure 3-3. FRS No. 4 Embankment Condition

3.13.7 Topographic Data

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 two data sources that provided coverage for the analysis include:

- Texas Natural Resource Information System (TNRIS). StratMap Program 50-cm resolution LiDAR for Central Texas. Data collected by Fugro EarthData, Inc. with third party quality assurance/quality control performed by AECOM between January and March 2017. Published November 13, 2017.
- FEMA. 61-cm resolution LiDAR data for Comal & Guadalupe Counties. Data collected by Fugro EarthData from November 20, 2010 through December 06, 2010. Published September 30, 2011.

The extracted LiDAR coverage with respect to the location of FRS No. 4, the contributing watershed, and the area used for evaluation is shown in **Figure 3-4**. The Mosaic tool within ArcGIS was used to combine the 50 and 61 cm tiles into a single Digital Elevation Model (DEM) at 1-meter resolution. Both datasets were referenced to GEOID 09, so no GEOID conversion was required when combining them. 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**.

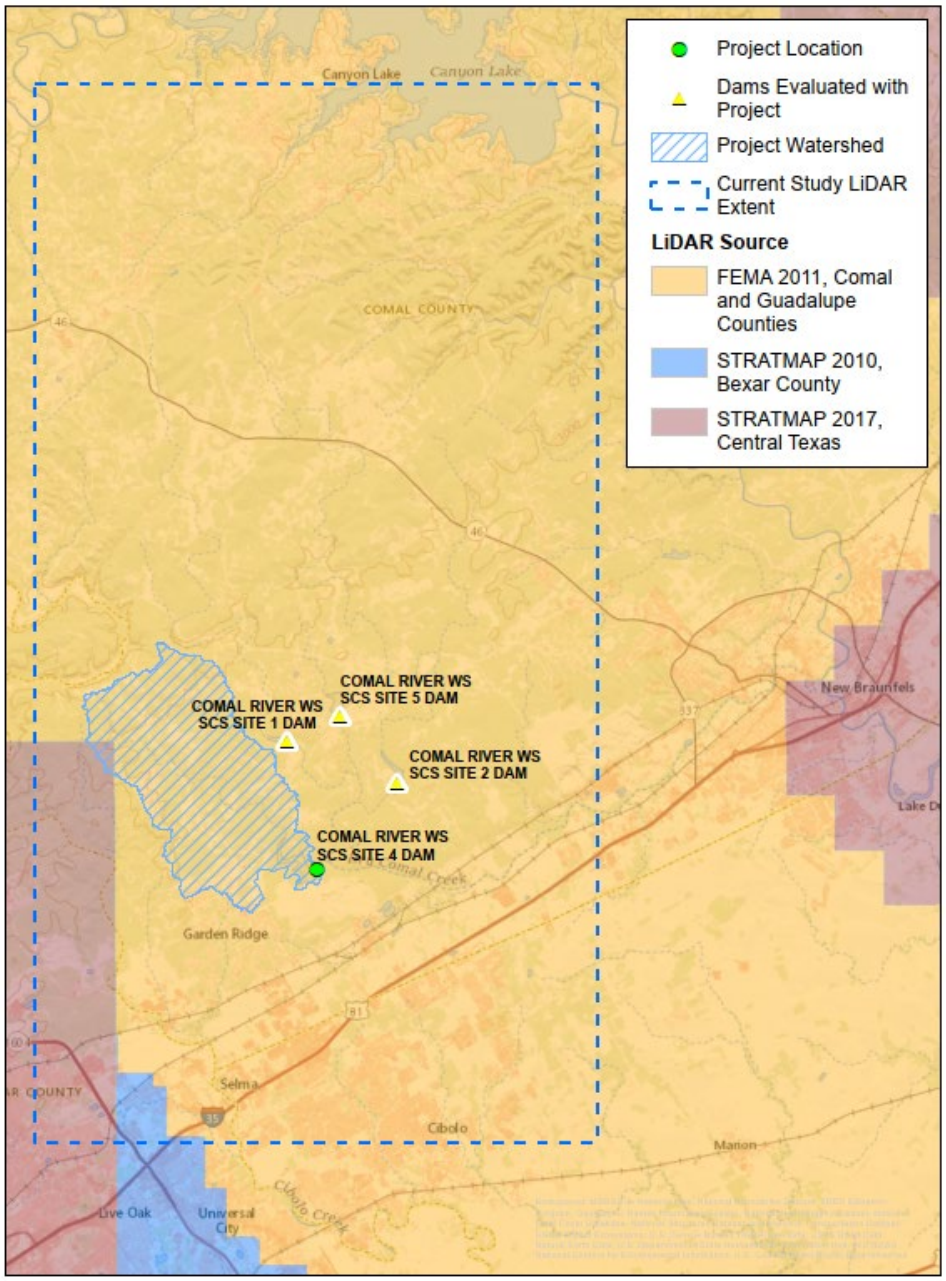


Figure 3-4. LiDAR Coverage Extracted for FRS No. 4

Table 3-12. As-Built and Existing Structural Data for FRS No. 4

Item	FRS No. 4	
	As-Built[a]	**Existing[b]**
Local Name	Herman Blank Site, Eikel Blank Site	
Latitude / Longitude	29.6512º / -98.2774º	
Site Number	TX01546	
Year Completed	1965	
Purpose	Flood Control	
Drainage Area (mi^2)	12.97	12.56
Dam Height (ft)	72	
Dam Type	Earthfill	
Dam Volume (yds^3)	286,570	
Dam Crest Length (ft)	1,997.5	2,000
Total Capacity (ac-ft)		
Sediment Submerged (ac-ft)	298.1	317.4
Sediment Aerated (ac-ft)	19.9	20.7
Floodwater Retarding (ac-ft)	3,286	3,141
Surface Area (ac)		
Sediment Pool (ac) [c]	22.3	24.0
High Stage Principal Spillway (ac)	28.3	30.1
Sediment Storage (ac) [d]	29.4	31.1
Flood Pool (ac)[e]	190.6	191.2
Principal Spillway		
Type	Drop inlet, Two Stage	
Riser Height (ft)	20.42	
Conduit Size (in)	30	
Low Level Port Elevation (ft)	759.85	759.85
Riser Crest Elevation (ft)	763.75	763.75
Capacity at Aux Crest (cfs)	139.1	139.1
Energy Dissipater	Plunge Pool	Plunge Pool
Auxiliary Spillway		
Type	Earthen channel with protective vegetative cover, rock outcrops	
Left Aux. Spillway Width (ft)	190	
Right Aux. Spillway Width (ft)	190	
Normal Pool (Low Stage) Elevation (ft)	759.85	759.85
Principal Spillway Crest Elevation (ft)	763.40	763.75
Flood Pool Elevation (ft)	799.15	799.15
Top of Dam Elevation (ft)	806.55	806.55
Datum.[a,b]	NAVD88	

a. As-built elevations are referenced to NGVD29 and were updated to NAVD88 datum for this plan using conversion factor of +0.354 ft.
b. No site topographic survey was performed as part of this plan; all analysis was based upon LiDAR data.
c. The as-builts identify the sediment pool as the elevation at which 200 ac-ft of storage is available.
d. The as-builts identify the sediment storage as the volume for total sediment storage, including aerated storage above the principal spillway crest elevation.
e. The flood pool area is defined at the elevation of the auxiliary spillway crests.

3.13.8 Sedimentation and Reservoir Storage

FRS No. 4 was designed for a service life of 100 years with a sediment pool of 199.6 acre-feet below the low level ports in the principal spillway riser, per **Table 3-13**. Presuming this dam would maintain a normal pool, these ports set the normal pool surface area at 22.3 acres. The sediment storage was set at 318 acre-feet, including 298.1 acre-feet of sediment storage below the principal spillway crest at elevation 763.75 feet (NAVD 88 adjusted), and an additional 19.9 acre-feet of flood pool sediment storage below elevation 764.43 feet (NAVD 88 adjusted). The surface area at the principal spillway riser crest was planned at 28.3 acres. The as-built storage capacities seem fairly accurate when compared with the LiDAR storage estimates. The LiDAR data are considered sufficient for this level of analysis since the reservoir is typically dry and therefore measurements are collected to the bottom of the reservoir.

A comparison was performed between the sediment pool volume reported in the as-builts for FRS No. 4 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, the reservoir was dry, thus no sediment or bathymetric survey was necessary for FRS No. 4. The comparison shows that at the principal spillway crest elevation, there is currently 317.4 acre-feet of storage available compared to the 298.1 acre-feet estimated at the time of construction. As this reservoir currently has more sediment storage than planned at the principal spillway crest, it is reasonable to conclude there has been little sediment accumulation in this reservoir.

Another comparison point shows that the largest difference in storage below the principal spillway crest occurs at elevation 748.35 feet (NAVD 88 adjusted), with 12.7 less acre-feet available in 2010 at the time of LiDAR data collection versus 1965, or 45 years elapsed time since construction. A loss of 12.7 acre-feet of storage divided by 45 years of operation equals a deposition rate of 0.282 acre-feet per year. Projected forward for 100 years of sediment storage plus an additional 16 years between the time of LiDAR data collection in 2010 and an estimated construction completion date of 2026, this equates to approximately 33.0 acre-feet of sediment storage needed for a future design life of 100 years. As the watershed contributing to FRS No. 4 has remained relatively undeveloped with the main change in land use low density housing, it was concluded that the historical estimated sediment yield is applicable for estimating the future sediment capacity requirement.

The principal spillway crest at FRS No. 4 can reasonably be lowered for any rehabilitation alternatives considered to approximately 758.0 or 759.0 feet. These elevations will provide 169.8 acre-feet and 192.1 acre-feet of sediment storage, respectively. The principal spillway crest cannot be lowered beyond this point due to the riser height needed for proper hydraulic design of a larger diameter (48-inch and above) principal spillway conduit, even if the sediment storage exceeds 100 years of sediment life.

Table 3-13. As-Built and Existing Storage for FRS No. 4

Notes	Elevation (ft NGVD 29)	Elevation (ft NAVD 88)	Storage As-Built (ac-ft)	Storage Current (ac-ft)
	736.0	736.35	1.1	--
Lowest Ground Surface Elevation per LiDAR	736.85	737.20	2.9	0.0
	740.0	740.35	9.7	2.2
	744.0	744.35	25.9	14.5
	748.0	748.35	48.5	35.8
	752.0	752.35	78.7	74.5
	756.0	756.35	130.5	135.5
Possible Rehabilitation Principal Spillway Crest	757.65	758.0	163.0	169.8
Possible Rehabilitation Principal Spillway Crest	758.65	759.0	182.7	192.1
Sediment Pool/Low Level Port Elevation	759.5	759.85	199.6	212.2
	760.00	760.35	210.9	224.4
Principal Spillway Crest	763.40	763.75	298.1	317.4
	764.0	764.35	315.3	335.8
Flood Pool Sediment	764.1	764.43	318.0	338.2
	768.0	768.35	452.9	474.4
	772.0	772.35	630.1	651.1
	776.0	776.35	856.9	869.3
	780.0	780.35	1141.1	1133.3
	784.0	784.35	1485.9	1463.5
	788.0	788.35	1915.5	1863.4
	792.0	792.35	2456.7	2357.7
	796.0	796.35	3098.8	2975.4
Auxiliary Spillway Crest	798.8	799.15	3604.6	3479.2
	800.0	800.35	3838.5	3714.2
	804.0	804.35	4709.5	4577.8
Dam Crest Effective	806.2	806.55	5267.5	5114.0
	808.0	808.35	5724.1	5588.7
	812.0	812.35	6867.3	6766.0

3.14 Status of Operations and Maintenance

O&M of FRS No. 4 is performed by Comal County Commissioners Court. Inspections are done bi-annually by representatives of the Comal County Commissioners Court and NRCS New Braunfels Service Center. The most recent formal inspections were completed November 21, 2017 by NRCS (NRCS, 2018) and August 9, 2012 by TCEQ. Routine brush management and repairs are conducted as needed. Based on a review of the most recent NRCS inspection report (NRCS, 2017), bi-annual inspection reports conducted by Comal County from 2015-2020 (Comal County, 2015-2020), and a site visit to FRS No. 4, O&M at FRS No. 4 is considered adequate. NRCS noted in the most recent inspection report (NRCS, 2018) that the Sponsors are to be commended for the woody plant and brush control they have accomplished since the March 2007 formal inspection.

3.15 Floodplain Management

Comal County and incorporated areas participate in the National Flood Insurance Program (NFIP). The current effective FEMA flood hazard delineation (panel 48091C0420F, shown in **Appendix C**, **Figure C-7**) and Countywide Flood Insurance Study (FIS) that includes the project area were published on September 2, 2009.

The effective FEMA Flood Zone along Bear Creek, which runs through FRS No. 4 to the confluence with Dry Comal Creek 0.34 miles downstream, and the effective FEMA Flood Zone for Dry Comal Creek have an effective panel date of 9/29/2009 (48091C0420F). The models for these streams were developed in between 2003 and 2005 using detailed methods. The effective models for Bear Creek were re-validated in 2015 by FEMA's Coordinated Needs Management Strategy (CNMS) and are listed as "valid", but the effective model for Dry Comal Creek did not pass the re-validation checks and is listed "to be studied". The reaches downstream of FRS No. 4 along Bear Creek and Dry Comal Creek are classified as Zone AE with Floodway. The reach upstream of FRS No. 4 is also classified as Zone AE with Floodway. The designation of Zone AE indicates that base flood elevations have been evaluated for these areas. The Floodway within a Zone AE floodplain is the channel of a stream plus any adjacent floodplain that must be kept free from encroachment so that the 1% AEP probability flood can be carried without substantial increases in flood heights.

The detailed models for both Bear Creek and Dry Comal Creek were available for review from the City of New Braunfels and were used to compare flows and provide a check on the reasonableness of the new hydrologic and hydraulic models developed for this study. A summary of the models reviewed is provided in **Appendix D**. A BLE hydraulic model (FEMA 2015) was also used below the detailed economic study area through the City of New Braunfels for a semi-quantitative look at flooding within the New Braunfels city limits.

There are approximately 29 habitable structures within the area classified as FEMA Zone AE within the study area downstream of FRS No. 4. According to the existing condition modeling performed for this plan, there are two structures at risk of flooding above the FFE during the 1% AEP flood downstream of FRS No. 4. During the 0.2% AEP flood the modeling estimates 20 structures at risk downstream of FRS No. 4.

FRS No. 4 provides flood damage reduction benefits by reducing the peak flow and duration of storm events within the watershed. The dam, however, is inhibited in performing this flood protection during periods of a series of major storms in series, because the principal spillway for FRS No. 4 (diameter 30 inches) takes more than 10 days to lower the flood pool once full. During wet periods, the flood could remain well above the requisite 10-day drawdown (per TR-210-60 [USDA NRCS, 2019], at least 85% of the PSH routed through the retarding pool in 10 days or less) for prolonged periods.

3.16 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. Breach maps depicting the results of the breach analysis for FRS No. 4 is provided in **Appendix C**.

A sunny day breach of FRS No. 4 is predicted to impact 34 residential structures (all structures within inundation zone, regardless of depth of flooding) and 22 road crossings, of which 6 are private

roads/driveways and 3 are unnamed dirt roads that are public, downstream of the dam. The breach analysis for FRS No. 4 was terminated at the location where the modeled breach boundary was inside the regulatory 1% AEP storm event floodplain and almost contained within the modeled 1% AEP storm event floodplain, approximately 4,110 feet downstream of Krueger Canyon Road.

Revised breach analyses will be performed during the design phase of the FRS No. 4 rehabilitation and the updated inundation data will be provided to the Sponsors for use in an Emergency Action Plan (EAP) update.

3.17 Evaluation of Potential Failure Modes

3.17.1 Sedimentation

The major land uses in the watershed above FRS No. 4 are provided in **Table 3-2** and include 47.1% evergreen forest, 27.0% shrub/scrub, 12.5% deciduous forest, 6.1% developed – open space, 2.4% developed - low intensity, and 0.4% developed – medium intensity. While it is expected that there will be some increases in the percentages of developed- open space to developed – high intensity land uses, it is not expected that they will change significantly or be adjusted to land uses that would increase sediment yield. The future sediment accumulation rate is therefore planned to be the similar to the historic rate for the 54 elapsed years (from dam construction until the 2010 LiDAR sediment analysis) based on current and future land uses in the watershed. Based upon the minimal sediment deposition rate and the available 317.4 acre-feet of sediment storage at the principal spillway crest, the remaining sediment storage life of FRS No. 4 is at least 100 years. Therefore, the potential for failure due to inadequate sediment storage capacity is low.

3.17.2 Hydrologic Capacity

Hydrologic failure of a dam occurs when the auxiliary spillway is breached or when the dam is overtopped and fails. FRS No. 4 was originally designed to retain 3,286 acre-feet of floodwater. 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 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 PMF and could cause it to erode and collapse. Therefore, FRS No. 4 is categorized as having high potential to fail due to deficient hydrologic capacity.

3.17.3 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.

Bedrock foundations like that present at FRS No. 4 are not typically susceptible to classic under-seepage and related piping that occurs in soils. Under-seepage through rock foundations is largely transmitted through discontinuities in the rock mass and tends to be a localized phenomenon. The Edwards Limestone underlying the dam site is well known for solution features and karst conditions, producing a porous rock mass with highly permeable zones that allow for the movement of groundwater through faults, fractures, and conduits. The lack of a permanent reservoir pool at FRS No. 4 is likely attributed to relatively rapid infiltration of surface water into the underlying Edwards Limestone upstream of the dam. While the porous rock mass of the Edwards Limestone serves to limit the development of differential hydrostatic head at the dam, the ready flow of surface water and groundwater into the rock mass can transport/erode overlying soils into solution features in the limestone. The presence of the two adversely-oriented bedrock faults crossing under the dam embankment also provide a potential conduit for concentrated seepage and associated piping erosion from upstream to downstream. Additionally, should a reservoir pool develop during storm event, the relatively high permeability of the rock mass could allow the development of concentrated seepage and relatively high exit gradients at the downstream toe.

Based on review of the as-built drawings, a minimum 2-foot thick filter/transition zone is present between the central zones of earthfill materials (Zones 1 and 2) and outer zones of Rockfill materials (Zones 3 and 4). Based on the age of the structure and design standards of that era, it is possible that the earthfill and filter/transition materials are not filter compatible. If an existing phreatic surface is present or will develop as a result of through-seepage within the dam, internal erosion (piping) of the embankment soils into pore-space in the filter/transition material could develop. Further, the presence of rockfill covering on the downstream slopes would likely conceal visual evidence of ongoing piping erosion until a significant void has developed. The existing concrete anti-seep collars around the principal spillway pipe exacerbate the risk of piping due to potential defects resulting from inadequate compaction of the surrounding backfill during construction.

No evidence of historic under-seepage or through-seepage has been reported FRS No. 4. However, one area of potential seepage has been identified in the upstream reservoir area, located in a small pool approximately 20 feet upstream of the principal spillway inlet riser, directly above the alignment of the pipe between the principal spillway inlet riser and the inlet filter house riser. This area was noted in the most recent NRCS Dam Safety Inspection (NRCS, 2018). While seepage located upstream of the dam embankment is not anticipated to pose a threat to dam safety, monitoring of the existing seep should continue in the future.

Based on the foregoing, the risk of dam failure due to under-seepage and/or through-seepage is estimated to be low to moderate.

3.17.4 Embankment Stability

Based on prior visual inspections of FRS No. 4, there is no evidence of embankment instability on either the upstream or downstream slopes (e.g., sloughing, toe bulges, scarps, erosion, etc.). The as-built drawings suggest that the dam is composed of well-compacted earthfill (i.e., 90% of maximum dry density at -1 to +3.5% of optimum moisture per Modified Proctor energy), with 10-foot wide blankets of rockfill on both the upstream and downstream slopes, and a rockfill toe section in the lower portion of the downstream toe. The maximum dry density values (118 to 126 pcf) and optimum moisture contents (10.5 to 14.5%) reported on the as-built drawings, combined with general knowledge of residual soils of the Edwards Limestone, suggest the earthfill consists of sandy to gravelly clays and/or silty to clayey sands and gravels.

Inadequate geotechnical data is available to make a conclusive assessment of embankment stability, as neither the original Geologic Investigation or Soil Mechanics Reports were available for review. Residual

soils of the Edwards Limestone which were likely used to construct the earthfill sections of the dam may contain relatively high plasticity clays, which are subject to long-term softening after initial compaction due to weathering effects. It is unknown whether the factors of safety meet NRCS and/or TCEQ design criteria. However, the dam includes several features which are favorable from a slope stability perspective, which include shallow bedrock under the embankment, rockfill comprising the lower half of the downstream slope, and a rock drain trench at the downstream toe for internal drainage/seepage control. At minimum, a review of additional background information regarding dam design and historic dam performance would be needed to provide an assessment of embankment stability. Based on the foregoing, the risk of failure due to embankment instability is estimated to be low.

3.17.5 Spillway Integrity

The auxiliary spillways are in adequate condition and according to the most recent NRCS Dam Safety Inspection (NRCS, 2018) the bottom of the auxiliary spillways are excavated into rock. The left auxiliary spillway exit section has a gully that formed during previous large flow events that is currently stable and is not likely to erode into the control section due to the presence of the rock outcrop. SITES integrity analysis for the existing spillways 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 these spillways will continue in the future, the risk of dam failure due to integrity is judged to be moderately low.

3.17.6 Seismic

FRS No. 4 is located in an area of low potential seismic activity per the USGS National Seismic Hazard Maps (2018) and the seismic hazard maps in the NRCS TR-60 (2005), and its risk of failure due to a seismic event is judged to be low.

3.17.7 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 during the most recent NRCS Dam Safety Inspection (NRCS, 2018), 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.

3.17.8 Conclusions

Currently, a hydrologic failure is the most likely failure mode for FRS No. 4. The other potential modes of failure present low to moderate risk.

3.18 Consequences of Dam Failure

Inundation due to dam failure potentially has the following consequences at FRS No. 4:

Both the population-at-risk (PAR) estimate (**Appendix E**) and breach zone analyses (**Appendix C**) estimate depths of inundation based upon the 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 natural ground. For the breach maps located in **Appendix C**, structures inundated above the FFE by any depth 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 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 30 residences and motorists on 13 "Main Local Roads and Minor State Highways" would be at-risk in the event of a breach. Using an average of 3 people per residence would result in 90 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 two people per "Main Local Road and Minor State Highway" would be at risk from a breach. This would result in 26 motorists being at risk from a breach of FRS No. 4. 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. 4 would be 116.

Release of Harmful Materials

The minimal volume of sediment stored in the reservoir and eroded embankment material released to Bear Creek and Dry Comal 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 comply with NRCS dam safety criteria, and 2) maintain a level of flood prevention 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. Through implementation of a viable alternative, 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 2022 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 Comal River Watershed FRS No. 4 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 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 TSSWCB. Alternative plans of action were developed based on NRCS planning requirements and the ability of the alternatives to bring FRS No. 4 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/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 Comal-Guadalupe SWCD (the "District") is the entity that owns the easement for the dam and is 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. An analysis of the dam indicated that both the 6-hour and 24-hour FBH events would overtop the dam. There is a risk of the dam failing from overtopping.

Appendix C-8 (Breach Inundation Map) depicts the area that could be inundated if the dam breached under fair weather conditions with the water surface in the reservoir static at the top of dam elevation, per TR-210-60 guidelines. Failure of the dam could result in significant damage and risk to loss of life. The District and Comal County considered the following options in deciding the most likely course of action:

- 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 District and Comal County 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 District does not currently have funds allocated to locally decommission the dam, the District and Comal County would initially accept the risk of damages from failure and continue to maintain the dam in its current condition without any major modifications until it has the local decommission funds allocated. The baseline economic conditions assume that the dam is not in place, since it is expected that the dam would be locally decommissioned by the District, unless the dam fails prior to be locally decommissioned, in which case it is assumed that the District would still perform a local decommission (following the initial failure) to stabilize the site.

The alternatives that were considered for FRS No. 4 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. 4 are described below.

4.2.1 Low Hazard Potential Classification with Nonstructural Measures

Reclassification of FRS No. 4 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 30 residential structures below FRS No. 4 within the breach area, modification and/or installation of flood warning systems of 13 roads downstream 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.

Actions required on the dam to meet low hazard potential classification include:

- Install a new, secondary principal spillway system consisting of a hooded inlet at elevation 758.0 feet (5.75 feet lower than the existing condition crest elevation of 763.75 feet) and a 30-inch RCP conduit discharging into a new impact basin;
- Provide 100-years of future sediment storage;
- Replace rock blanket on 2.5:1 embankment slopes; and
- Existing auxiliary spillways and top of dam elevation to remain.

This alternative meets the purpose and need of the Project but is not considered feasible due to the disruption to community cohesion because of home relocations and the high costs associated with property acquisition and the purchase of easements to restrict future development. This alternative was therefore eliminated from further evaluation.

4.2.2 Dam Rehabilitation with Varying Structural Auxiliary Spillways

The dam rehabilitation alternative carried through to detailed analysis as presented in **Section 4.3.3** was selected after initial analysis of multiple configurations of rehabilitated principal spillway conduit size; addition of a structural overtopping auxiliary spillway over the existing embankment (set at a minimum elevation equal to the 2% AEP PSH); crest raise, widening, and regrading of the left vegetated auxiliary spillway; crest raise and regrading of the right vegetated auxiliary spillway; and corresponding top of dam raise.

A 100-year evaluated life and 104-year period of analysis were established. The principal spillway conduit size of 54 inches was selected for all evaluated alternatives based upon the need to: a) safely pass the PSH; b) achieve a drawdown period less than 10 days; c) keep the proposed auxiliary spillway crest within 2.0 feet of the as-built elevation due to construction considerations of fill placement within an existing vegetated channel; and d) minimize the dam crest raise due to the lack of onsite fill material and volume of fill material required due to dam height. The configuration presented in **Section 4.3.3** for FRS No. 4 best meet these objectives. The other alternatives were eliminated from detailed study due to higher costs and would have similar environmental, social, and economic impacts and benefits as the selected alternative. **Table 4-1** shows the high hazard rehabilitation alternatives that were considered for the Comal River Watershed FRS No. 4 study but eliminated from detailed study.

Table 4-1. High Hazard Rehabilitation Alternatives Considered but Eliminated from Detailed Study

Alt.	Principal Spillway		Earthen Auxiliary Spillway				Structural Spillway		Top of Dam[1]	
	Pipe Size	Crest Elevation	Spillway Width Left	Spillway Width Left	Spillway Crest Elevation	Raised Height	Spillway Width Width/Type	Crest Elevation	Elevation	Raised Height
	[in]	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]	[ft]
Existing	30	763.75	190	190	799.15	N/A	N/A	N/A	806.55	N/A
A	54	758.0	190	190	800.9	1.75	350/RCC step	798.6	807.5	0.95
B	54	758.0	310	190	801.1	1.95	250/RCC step	798.6	808.1	1.55
C	54	759.0	310	190	800.7	1.5	250/RCC step	798.2	807.6	1.05
D	54	758.0	310	190	800.9	1.75	350/RCC step	798.6	807.5	0.95
E	54	758.0	190	190	800.3	1.15	160/ Labyrinth	798.6	806.4	-0.15
F	54	759.0	310	190	801.1	1.95	240/ Labyrinth	800.4	807.1	0.55
G	54	759.0	blocked	190	blocked	N/A	342/ Labyrinth	800.4	806.9	0.35

1. Top of dam elevation includes a preliminary estimate of wave height added to the auxiliary spillway hydrograph peak WSE.

4.2.3 Non-Rehabilitation Program Alternatives for Comal River Watershed

While there are potential structural and non-structural measures that could be implemented within the original Comal River 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 Comal River Watershed FRS No. 4. Alternatives for FRS No. 4 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 to bring FRS No. 4 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 to 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 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 state and federal requirements would also remain. It should also be noted that the dam does not currently meet State dam safety criteria and 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.

This local decommission consists of excavating a breach in the dam of sufficient size to safely pass the 1% AEP, 24-hour storm 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 Sponsor's dam safety liability but would not eliminate all liability. The excavated material (about 110,000 cu. yd.) would be placed in the present easement area. All exposed areas would have vegetation established for erosion control (approximately 20 acres). Construction activities would require that a SWPPP be in effect.

Following the future local decommissioning (prior to or after dam failure) to stabilize 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 7.22 miles downstream of FRS No. 4, ending downstream of Krueger Canyon Road. Since the 1% AEP inundation area (modeled for the purposes of this plan) would be enlarged from 728 acres to 925 acres due to the absence of flood attenuation, potential present and future downstream development would be affected by the increased flood profiles.

The number of residential and nonresidential structures inundated above the FFE during the modeled 1% AEP, 24-hour storm event would increase to six structures. Further downstream through the City of New Braunfels, an additional estimated 26 structures and 273 structures would be inundated above the FFE during the 1% AEP, 24-hour storm and 0.2% AEP storm events, respectively. Floodwaters from a 1% AEP, 24-hour storm event would cause induced flooding on 15 road segments (**Table 4-2**). No mitigation

for induced flooding is included with this alternative. The estimated cost to implement this alternative is $2,260,000.

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 66.1 feet bottom width to safely pass the 1% AEP flood.

The remaining portion of the embankment and the land currently covered by the sediment pool would be maintained as a greenbelt area. The excavated material (about 110,000 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 20 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 2.8 acres). A grade stabilization structure would be installed to stabilize sediment and prevent stream headcutting. In order not to 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 like those described for Alternative 1 - FWOFI with regard to induced flooding on roadways and structures. 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 7.22 miles downstream of FRS No. 4, ending downstream of Krueger Canyon Road. The number of residential and nonresidential structures inundated above the FFE during the modeled 1% AEP, 24-hour storm event would increase to six structures (**Table 4-2**). To mitigate for induced flooding, three structures would be dry floodproofed. Further downstream through the City of New Braunfels, an additional estimated 26 structures and 273 structures would be inundated above the FFE during the 1% AEP and 0.2% AEP, 24-hour storm events, respectively. Costs for mitigation within this semi-qualitative study area in New Braunfels are not included in the economic analysis.

Floodwaters from a 1% AEP, 24-hour flood would cause induced flooding on 15 road segments (**Table 4-2**). To mitigate the impacts, six road segments would have flood warning systems installed that include barricades with flood warning lights that are activated when there is water over the road. The estimated cost to decommission the dam is $4,545,000. Additional costs, including flood warning systems on six roadways to mitigate for induced flooding and floodproofing, are estimated to be $792,000 for a total alternative cost of $5,337,000. A conceptual figure is included as **Appendix C-10**.

Table 4-2. Alternative 1 and Alternative 2 Roadway Induced Flooding During 50%, 1%, and 0.2% AEP Events

Road Segment	Orientation to Dry Comal Creek	Annual Average Daily Traffic (AADT)	Depth Overtop Existing Condition (ft)			Depth Overtop FWOFI / FWFI (ft)			Depth of Overtopping Difference (ft)		
			50%	1%	0.2%	50%	1%	0.2%	50%	1%	0.2%
Maroon Street[1]	Perpendicular	-	0.46	3.57	8.47	0.92	8.60	11.42	0.46	5.03	2.95
Coyote Run (West)[2]	Perpendicular	-	0.00	3.58	9.80	0.00	6.84	10.78	0.00	3.26	0.98
Old Nacogdoches Road at Railroad[2]	Parallel	2278	0.00	4.86	11.60	0.00	8.44	12.65	0.00	3.58	1.05
Old Nacogdoches Road (West of Coyote Run East)[2]	Parallel	530	0.00	4.06	6.93	0.00	5.64	8.09	0.00	1.58	1.16
Coyote Run (East)[2]	Perpendicular	-	0.67	4.35	9.27	0.65	7.23	9.96	-0.02	2.88	0.69
High Creek Road	Perpendicular	-	0.50	4.90	7.77	0.42	6.48	8.93	-0.08	1.58	1.16
FM 482 (West of Bunker St)[3]	Parallel	3041	0.00	0.88	4.14	0.00	3.41	5.24	0.00	2.53	1.10
Bunker Street	Perpendicular	429	0.00	8.52	10.18	0.00	9.93	11.47	0.00	1.41	1.29
FM 482 (East of Bunker St)[3]	Parallel	3041	0.00	8.10	10.42	0.00	9.62	10.97	0.00	1.52	0.55
Schwab Road	Parallel	-	0.00	7.44	10.22	0.00	9.36	10.73	0.00	1.92	0.51
FM 482 (West of Solms Quarry Road)[3]	Parallel	3028	0.00	4.81	7.07	0.00	9.62	10.97	0.00	4.81	3.90
Solms Quarry Road	Perpendicular	-	0.00	10.64	13.93	0.00	12.48	15.94	0.00	1.84	2.01
Krueger Canyon (South)	Perpendicular	1514	0.00	10.56	14.53	0.00	12.42	17.57	0.00	1.86	3.04
Wald Road/Krueger Canyon (West)[4]	Parallel	2268/754	0.00	1.31	5.28	0.00	3.17	8.32	0.00	1.86	3.04
Daniel Drive	Parallel	-	0.00	2.22	5.35	0.00	3.78	6.49	0.00	1.56	1.14

1. This crossing is perpendicular to Bear Creek, just upstream of Dry Comal Creek.
2. These roads have two distinct inundation locations along or perpendicular to Dry Comal Creek and are therefore presented as two road segments in **Table 4-2**.
3. This road has three distinct inundation locations along Dry Comal Creek and is therefore presented as three road segments in **Table 4-2**.
4. Wald Road and Krueger Canyon (West) are connected (i.e. a single road).

4.3.2 Alternative 3 - High Hazard Potential Rehabilitation (FWFI)

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 crest at elevation 759.0 feet and 54-inch RCP conduit discharging into the RCC-step stilling basin,
- Install a 250-feet wide RCC-step structural spillway over the existing embankment with crest set above the 2% AEP PSH elevation at 798.2 feet and discharging into a concrete stilling basin,
- Regrade inlet and outlet channel of the existing left vegetated auxiliary spillway, widen crest from 190 feet to 310 feet, and raise crest to the 1% AEP PSH elevation of 800.7 feet (1.5 feet raise),
- Regrade inlet and outlet channel of the existing right vegetated auxiliary spillway, keep crest at 190 feet wide, and raise crest to the 1% AEP PSH elevation of 800.7 feet (1.5 feet raise),
- Retain top of dam elevation at 806.55 feet, and
- Replace rock blanket on 2.5:1 embankment slope.

Additional spillway protection was not included in Alternative 3 based upon a stability evaluation of the channel spillways as vegetated channels. The analysis indicates that the exit channels are stable under the SDH flows. A detailed geological investigation during the design phase may reveal that the spillways do not meet stability and/or integrity criteria, and thus ACB armoring or a shallow cutoff wall may be necessary. Currently an earthen spillway raise is proposed over in-situ rock and the exit channel slopes are relatively steep on this structure.

The elevation of the RCC-step structural spillway was set between the 50-year and 100-year PSH peak WSE with consideration of the peak flow during both the 100-year PSH event and the 1% AEP event. The discharge from the dam with the RCC-step crest at 798.2 feet will keep both the 100-year PSH and the 1% AEP, 24-hour event peak flows out of the dam slightly less than the existing condition. For all frequency storm events, the peak flow will slightly increase downstream throughout the modeled reach due to the increased discharge from the larger 54-inch versus the 30-inch conduit. No additional habitable structures will be flooded. Induced flooding impacts to roadways during the 1% AEP event for Alternative 3 are provided in **Table 4-3**.

There is a quarry-owned clubhouse located north of the right auxiliary spillway (approximate ground elevation of 771.0 feet) that will not be impacted during any frequency storm event. The WSE during the 1% AEP decreases from 768.5 feet during existing conditions no flow past the clubhouse after rehabilitation. The WSE during the 0.2% AEP decreases from 774.09 feet during existing conditions to 770.26 feet after rehabilitation.

Table 4-3. Alternative 3 Roadway Induced Flooding During 50%, 1%, and 0.2% AEP Events

Road Segment	Orientation to Dry Comal Creek	Annual Average Daily Traffic (AADT)	Depth Overtop Existing Condition (ft)			Depth Overtop Alternative 3 (ft)			Depth of Overtopping Difference (ft)		
			50%	1%	0.2%	50%	1%	0.2%	50%	1%	0.2%
Maroon Street[1]	Perpendicular	-	0.46	3.57	8.47	0.68	3.56	8.75	0.22	-0.01	0.28
Coyote Run (West)[2]	Perpendicular	-	0.00	3.58	9.80	0.00	3.66	9.83	0.00	0.08	0.03
Old Nacogdoches Road at Railroad[2]	Parallel	2278	0.00	4.86	11.60	0.00	4.96	11.64	0.00	0.10	0.04
Old Nacogdoches Road (West of Coyote Run East)[2]	Parallel	530	0.00	4.06	6.93	0.00	4.14	6.97	0.00	0.08	0.04
Coyote Run (East)[2]	Perpendicular	-	0.67	4.35	9.27	0.66	4.44	9.30	-0.01	0.09	0.03
High Creek Road	Perpendicular	-	0.50	4.90	7.77	0.50	4.98	7.81	0.00	0.08	0.04
FM 482 (West of Bunker St)[3]	Parallel	3041	0.00	0.88	4.14	0.00	0.95	4.19	0.00	0.07	0.05
Bunker Street	Perpendicular	429	0.00	8.52	10.18	0.00	8.59	10.16	0.00	0.07	-0.02
FM 482 (East of Bunker St)[3]	Parallel	3041	0.00	8.10	10.42	0.00	8.16	10.48	0.00	0.06	0.06
Schwab Road	Parallel	-	0.00	7.44	10.22	0.00	7.50	10.27	0.00	0.06	0.05
FM 482 (West of Solms Quarry Road)[3]	Parallel	3028	0.00	4.81	7.07	0.00	4.87	7.11	0.00	0.06	0.04
Solms Quarry Road	Perpendicular	-	0.00	10.64	13.93	0.00	10.71	13.97	0.00	0.07	0.04
Krueger Canyon (South)	Perpendicular	1514	0.00	10.56	14.53	0.00	10.61	14.59	0.00	0.05	0.06
Wald Road/Krueger Canyon (West)[4]	Parallel	2268/754	0.00	1.31	5.28	0.00	1.36	5.34	0.00	0.05	0.06
Daniel Drive	Parallel	-	0.00	2.22	5.35	0.00	2.29	5.38	0.00	0.07	0.03

1. This crossing is perpendicular to Bear Creek, just upstream of Dry Comal Creek.
2. These roads have two distinct inundation locations along or perpendicular to Dry Comal Creek and are therefore presented as two road segments in **Table 4-3**.
3. This road has three distinct crossings over Dry Comal Creek and is therefore presented as three road segments in **Table 4-3**.
4. Wald Road and Krueger Canyon (West) are connected (i.e. a single road).

During construction, Best Management Practices (BMPs) 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 change in reservoir or downstream operation would result from this alternative. The cost of this alternative is $15,680,000 and a conceptual figure is included as **Appendix C-11**. Additional costs, including flood warning systems on two roadways to mitigate for induced flooding, are estimated to be at least $240,000 for a total alternative cost of $15,920,000.

4.4 Comparison of Alternatives

Table 4-4 provides a comparison of the social, environmental, and economic impacts and benefits of each of the considered alternatives. **Table 4-5** provides a summary of the impacts and benefits of the considered alternatives in the context of the Guiding Principles from the PR&G.

Based up on the comparisons below, Alternative 3 is the recommended plan. NRCS and the Sponsors are in agreement on the recommended plan. Further discussion is included in **Section 7.1**.

Table 4-4. Summary and Comparison of Alternative Plans for Comal River Watershed FRS No. 4

Item	No Federal Action/FWOFI Alternative 1	Decommission with Federal Assistance Alternative 2	Rehabilitation (High Hazard Potential) Alternative 3
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.	No impacts to prime and unique farmlands are anticipated within the FRS No. 4 LOD. Would eliminate current flood protection for downstream prime and unique farmlands. No estimated agricultural damages of actively farmed crops would be avoided.	No impacts to prime and unique farmlands are anticipated within the FRS No. 4 LOD. Would continue to provide similar level of flood protection for prime and unique farmlands. The estimated annual agricultural damages of actively farmed crops that would be avoided total $1,000.
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, other waterbodies, and wetlands downstream. Long-term positive impact resulting in a more natural, higher quality aquatic function.	The controlled breach of the dam would increase the potential for flooding that would likely impact streams, other waterbodies, and wetlands downstream. Long-term positive impact resulting in a more natural, higher quality aquatic function.	No impacts as there are no potentially jurisdictional waters of the U.S. present.
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 sedimentation downstream. Local decommission would eliminate the current	Would result in streambank erosion downstream and within the drained sediment pool, eliminate the current function of the dam to collect and retain	The increase in conduit flow will cause an initial period of streambank erosion during routine storm events until the streambanks stabilize. Would continue to allow the dam

Item	No Federal Action/FWOFI Alternative 1	Decommission with Federal Assistance Alternative 2	Rehabilitation (High Hazard Potential) Alternative 3
	function of the dam to collect and retain sediment and increase the potential for downstream erosion and sedimentation to properties, roads, and utilities.	sediment, and increase the potential for downstream erosion and sedimentation to properties, roads, and utilities.	to collect and retain sediment, would provide 100-yrs of sediment capacity, and would reduce the downstream erosion potential by safely passing controlled storm flows through the new conduit.
Floodplain Management	Initially, no change. Breach would result in extensive flooding downstream. Local decommissioning would result in increased floodplain area and induced flooding to roadways. A FEMA LOMR may be required.	Would result in increased floodplain area and induced flooding to roadways. Floodproofing of three structures and flood warning systems on six roadway segments are recommended to mitigate induced flooding impacts. A FEMA LOMR may be required.	Would continue to provide flood protection benefits and would have minimal impacts on the existing downstream floodplain. Flood warning systems on two roadway segments are recommended to mitigate induced flooding impacts. The upstream floodplain elevation would decrease 1.6 ft due to the lower water surface in the reservoir.
Sole Source Aquifer	Initially, no change. Breach and local decommission would likely reduce the recharge rate to the Edwards Aquifer by allowing for continuous water flow rather than creating a standing pool that may allow steady infiltration.	Would likely reduce the recharge rate to the Edwards Aquifer by allowing for continuous water flow rather than creating a standing pool that may allow steady infiltration.	Would continue to provide similar recharge benefits to the Edwards Aquifer.
Water Quality	Initially, no change. Breach would cause impacts due to discharge of fill and sediment. Local decommission would allow sediment to move downstream decreasing the water quality. Minor, temporary impacts to water quality during construction. No significant impacts on bacterial impairment of Dry Comal Creek.	Would allow sediment to move downstream decreasing the water quality. Minor, temporary impacts to water quality during construction. No significant impacts on bacterial impairment of Dry Comal Creek.	Minor, temporary impacts to water quality during construction. Sedimentation would be managed through a SWPPP. No significant impact on the bacterial impairment of Dry Comal Creek.
Woodland Vegetation/Forest Resources	Initially, no change. Breach would result in loss of forest resources due to sudden release of flows. Local decommission would result in the removal of approximately 2.0 acre of vegetation including trees. Forest resources downstream would be subject to frequent flooding.	Would result in the removal of approximately 2.0 acre of vegetation including trees. Forest resources downstream would be subject to frequent flooding.	Would result in the removal of approximately 5.0 acres of vegetation including trees.

Item	No Federal Action/FWOFI Alternative 1	Decommission with Federal Assistance Alternative 2	Rehabilitation (High Hazard Potential) Alternative 3
Invasive Species (Plants)	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.	Same impacts as Alternative 2.
Threatened and Endangered Species - Plants	Based on USFWS species list for the project, there are no federally listed plant species with the potential to occur within the project.		
Threatened and Endangered Species – Animals	Suitable habitat is present for the federally endangered golden-cheeked warbler. However, based on presence/absence surveys, the species was determined to be absent for the 2023 breeding season. Based on the presence of suitable habitat but absence of individuals, the effect determination for the golden-cheeked warbler would be may effect, not likely to adversely affect. The project is anticipated to participate in the Comal County Habitat Conservation Plan as directed by the USFWS during communications. In addition, based on communication with the USFWS in April 2023, there are not enough project details (design) to complete a Biological Assessment/Biological Opinion at this time; therefore, consultation/coordination cannot be completed until the project is further into design. Suitable habitat is not present for any additional federally listed animal species. Suitable habitat is present for the federally proposed endangered tricolored bat. However, no action is required at this time as this species is not currently afforded statutory protection under the Endangered Species Act.		
Fish and Wildlife	Initially, no change. Breach would cause impacts to downstream fish and wildlife habitat due to sudden release of flows and sediment. Local decommission would eliminate downstream protection from flooding which would result in impacts to downstream aquatic and terrestrial wildlife and their habitat. Minor, temporary impacts to terrestrial habitat may occur during construction. Less-mobile species may be lost due to equipment during construction.	Would eliminate downstream protection from flooding which would result in impacts to downstream aquatic and terrestrial wildlife and their habitat. Minor, temporary impacts to terrestrial habitat may occur during construction. Less-mobile species may be lost due to equipment during construction.	Would maintain the existing terrestrial wildlife and their habitat in the long term. Downstream aquatic and terrestrial wildlife and habitat would continue to be maintained and protected by controlling the stream flow. Minor, temporary impacts to terrestrial habitat may occur during construction. Less-mobile species may be lost due to equipment during construction.
Migratory Birds/Bald and Golden Eagle	Initially, no change. Breach could have effects on migratory birds as result of tree damage from sudden release of flows. Local decommissioning may temporarily affect migratory birds if construction activities	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.	Same as Alternative 2

Item	No Federal Action/FWOFI Alternative 1	Decommission with Federal Assistance Alternative 2	Rehabilitation (High Hazard Potential) Alternative 3
	occur between March 1 and August 31. Appropriate measures will be implemented in accordance with the MBTA.		
Cultural Services – Makes the world a place people want to live (e.g., recreation , spiritual, aesthetics)			
Environmental Justice	Initially, no change. Breach could have significant impacts to downstream minority and low-income populations. Local decommissioning would remove flood protection benefits and could trigger increased development regulations, which could negatively impact minority and low-income populations.	Decommissioning would remove flood protection benefits and could trigger increased development regulations, which could negatively impact minority and low-income populations.	Would allow flood protection benefits to continue and would avoid potential negative impacts to 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 regulations.	Would result in downstream land use changes because of more frequent flooding and development regulations.	Minimal changes to land use and vegetation cover due to the widening of the left existing auxiliary spillway crest and installation of the overtopping spillway.
Local and Regional Economy	Initially, no change. Breach would result in significant impacts to local economy as a result of downstream damage. 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 developed areas, infrastructure, and agricultural 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 developed areas, infrastructure, and agricultural areas.	Would result in a temporary positive impact on the local economy during construction and would continue to provide flood protection for downstream developed areas, infrastructure, and agricultural areas.
Public Health and Safety	Initially no changes. Breach would cause significant impacts due to sudden release of flows and fill. Local decommission would remove the risk associated with the potential for dam failure. The 1% AEP floodplain would be expanded, and increased development regulations 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, after the dam has been removed. The 1% AEP floodplain would be expanded, and increased development regulations would be implemented to protect public health and safety within the enlarged floodplain area.	Would maintain the flood protection benefits for 100 years. Upstream of the dam, the 1% AEP 24-hour flood pool will be 1.3 feet lower than the existing condition. The downstream water surface elevation during the 1% AEP 24-hour storm event will be similar to the current condition (maximum increase 0.29 feet). The threat to loss of life from failure of the dam would be greatly reduced.

Item	No Federal Action/FWOFI Alternative 1	Decommission with Federal Assistance Alternative 2	Rehabilitation (High Hazard Potential) Alternative 3
Cultural Resources/ Historic Properties	Initially, no change. Breach could result in impacts to downstream cultural resources. if there are any located within the breach inundation area. NRCS determined that no historic properties are present or affected. Coordination was completed with the Texas SHPO and concurrence was received on June 26, 2021. Cultural resources are not anticipated to be impacted by the local decommissioning. Consultation with relevant tribes was initiated on July 6, 2022 and was completed on March 7, 2023.	NRCS determined that no historic properties are present or affected. Coordination was completed with the Texas SHPO and concurrence was received on June 26, 2021. Cultural resources are not anticipated to be impacted by this alternative. Consultation with relevant tribes was initiated on July 6, 2022 and was completed on March 7, 2023.	Same as Alternative 2
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 loss of community cohesion due to increased flooding on roadways and impacts to downstream structures.	Could result in loss of community cohesion due to increased flooding on roadways and impacts to downstream structures.	No impacts to community cohesion anticipated.
Economic Analysis			
Costs			
Project Investment			
Total	$2,260,000	$5,337,000	$15,920,000
Annual O&M Costs			
Total	$0	$0	$5,000
Total Annual Costs	$64,000	$150,000	$452,000
Benefits			
Structures	$0	$10,000	$28,000
Agricultural	$0	$0	$1,000
Infrastructure	$0	$0	$10,000
Total Annual Benefits	$0	$10,000	$38,000
Evaluation			
Benefit-Cost Ratio	N/A	0.07	0.08
Net Benefit	N/A	-$140,000	-$414,000

Notes: Price Base: 2022 price level, 2.5% discount rate, 104-year period of analysis, Total Annual Costs includes interest during construction, columns may not sum exactly due to rounding.

Table 4-5. Consideration of PR&G Guiding Principles for Comal River Watershed FRS No. 4

PR&G GUIDING PRINCIPLES	Alternative 1 No Federal Action/FWOFI – Sponsor Breach	Alternative 2 Decommission with Federal Assistance	Alternative 3 High Hazard Potential Rehabilitation
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 conditions.	Return stream's ecological function to pre-impoundment conditions.	Maintain current ecological function of impoundment area for wildlife habitat.
Sustainable Economic Development	Initially no effect while still subjecting downstream areas to risk of 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 subjecting downstream areas to risk of breach. The 1% AEP floodplain downstream would be increased from 728 to 925 acres (27% increase).	Remove flood protection benefits. Three structures would be dry floodproofed. The 1% AEP floodplain downstream would be increase from 728 to 925 acres (27% increase).	1% AEP floodplain downstream would remain similar to existing condition, area would be slightly increased from 728 to 735 acres (1% increase).
Public Safety	Initially maintain current level of public safety while still subjecting downstream areas to breach risk. Breach would cause significant, temporary impacts to public safety. Local decommission would remove loss of life threat but would also remove flood protection benefits and increase frequency and extent of flooding.	Threat to loss of life from breach eliminated. Remove public safety benefits from dam and increase flooding extents. Flood warning systems to be installed on six road segments to mitigate increased risk to public safety.	Reduced threat to loss of life with flood protection maintained. Flood warning systems to be installed on two road segments to mitigate increased risk to public safety.
Environmental Justice	Initially, affected populations downstream will continue to be at risk of a dam breach. Local decommission will result in loss of flood protection for downstream minority and low-income populations.	Loss of flood protection for downstream minority and low-income populations.	Flood protection maintained with minimal change to existing condition.
Watershed Approach	Initially, maintain ecological function of Dry Comal Creek and contribution to ecological function of Comal 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 Dry Comal Creek and contribution to ecological function of Comal River system but would also subject downstream habitat area to routine uncontrolled flows and sediment.	Maintain ecological function of Dry Comal Creek and contribution to ecological function of Comal 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. 4. 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. 4.
- 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. 4 rehabilitation project to determine the level of NEPA approvals required. 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 evaluated alternatives at FRS No. 4 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
- Riparian Areas
- Coral Reefs
- Ecologically Critical Areas
- Essential Fish Habitat
- Invasive Species (Animals)
- Cultural Resources/Historic Properties
- Drought
- Park Lands, Scenic Areas
- Public Recreation
- Scenic Beauty
- Scientific Resources

5.3 Comparative Environmental Effects of Alternatives – FRS No. 4

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 no areas of prime and unique farmland within the FRS No. 4 projected maximum LOD.

There are areas located adjacent to Dry Comal Creek downstream of FRS No. 4 that have been identified as prime farmland that appear to be actively being farmed. The nearest such area is approximately 2 river miles downstream of FRS No. 4. Actively farmed crops within the study area include corn, forage, oats, and winter wheat.

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 the downstream areas of prime farmland and farmland of statewide importance to more frequent and severe flooding. Due to the potential for more frequent flooding if flood protection is removed, these areas may not be considered prime and unique farmlands. No impacts to prime and unique farmlands are anticipated within the FRS No. 4 LOD.

Decommission (FWFI)
The Dam Decommission Alternative eliminates the existing flood protection and subjects the areas downstream to more frequent and severe flooding. Due to the potential for more frequent flooding if flood protection is removed, these areas may not be considered prime and unique farmlands. No impacts to prime and unique farmlands are anticipated within the FRS No. 4 LOD. No estimated agricultural damages of actively farmed crops would be avoided as a result of the Dam Decommission Alternative.

High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alternative would maintain the flood protection downstream of the dam resulting in inundation for short periods of time. No impacts to prime and unique farmlands are anticipated within the FRS No. 4 LOD. The estimated annual agricultural damages of actively farmed crops that would be avoided as a result of the High Hazard Potential Rehabilitation Alternative total $1,000.

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. 4 LOD is Comfort-Rock outcrop complex (CrD). Current conditions indicate that some areas of erosion in the left auxiliary spillway section are present. The gully is currently stable and should not erode into the control section of the auxiliary spillway due to a rock outcropping that would likely prevent it.

Sedimentation – FRS No. 4 is currently functioning to collect and retain sediment, albeit minimal, from the contributing watershed.

No Action/FWOFI
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.

Decommission (FWFI)
The Dam Decommission Alternative would result initially result in streambank erosion downstream and within the drained sediment pool until the streambanks stabilize following a period of routine storm event flows. 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.

High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alternative would rehabilitate the dam to meet NRCS High Hazard Potential Class dam criteria. Due to the increased conduit size, the flows out of the dam will increase from 90 cfs and 105 cfs to 123 cfs and 345 cfs, respectively, during the 50% and 20% AEP events. The increased conduit flow will cause an initial period of streambank erosion during these routine storm events until the streambanks stabilize. This Alternative would continue to allow the dam to collect and retain sediment as well as continue to reduce the downstream erosion potential by safely passing controlled storm flows through the new conduit.

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 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 breach of other flood retarding structures within the watershed.

5.3.3 Floodplain Management

Existing Conditions

FRS No. 4 is within a FEMA-regulated 1% AEP floodplain (Zone AE with Floodway) for Comal County Unincorporated Areas, effective date September 2, 2009. Zone AE designates a special flood hazard area that has Base Flood Elevations that have been determined. The Floodway within a Zone AE floodplain is the channel of a stream plus any adjacent floodplain that must be kept free from encroachment so that the 1% AEP flood can be carried without substantial increases in flood heights.

1% and 0.2% AEP floodplains were generated from the detailed hydraulic models developed for this project and are shown on Figure C-9. 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, 24-hour storm event is 801.00 feet, which is 1.85 feet higher than the existing auxiliary spillway elevation of 799.15 feet (as-built adjusted). The corresponding peak outflow from FRS No. 4 during the 1% AEP event is 1,596 cfs.

The modeled floodplain areas for the existing conditions for the 4%, 2%, 1%, and 0.2% AEP storm events would be 417 acres, 574 acres, 728 acres, and 1080 acres, respectively.

No Action/FWOFI

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 floodplain management due to 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 retard peak flows. This alternative will cause additional damages to downstream private property and road crossings. The number of residential and nonresidential structures inundated above the FFE during the modeled 1% AEP, 24-hour storm event would increase from two to six structures. Floodwaters from a 1% AEP, 24-hour storm event would cause induced flooding on 15 road segments (**Table 4-2**).

The modeled floodplain areas for this alternative for the 4%, 2%, 1%, and 0.2% AEP storm events would be 577 acres, 757 acres, 925 acres, and 1,234 acres, respectively. The increase in 1% AEP floodplain acreage withing the modeled study area is 197 acres. A Letter of Map Revision (LOMR) may be required from FEMA post-construction to revise effective FIRMs and show changes to the floodplains and/or flood elevations.

Downstream of the detailed modeled study area, additional floodplain impacts were evaluated using a less detailed approach through the City of New Braunfels with the existing BLE HEC-RAS model (FEMA 2015). This semi-quantitative evaluation indicates that through this populated area, decommissioning the dam would put 26 and 273 more homes in the modeled floodplain during the 1% and 0.2% AEP events, respectively (Figure D-6A and D-6B). These structures were not considered in the detailed economic evaluation; however these additional structures would only increase the damages associated with the No Action/FWOFI Alternative.

Decommission (FWFI)

Decommission Alternative would remove the flood protection benefits, as the structure would no longer be able to store floodwater, store sediment, and retard peak flows. The downstream floodplain extent would increase. This alternative will cause additional damages to downstream private property and road

crossings. The number of residential and nonresidential structures inundated above the FFE during the modeled 1% AEP, 24-hour storm event would increase from two to six structures. Floodwaters from a 1% AEP, 24-hour storm event would cause induced flooding on 15 road segments (**Table 4-2**). Mitigation for the residential, non-residential, and road crossing structures would be necessary to meet the purpose and need of the project. Based on the estimated depth of flooding at each of the impacted residential and nonresidential structures in the detailed economics study area, it was assumed that five structures would be floodproofed to prevent induced flooding. Additionally, six roads would have flood warning systems installed to protect against induced flooding.

The modeled floodplain areas for this alternative for the 4%, 2%, 1%, and 0.2% AEP storm events are the same as the No Action/FWOFI Alternative. A CLOMR may be required from FEMA post-construction to revise effective FIRMs and show changes to the floodplains and/or flood elevations.

Downstream of the economic modeled study area, additional floodplain impacts along Dry Comal Creek were evaluated using a less detailed approach through the City of New Braunfels with the existing BLE HEC-RAS model (FEMA 2015). This semi-quantitative evaluation indicates that through this populated area, decommissioning the dam would put 26 and 273 more homes in the modeled floodplain above the FFE during the 1% and 0.2% AEP events, respectively (**Figure D-6a** and **Figure D-6B**). These structures were not considered in the detailed economic evaluation; however, these additional structures would only increase the damages associated with the Decommissioning Alternative.

<u>High Hazard Potential Rehabilitation (FWFI)</u>
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 reduced to less than 10 days. Based on the flood routing for the 1% AEP, 24-hour event, the peak WSE elevation in the dam backwater would be approximately 799.4 feet, or 1.6 feet lower than the existing condition. The peak outflow from FRS No. 4 during the 1% AEP event is approximately 1,582 cfs, including outflow from both the conduit and the RCC overtopping spillway.

The increased conduit size will allow larger, more routine flows immediately downstream of FRS No. 4 (50% AEP = 123 cfs and 4% AEP = 473 cfs) versus the existing condition conduit (50% AEP = 90 cfs and 4% AEP = 130 cfs). The increase in discharge from the existing condition at the 50% AEP event will only cause an increase in overtopping depth of 0.22 feet at private quarry road Maroon Street just downstream of Dam 4, and will not cause increase in overtopping depths at any other downstream road crossing. Due to the impacts at roadways, two roads will have flood warning systems installed to protect against induced flooding.

The modeled floodplain areas for this alternative for the 4%, 2%, 1%, and 0.2% AEP storm events would be 430 acres, 582 acres, 735 acres, and 1084 acres, respectively. The increase in 1% AEP floodplain acreage withing the modeled study area is 7 acres.

Downstream into the City of New Braunfels using the BLE model, floodplain impacts indicate no additional structures in the modeled 1% AEP floodplain and six additional structures in the 0.2% AEP floodplain above the FFE elevations. These structures were not considered in the detailed economic evaluation.

<u>Cumulative Impacts</u>
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. 4 is located within the Edwards Aquifer Recharge Zone. The Edwards Formation is porous and karstic which creates highly permeable zones that allow for the movement of groundwater through faults, fractures, and conduits. Recharge occurs primarily from losing streams in the outcrop area and, to lesser extent, from rainfall. Because rainfall is highly variable, recharge amounts change from year to year. The original purpose of FRS No. 4 did not include recharge benefits. The rate or quantity of recharge provided by this structure has not been quantified.

No Action/FWOFI
The No Action/FWOFI Alternative would have no effect on the existing conditions of recharge to the Edwards 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 a reduction in recharge due to the loss of storage function of the dam. 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, any current recharge benefits would be decreased, as the structure would no longer be able to store floodwater to facilitate recharge.

Decommission (FWFI)
The Decommission Alternative could result in less recharge to the Edwards Aquifer. This Alternative includes a controlled breach of the dam and would eliminate the current function of the dam to provide recharge benefits to the Edwards Aquifer.

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 provide similar recharge benefits to what it currently provides.

Cumulative Impacts
Potential long-term minor impacts to recharge of the Edwards Aquifer could 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 Edwards Aquifer resulting from future development and rehabilitation or breach of other flood retarding structures within the watershed.

5.3.5 Streams, Lakes, and Wetlands

Existing Conditions
Based on desktop review, two NHD mapped features, Bear Creek and an unnamed tributary, were determined to be potentially present within FRS No. 4. However, based on field investigations, these features were determined not to be present. Therefore, no potentially jurisdictional streams, lakes, or wetlands were observed within FRS No. 4.

In addition, based on field investigations, FRS No. 4 did not exhibit a normal pool/sediment area.

The existing condition exhibits a lower quality aquatic function due to impoundment.

No Action/FWOFI
The No Action/FWOFI Alternative would have no effect on the downstream streams and 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. downstream and would cause temporary flooding that would impact the features downstream of FRS No. 4 through destruction or accumulation of fill material. 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 be eliminated. The controlled breach of the dam would increase the potential for routine flooding that would likely negatively impact streams, other waterbodies, and wetlands downstream of FRS No. 4 due to uncontrolled flows and sediment. The controlled breach could have a long-term positive impact resulting in a more natural, higher quality aquatic function through the conversion of still water back to the free flowing.

Decommission (FWFI)
The Decommission Alternative would result in a discharge of fill material into potentially jurisdictional waters of the U.S. during and after the controlled breach downstream of FRS No. 4. This would be managed through the implementation of a SWPPP and use of BMPs. The controlled breach of the dam would increase the potential for routine flooding that would likely negatively impact streams, other waterbodies, and wetlands downstream of FRS No. 4 due to uncontrolled flows and sediment accumulation. Decommissioning of the dam could have a long-term positive impact resulting in a more natural, higher quality aquatic function through the conversion of still water back to the free flowing.

High Hazard Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alternative would not result in the discharge of fill material into potentially jurisdictional waters of the U.S. due to the lack of features associated with FRS No. 4. Potential downstream impacts would be managed through the implementation of a SWPPP and use of BMPs. This alternative maintains the aquatic function due to continued impoundment.

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 that existed prior to the dam being constructed. These potential long-term effects would be incremental to other regional impacts to streams, other waterbodies, and wetlands resulting from future development and 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 (TCEQ, 2020) did not identify Bear Creek (mapped NHD feature) as being an impaired stream but did identify Dry Comal Creek as being impaired for bacteria in water. The confluence of Bear Creek with Dry Comal Creek is approximately 0.34 miles downstream of FRS No. 4.

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. 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 minimal sediment from upstream erosion to move downstream, decreasing the water quality. Minor, temporary impacts to water quality would occur as a result of erosion and sedimentation during construction. Erosion and sedimentation would be managed through the implementation of a SWPPP and use of BMPs. It is not anticipated that the No Action/FWOFI Alternative would have an impact on the current bacterial impairment in Dry Comal Creek.

Decommission (FWFI)
The Decommission Alternative would allow minimal sediment from upstream erosion to move downstream as a result of the controlled breach of the dam decreasing the water quality. Minor, temporary impacts to water quality would occur as a result of erosion and sedimentation during construction. Erosion and sedimentation would be managed through the implementation of a SWPPP and use of BMPs. It is not anticipated that the No Federal Action/FWOFI Alternative would have an impact on the current bacterial impairment in Dry Comal Creek.

High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alternative would result in temporary impacts to water quality during construction. Erosion and sedimentation would be managed through the implementation of a SWPPP and use of BMPs. It is not anticipated that the High Hazard Potential Alternative would have an impact on the current bacterial impairment in Dry Comal Creek.

Cumulative Impacts
Temporary impacts to water quality would occur during construction associated with decommissioning or rehabilitation; however, these impacts would be minimized 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, minimal 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 development in the watershed and rehabilitation or breach of other flood retarding structures within the watershed.

5.3.7 Woodland Vegetation/Forest Resources

Existing Conditions
There is approximately 25 acres with trees within the LOD consisting primarily of Ashe juniper (*Juniperus ashei*), live oak (*Quercus fusiformis*), honey mesquite (*Prosopis glandulosa*), hackberry (*Celtis laevigata*), and cedar elm (*Ulmus crassifolia)*.

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 result in significant impacts through damage and/or uprooting woodland vegetation/forest resources resulting from the sudden discharge of large, high velocity 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 decommission is estimated to result in the removal of approximately

2.0 acres of vegetation including trees. Temporary, but significant negative impacts to woodland vegetation/forest could occur by uprooting vegetation as a result from the sudden discharge of large, high velocity flows. Potential positive impacts could occur due to increased water availability outside of the existing limits if the dam is removed either through catastrophic breach or decommissioning and no longer impounding water that could allow for increased diversity in vegetation.

Decommission (FWFI)
The Decommission will result in the removal of approximately 2.0 acres of vegetation including trees. Temporary, but significant negative impacts to woodland vegetation/forest could occur by uprooting vegetation as a result from the sudden discharge of large, high velocity flows. Potential positive impacts could occur due to increased water availability outside of the existing limits because the dam is no longer impounding water that could allow for increased diversity in vegetation.

High Hazard Potential Rehabilitation (FWFI)
The High Hazard Rehabilitation Alternative would result in the removal of approximately 5.0 acres of vegetation including trees. This alternative maintains the existing flood protection and water availability for downstream woodland vegetation/forest resources.

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 negative impacts to woodland vegetation/forest could occur in the event of catastrophic breach by uprooting vegetation as a result of the sudden discharge of large, high velocity flows. Potential long-term negative impacts to downstream woodland vegetation/forest resources could occur if the storage function of the dam is removed either through catastrophic breach or decommissioning by uprooting vegetation and/or change in resource availability/capacity as a result of flooding. Potential long-term positive impacts could occur due to increased water availability outside of the existing limits if the dam is removed either through catastrophic breach or decommissioning and no longer impounding water that could allow for increased diversity in vegetation. These long-term effects would be incremental to other regional impacts to woodland vegetation/forest resource resulting from future development in the watershed and rehabilitation or breach of other flood retarding structures within the watershed.

5.3.8 Invasive Species - Plants

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 where FRS No. 4 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 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.

5.3.9 Threatened and Endangered Species – Plants and Animals

Existing Conditions
Based on the USFWS IPaC report, federal species with the potential to occur in the project area include:

- Golden-cheeked warbler (*Setophaga chrysoparia*), 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;
- San Marcos salamander (*Eurycea nana*), Federal Threatened/State Threatened;
- Texas blind salamander (*Eurycea rathbuni*), Federal Endangered/State Endangered;
- Fountain darter (*Etheostoma fonticola*), Federal Endangered/State Endangered;
- False spike (Fusconaia mitchelli), Federal Proposed Endangered;
- Guadalupe orb (Cyclanaias necki), Federal Proposed Endangered;
- Monarch butterfly (Danaus plexippus), Federal Candidate;
- Guadalupe fatmucket (Lampsilis bergmanni), Federal Proposed 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;
- Tricolored Bat (*Permyotis subflavus*), Federal Proposed Endangered; and
- Texas wild-rice (*Zizania texana*), Federal Endangered.

Field investigations occurred on July 21, 2020 and July 6, 2022 to assess the potential for suitable habitat at FRS No. 4. 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. 4 totaling approximately 25 acres. However, based on presence/absence surveys, the species was determined to be absent for the 2023 breeding season. Suitable habitat is present for the federally proposed endangered tricolored bat.

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

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 federally-listed endangered golden cheeked warbler and federally proposed endangered tricolored bat have the potential to occur in the project area and may be directly affected by the local decommissioning by removing the species' habitat as well as indirectly temporarily impacted as a result of construction. Based on presence/absence surveys for the golden cheeked warbler, the species was determined to be absent for the 2023 breeding season. Based on the presence of suitable habitat but absence of individuals, the effect determination for the golden-cheeked warbler would be may effect, not likely to adversely affect. The project is anticipated to participate in the Comal County Habitat Conservation Plan as directed by the USFWS during communications. In addition, based on communication with the USFWS, there are not enough project details (design) to complete a Biological Assessment/Biological Opinion at this time; therefore, consultation/coordination cannot be completed until the project is further into design. Suitable habitat is not present for any additional federally listed animal species.

No action is required at this time for the tricolored bat as it is not currently afforded statutory protection under the Endangered Species Act.

BMPs would be implemented to minimize impacts to state-listed species.

Decommission (FWFI)

The federally-listed endangered golden cheeked warbler and federally proposed endangered tricolored bat have the potential to occur in the project area and may be directly affected by the Decommission Alternative by removing the species' habitat as well as indirectly temporarily impacted as a result of construction. Based on presence/absence surveys for the golden cheeked warbler, the species was determined to be absent for the 2023 breeding season. Based on the presence of suitable habitat but absence of individuals, the effect determination for the golden-cheeked warbler would be may effect, not likely to adversely affect. The project is anticipated to participate in the Comal County Habitat Conservation Plan as directed by the USFWS during communications. In addition, based on communication with the USFWS, there are not enough project details (design) to complete a Biological Assessment/Biological Opinion at this time; therefore, consultation/coordination cannot be completed until the project is further into design. Suitable habitat is not present for any additional federally listed animal species.

No action is required at this time as the tricolored bat as it is not currently afforded statutory protection under the Endangered Species Act.

BMPs would be implemented to minimize impacts to state-listed species.

High Hazard Potential Rehabilitation (FWFI)
Same as the Decommission Alternative.

Cumulative Impacts
Temporary impacts to threatened and endangered species would occur during construction associated with decommissioning or rehabilitation due to noise and air impacts from equipment. Temporary but significant impacts would occur in the event of catastrophic breach due to flooding that could result in loss of life and/or minor loss of habitat. Potential negative long-term impacts to downstream threatened and endangered species would result from minor loss of habitat and uncontrolled flows being discharged into downstream habitat if the is dam removed either through catastrophic breach or decommissioning.

5.3.10 Fish and Wildlife

Existing Conditions
The FRS No. 4 LOD and surrounding area is generally consistent with previously disturbed lands associated with the dam and an adjacent quarry. 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 upland mowed grasses and woodland areas.

No Action/FWOFI
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 including loss of life and/or loss of habitat as a result of the sudden discharge of fill/sediment and large, high velocity 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 decommissioning, downstream protection from routine flooding would be eliminated, which would result in negative impacts to downstream aquatic and terrestrial wildlife and their habitat from loss of habitat and uncontrolled flows being discharged into downstream habitat 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.

Decommission (FWFI)
The Decommission Alternative would eliminate downstream protection from flooding which would result in negative impacts to downstream aquatic and terrestrial wildlife and their habitat from loss of habitat and uncontrolled flows being discharged into downstream habitat 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.

High Hazard Potential Rehabilitation (FWFI)
The High Hazard Rehabilitation Alternative would maintain the existing 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 providing flood protection. 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.

Cumulative Impacts
Temporary impacts to fish and wildlife would occur during construction associated with decommissioning or rehabilitation. Temporary, but significant negative impacts to fish and wildlife from loss of life and/or loss of habitat as a result of the sudden discharge of fill/sediment and large, high velocity flows in the event of catastrophic breach. Negative long-term impacts to downstream fish and wildlife from loss of life and/or loss of habitat 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 back to free flowing which could increase available habitat resources. 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.

5.3.11 Migratory Birds/Bald and Golden Eagles

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. 4 LOD are protected by the MBTA. During the site reconnaissance, no bald eagles or nests were observed.

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 where tree removal is necessary.

Decommission (FWFI)
Same as the No Action/FWOFI Alternative during the local decommissioning phase.

High Hazard Potential Rehabilitation (FWFI)
Same as the Decommission Alternative.

Cumulative Effects
Temporary impacts to migratory birds have the potential to occur during construction associated with decommissioning or rehabilitation unless the required measures are taken. Temporary, but significant impacts to migratory birds would occur in the event of catastrophic breach due to flooding that could result in loss of life and/or minor loss of habitat. Potential negative long-term impacts to migratory birds could result from minor loss of habitat and uncontrolled flows being discharged into downstream habitat if the is dam 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.

5.3.12 Environmental Justice

Existing Conditions
The census tracts potentially affected by the project have a higher share of white residents and lower share of all other races (combined) compared to the entire state of Texas. Similarly, the affected census tracts, except Census Tract 3104.01, have a smaller share of residents identifying as Hispanic or Latino compared to the entire state of Texas. The majority of census tracts potentially affected by the project also have a similar or 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, Census tracts 3101 and 3104.01 had a notably higher incidence of families living in poverty than Texas at large.

No Action/FWOFI
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 regulations downstream which could negatively impact minority and low-income populations. Note that multiple mobile home parks are adjacent to the floodplain in New Braunfels and would be the first areas impacted by any increase in flooding.

Decommission (FWFI)
Same as the No Action/FWOFI Alternative during the local decommissioning phase.

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.

Cumulative Effects
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.

5.3.13 Land Use

Existing Conditions
The land use in the upstream watershed has remained fairly consistent for the life of the dam but has experienced limited residential development. The primary land use types are Evergreen Forest (47.1%), Shrub/Scrub (27.0%), Deciduous Forest (12.5%), Developed - Open Space (6.1%), Herbaceous (4.1%), and Developed – Low Intensity. The upstream drainage area consists of approximately 8040.1 acres. The existing area at the dam is a FRS with an impounded normal pool/sediment pool area that remains dry. The area downstream of the dam receiving flood damage reduction benefits has also experienced residential development since installation of the existing dam.

No Action/FWOFI (Sponsor Breach)
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 30 residences, 13 "Main Local Roads and Minor State 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.

Decommission (FWFI)
The Decommissioning Alternative would result in agricultural, residential, and road crossings downstream no being longer protected from flooding.

High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alterative will result in minimal changes to land use adjacent to FRS No. 4 due to the widening of the existing left auxiliary spillway crest and the installation of an overtopping spillway. The 1% AEP flood pool would be raised from 799.15 feet to 800.7 feet, which lies within the existing easement up to elevation 806.55 feet (i.e. top of dam). This alternative should not require additional land rights. 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.

5.3.14 Local and Regional Economy

Existing Conditions
There are developed areas (residential and commercial) with associated infrastructure located downstream of FRS No. 4 project area that are upstream of and within the City of New Braunfels that contribute to the local and regional economy. There are also agricultural areas located adjacent to Dry Comal Creek downstream of FRS No. 4 that contribute to the local and regional economy. The dam and impoundment are located on private property and are not used for tourism or recreation activities that contribute to the local and regional economy.

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 that could impact developed areas, infrastructure, and agricultural areas. 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 for downstream developed areas, infrastructure, and agricultural areas.

Alternative 2 - Decommission (FWFI)
Dam 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 for downstream developed areas, infrastructure, and agricultural areas.

Alternative 3 - High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alterative would result in a temporary positive impact on the local economy during construction. Following construction, the rehabilitated dam would continue to provide flood protection for downstream developed areas, infrastructure, and agricultural areas and have a similar impact on the local/regional economy as it does in the existing condition.

Cumulative Impacts
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 Public Health and Safety

Existing Conditions
The existing auxiliary spillways do not have the capacity necessary to safely pass the FBH event. Overtopping the dam could cause the dam to erode and collapse, resulting in a release of the water, minimal sediment stored behind the dam, and eroded material from the dam embankment. Approximately 116 people are at risk for loss of life. There are 34 homes within the breach zone of this dam, 30 of which are inundated by more than 1 foot of water. During frequency-based storm events, there are no habitable

structures within the 50% and 1% AEP event floodplains. There are also 13 road segments that would be inundated by over 1 foot of water, putting individuals in vehicles at risk.

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.

Decommission (FWFI)
The Decommissioning Alternative 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.

High Hazard Potential Rehabilitation (FWFI)
With the High Hazard Potential Rehabilitation Alternative, the dam would be rehabilitated using current design and safety criteria and performance standards to provide increased flood protection for an additional 100 years. Upstream of the dam, the 1% AEP flood pool will be lower than the existing condition, and no homes will be at risk. The downstream water surface elevation during the 1% AEP and 0.2 % AEP storm events will be similar to the current condition. Immediately below the dam to the confluence with Dry Comal Creek, the water surface elevation will be adjusted from the existing condition approximately -0.03 feet to 0.27 feet for the 1% AEP event and approximately -0.03 feet to 0.32 feet for the 0.2% AEP event. Along Dry Comal Creek, the water surface elevation will be adjusted approximately 0.02 feet to 0.30 feet for the 1% AEP event and -0.20 feet to 0.34 feet for the 0.2% AEP event, depending on location. The threat to loss of life from failure of the dam would be greatly reduced. Access to the site will be restricted during construction.

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.

5.3.16 Social Issues/Community Cohesion

Existing Conditions
FRS No. 4 has provided value to the community since 1958 by providing flood protection benefits that enhance the quality of life for downstream residents.

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 downstream community cohesion as a result of damage to properties and injuries to individuals within the community. The damages/injuries may result in an

increase in community cohesion if the community bonds in the aftermath of the breach or could result in a loss of community cohesion as individuals within the community would not be impacted consistently. 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 could increase development regulations downstream. This could negatively impact community cohesion, as individuals within the community would not be impacted consistently.

Decommission (FWFI)
The No Federal Action Alternative would remove the flood protection benefits and could increase development regulations downstream due to the expanded 1% AEP floodplain, which could result in negative impacts to community cohesion. Individuals within the community would not be impacted consistently.

High Hazard Potential Rehabilitation (FWFI)
The High Hazard Potential Rehabilitation Alterative will allow flood protection benefits to continue for 100 years and would avoid the loss of flood protection and increased development regulations downstream. Property values will be maintained for downstream residents.

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 future rehabilitation or breach of other flood retarding structures and development within the watershed.

5.4 Cumulative Effects

Comal County and NRCS have constructed six flood control dams in the Comal River Watershed, including five NRCS FRS and Dry Comal FRS No. 11. This system of upstream impoundments provides a network of flood protection for local residents as well as farmland adjacent to the Bear Creek and Dry Comal Creek.

Construction of FRS No. 4 has had long-term direct effects on the environment through the excavation of the site and development of an impoundment upstream from the dam that now provides flood control, wildlife habitat, and other incidental benefits (i.e. recharge). The dam has reduced downstream peak flows during storm events, and consequently protect property and people in otherwise flood-prone areas.

FRS No. 4 will be the first dam with the Comal River Watershed to be rehabilitated. Rehabilitation of the dam under the alternatives considered would not significantly change the hydrology downstream except for better protection of the downstream area from catastrophic flooding that could occur if FRS No. 4 was to fail.

Rehabilitation of FRS No. 4 under the Preferred Alternative would allow downstream areas within the floodplain to support continued agricultural areas and residential development. The rehabilitation of FRS No. 4 will ensure that this structure continues to function as intended and provide benefits into the future.

The cumulative effects of this project on the principal resources of concern, along with the social and economic effects, is to maintain the existing social, economic, and environmental conditions of the community. In the selected alternative, the dam would stay in place and provide continued flood protection. The existing EAP will be revised to reflect the higher top of dam elevation and larger breach flow.

There is an overall positive effect on the downstream residents due to the reduced threat to loss of life and property for a catastrophic breach of the dam. The useful life of the project will be extended by an additional 100 years following construction. No other sites in the Comal River 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, field survey, and assessment, no cultural resources that meet the necessary criteria to be considered eligible for inclusion in the NRHP or to merit designation as SALs have been identified within the APE associated with rehabilitation measures at FRS No. 4. NRCS consultation with the SHPO/THC is complete, and concurrence with a no effect determination was received on June 26, 2021 (**Appendix E**).

The tribal search indicated that the Comanche Nation of Oklahoma, the Apache Tribe of Oklahoma, the Coushatta Tribe of Louisiana, the Tonkawa Tribe of Indians of Oklahoma, and the Wichita and Affiliated Tribes (Wichita, Keechi, Waco, and Tawakonie) of Oklahoma have indicated interest in ancestral lands and might attach religious or cultural significance to historic properties or have claims to land areas within Comal County, Texas. NRCS initiated consultation with each of these tribes by letter on July 12, 2022 (**Appendix E**) and completed consultation on March 7, 2023.

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. The extent studied for economic evaluation was consistent with the hydraulic modeling extents which ended upstream of a large population center. Subsequent semi-quantitative analysis through the city identified additional benefits that could be captured from Alternative 3. Identification of the national economic benefit 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 alternative.

Hydrology and Hydraulics
Areas of risk and uncertainty associated with this project lie in the accuracy of estimating flood flows and flood elevations. Flood flows and water surface elevations were derived using new models, and proven consistent with measured rainfall and flowrates from significant recent events. 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. 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. Several factor that require further study during future design-level geologic investigation could significantly affect these estimates; notable factors include the bedrock foundation conditions underlying the existing embankment, spillways, and proposed spillway structures; and availability of suitable on-site borrow material for embankment construction. 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 a Dam Assessment Report and estimated a risk-based profiles of FRS No. 4 in June 2014. The dam assessment indicated that FRS No. 4 did not meet NRCS requirements with respect to the current hazard potential classification and recommended modifications to meet current design criteria.

The Sponsor submitted formal requests for assistance to NRCS for FRS No. 4 on April 25, 2014. The requests for assistance listed concerns about compliance with current dam safety criteria.

6.2 Scoping and Public Meetings

The project sponsors are the Comal-Guadalupe SWCD, the Comal County Commissioners Court, City of New Braunfels, and the Edwards Aquifer Authority. Multiple meetings were held throughout the project with representatives of the Comal-Guadalupe SWCD, the Comal County Commissioners Court, City of New Braunfels, the Edwards Aquifer Authority, 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 4, 2020. The required sponsor commitment, overall project scope, schedule, and public participation plan were reviewed and discussed. An overview of FRS No. 4 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, Comal-Guadalupe SWCD, the Comal County Commissioners Court, City of New Braunfels, and the Edwards Aquifer Authority.

The first public meeting for FRS No. 4 was held virtually via Microsoft Teams on August 5, 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. 4 project area. A slide show was presented to help facilitate discussions. Notice for the public meeting was published in the New Braunfels Herald-Zeitung and the meeting materials and public comment form were posted on the Comal County Engineer's Office Website following the meeting date.

Additional meetings were held via Microsoft Teams with the project sponsors, NRCS and TSSWCB on March 4, 2021, and May 18, 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. 4 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 New Braunfels Herald-Zeitung and the meeting materials and public comment form were posted on the Comal County Engineer's Office Website following the meeting date. The rehabilitation alternatives included in the plan, the economic analysis, and the environmental assessment results will be presented at the meeting.

A Draft 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 Comal County Engineer's Office Website. Comments will be solicited from the public during the comment period. After the interagency and public review period, comments received on the draft will be incorporated into the Final Plan. Letters of comment received on the draft plan and NRCS responses to the comments will be included in **Appendix A**.

6.3 Agency and Tribal Consultation

Consultation with the Texas SHPO/ THC was initiated in March 26, 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. 30091 was issued by the THC on April 6, 2021. NRCS completed the pedestrian survey of the APE on April 16, 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**).

While the NRCS Texas works to build a relationship with Federally Recognized Tribes (FRTs) in this county through establishing Tribal consultation protocols, the NRCS State Conservationist is responsible for inviting Tribes to consult on proposed projects that may impact places of cultural or religious significance and NHPA historic properties. NRCS-Texas recognizes Tribal sovereignty and importance of Tribes' interest in places of cultural or religious significance on ancestral lands, including those on private lands. Tribal coordination was performed in accordance with the NHPA and other related authorities. **Appendix E** provides tribal correspondence and a summary of NRCS completed consultations.

Based on communication with the USFWS in April 2023, the conceptual design is not advanced to the final design level needed to complete a Biological Assessment/Biological Opinion; therefore, consultation/coordination cannot be completed until the project is in final design. Any further consultation/coordination and documentation with the USFWS will be completed during the design phase of the project, as directed during communication with the USFWS.

7.0 SELECTED ALTERNATIVE

Alternative 3 has been selected as the Preferred Alternative. This alternative best meets the purpose and need for the project and is preferred by the Sponsors, local community, and their leadership. Of the two alternatives involving federal investment (2 and 3), Alternative 3 has the fewest environmental and social impacts.

7.1 Rationale for Selected Alternative per PR&G

The preferred alternative is to rehabilitate FRS No. 4 to meet current NRCS and TCEQ 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:

- Significantly reduces the threat to loss of life from catastrophic breach of FRS No. 4 to approximately 116 people.
- Ensures continued flood protection downstream of FRS No. 4 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. 4 to meet current performance standards.
- Maintains existing stream habitat downstream of FRS No. 4.
- Retains the existing habitat in and around FRS No. 4.

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 2 reduces the risk of dam failure by overtopping and provides mitigation for downstream structures impacted by the Federal dam decommissioning. Alternative 3 also reduces the risk of dam failure by overtopping and continues to provide downstream flood protection. Therefore, the two federally assisted Alternatives 2 and 3 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 2 has the highest net economic benefits and the lowest construction cost, so it has the highest benefit-cost ratio. Alternative 2 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 2 is the Economically preferred alternative. Alternative 3 is considered the Environmentally, Socially, and Locally 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.

Additionally, Comal County has been very proactive in reducing flood control damages within the county and the City of New Braunfels, as evidenced by the recent installation (2012) of Dry Comal FRS No. 11 with support from FEMA mitigation grant funding. This flood control dam was built downstream of FRS No. 4 as a mitigation measure to the damages cause by the 1998 flood. There is strong community support for the rehabilitation of FRS No. 4, as Federal Decommissioning would reverse the community's recent efforts to increase their flood resilience.

7.2 FRS No. 4 Measures to Be Installed

Measures included for the high hazard potential rehabilitation of FRS No. 4 are:

- Remove the existing principal spillway system consisting of:
  - A drop inlet riser with debris guard and crest at elevation 763.75 feet, and
  - 30-inch-diameter prestressed, concrete lined, steel cylinder pipe discharging into a plunge pool.
- Install a new principal spillway system consisting of:
  - A standard covered riser,
  - Crest at elevation 759.0 feet (4.25 feet lower than existing), and
  - 54-inch diameter RCP conduit discharging into the RCC-step stilling basin.
- Install a 250-foot-wide RCC-step structural spillway over the existing embankment, with crest set above the 2% AEP PSH elevation at 798.2 feet, discharging into a concrete stilling basin,
- Regrade the inlet and outlet channel of the existing left vegetated auxiliary spillway, widen crest from 190 feet to 310 feet, and raise crest to the 1% AEP PSH elevation of 800.7 feet (1.5 feet raise),
- Regrade the inlet and outlet channel of the existing right vegetated auxiliary spillway, keep crest at 190 feet wide, and raise crest to the 1% AEP PSH elevation of 800.7 feet (1.5 feet raise),
- Retain top of dam elevation at 806.55 feet, and
- Replace rock blanket on 2.5:1 embankment slope.

After the implementation of these planned works of improvement, FRS No. 4 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. 4 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. 4 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. 4.

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 O&M 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 sponsor is legally unable to comply with the real property acquisition requirements, it agrees that, before any Federal financial assistance is furnished; it will provide a statement to that effect, supported by an opinion of the chief legal officer of the state containing a full discussion of the facts and law involved. This statement may be accepted as constituting compliance.

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 Comal 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 dated 6/7/1961 covered approximately 1098.43 acres. On 11/9/1970, all but 427.7 acres of the easement was released. Then on 12/23/1982, all lands currently covered under the easement, except the 226.9 acres containing backwater below 806.2 (NGVD 29), the dam, and the spillway were released.

For FRS No. 4, the flood pool area associated with the preferred alternative (i.e., auxiliary spillway elevation set at the 100-year PSH) is 203 acres at elevation 800.7 feet. The recommended easement elevation for Alternative 3 is to maintain the existing top of dam easement at elevation 806.2 (NGVD29)/806.55 (NAVD88). Additional land rights are not anticipated. There is a noted discrepancy, however, between the existing easement area of 226.9 acres at the top of dam elevation, which is described as containing the backwater below 806.2 (NGVD 29), the dam, and the spillway area, compared to the estimated top of dam backwater area (excluding full dam and spillway area) of 255 acres from LiDAR. This discrepancy and the actual easement area will need to be confirmed during final design.

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 Sponsor's 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. Based on previous consultations with USACE, it appears that any discharges into Waters of the U.S. associated with the rehabilitation of FRS No. 4 would be authorized by a Nationwide Permit No. 43, Stormwater Management Facilities with a Pre-Construction Notification. Nationwide Permit No. 43 authorizes discharges of dredged or fill material into waters of the U.S. for the construction and maintenance of stormwater management facilities such as the proposed Project. However, based on formal delineations performed in April 2023, there are no potentially jurisdictional waters of the U.S. associated with FRS No. 4.

Based on preliminary communication with the USFWS in April 2023, there are not enough project details (design) to complete a Biological Assessment/Biological Opinion at this time; therefore, consultation/coordination cannot be completed until the project is further into design. 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 SWPPP in place prior to construction of the proposed project and filing a Notice of Intent with the TCEQ is required. A NOT must be filed once the site has reached final stabilization. Construction activities associated with the rehabilitation of FRS No. 4 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.

The project is located within the Edwards Aquifer Recharge Zone; therefore, a Water Pollution Abatement Plan, including a Geological Assessment, will be required prior to construction. In addition, the project is located within the 100-year floodplain boundary; therefore, coordination with the local floodplain administrator will be required prior to construction. A floodplain development permit may also be required prior to construction.

7.7 Costs and Cost Sharing

Table 7-1 through **Table 7-6** 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 Sponsor 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 alternative, and **Table 7-7** provides a comparison of national economic benefits and costs. A 2022 price base was used and amortized at 2.5% interest over the 104-year period of analysis following construction.

7.8 Installation and Financing

The project is planned for a phased installation totaling about 4 years 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. 4 Rehabilitation project. NRCS will be responsible for the following:

- Execute a new O&M Agreement with the Sponsors that extends the O&M responsibilities for another 100 years following construction. This agreement will be based on the NRCS NOMM.
- Provide financial assistance equal to 65% of total eligible project costs, not to exceed 100% of actual construction costs.
- Verify that a current EAP 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.

Comal-Guadalupe SWCD, the Comal County Commissioners Court, City of New Braunfels, and the Edwards Aquifer Authority will be responsible for the following:

- Secure all needed environmental permits, easements, and rights for installation and O&M of the rehabilitated structure.
- Prepare an updated EAP for the FRS prior to the initiation of construction.
- Execute an updated O&M Agreement with NRCS for the FRS. This agreement will be based on the NRCS NOMM.
- 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 Sponsors. The Sponsor also understands 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 Sponsor with technical assistance from federal, state, and local agencies in accordance with their delegated authority. An updated O&M agreement will be developed for FRS No. 4, utilizing the NRCS NOMM, 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 Sponsor, 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. 4	$11,245,500	$4,674,000	$15,919,500[1]

[1] Price base: 2022 dollars

[2] Federal agency responsible for assisting in installation of works of improvement (includes dam rehabilitation and installation of flood warning system)

Table 7-2. Estimated Cost Distribution – Structural Measures

	Installation Costs: PL-83-566[1]				Installation Costs: Other Funds[1,2]						
Cost Item	Construc-tion	Engi-neering	Project Admini-stration	Total PL-83-566	Construc-tion	Engi-neering	Real Property	Permits	Project Admini-stration	Total Other Funds	Total Project Cost
FRS No. 4	$8,289,000	$1,707,100	$1,246,500	$11,245,500	$4,448,300	$0	$0	$210,700	$15,000	$4,674,000	$15,919,500

[1] Price base: 2022 dollars

Table 7-3. Structural Data

Item	Unit	FRS No. 4 Planned Rehabilitation
Class of Structure		High
Seismic Zone		0
Uncontrolled Drainage Area	sq-mi	12.56
Runoff Curve Number (1-day) (Avg. AMC)		68.4
Time of Concentration (T_c)	hrs	3.02
Elevation Top of Dam[1]	ft	806.6
Elevation Crest of Vegetated Auxiliary Spillways	ft	800.7
Elevation Crest of Structural Auxiliary Spillway	ft	798.2
Elevation Crest Principal Spillway	ft	759.0
Auxiliary Spillway Type		Vegetated
Auxiliary Spillway Bottom Width (Left / Right)	ft	310 / 190
Auxiliary Exit Slope (Left / Right)	ft	5.5 / 9.1
Auxiliary Spillway Type		Structural, RCC Step
Auxiliary Spillway Bottom Width	ft	250
Maximum Height of Dam	ft	73
Volume of Embankment Fill[2]	yd^3	265,570
Total Capacity (Auxiliary Spillway Crest)[3]	ac-ft	3,784
Sediment Submerged	ac-ft	192
Sediment Aerated	ac-ft	7
Floodwater Retarding Pool	ac-ft	3,592[4]
Surface Area		
Sediment Pool (PS Crest)	acres	23
Floodwater Retarding Pool	acres	203
Principal Spillway		
Rainfall Volume (1-day)	in	12.58
Rainfall Volume (10-day)	in	18.5
Runoff Volume (10-day)	in	8.77
Capacity (at Vegetated Auxiliary Crest)	ft^3/s	538
Type of Conduit		RCP
Dimensions of Conduit	in	54
Frequency of Operation (Vegetated Auxiliary Spillway)	% chance	1.0
Frequency of Operation (Structural Auxiliary Spillway)	% chance	> 2.0
Auxiliary Spillway Hydrograph		
Rainfall Volume	in	13.79
Runoff Volume	in	7.55
Storm Duration	hrs	6
Velocity of Flow (V_e) (Left / Right)	ft/s	2.75 / 3.08[5]
Maximum Reservoir Water Surface Elevation	ft	801.7
Freeboard Hydrograph		
Rainfall Volume	in	26.97
Runoff Volume	in	20.09

Item	Unit	FRS No. 4 Planned Rehabilitation
Storm Duration	hrs	6
Maximum Reservoir Water Surface Elevation	ft	806.5
Storage Capacity Equivalents		
Sediment Volume	in	0.29
Floodwater Retarding Volume	in	5.36

1/ All elevations are recorded in North American Vertical Datum 1988 (NAVD88).
2/ Total volume of earthfill in FRS No. 4 = 248,970 CY (286,570 CY from FRS No. 4 As-builts [1965] minus an overall volume reduction of 37,600 CY for proposed rehabilitation due to RCC-step spillway installation).
3/ Total capacity is provided at the crest of the vegetated auxiliary spillway channels. Note that the capacity of FRS No. 4 is 3,301 acre-feet at the elevation of the structural RCC step crest 798.2 feet.
4/ Floodwater retarding pool at the elevation of the vegetated auxiliary spillway crest includes 3,109 acre-feet between elevation of the sediment storage/PS crest and RCC crest elevation and 483 acre-feet between the RCC crest elevation and vegetated auxiliary spillway crest, for a total of 3,592 acre-feet.
5/ Velocity of flow is provided through the vegetated spillways only.

Table 7-4. Average Annual Costs

Cost Item	Average Annual Construction Cost	Average Annual O&M Cost	Total Average Annual Cost
FRS No. 4	$447,000	$5,000	$452,000

Notes: 2022 price level, 2.5% discount rate, 104-year period of analysis, Average Annual Construction Cost includes interest during construction

Table 7-5. Estimated Average Annual Benefits

Benefit Category	Average Annual Damages		Average Annual Benefits
	Without Project	With Project	
Structures	$54,000	$26,000	$28,000
Agricultural	$4,000	$3,000	$1,000
Infrastructure	$47,000	$37,000	$10,000
Total Annual Benefits	$105,500	$67,400	$38,000

Notes: 2022 price level, 2.5% discount rate, 104-year period of analysis

Table 7-6. Comparison of National Economic Benefits and Costs

Dam	Average Annual Benefit	Average Annual Cost	Net Benefits	Benefit-Cost Ratio
FRS No. 4	$38,000	$452,000	-$414,000	0.08

Notes: 2022 price level, 2.5% discount rate, 104-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	4	B.S. Ag. Engineering	35	
David Sullivan, Civil Engineer	3	B.S. Civil Engineering	13	
Rocky Ingram, Soil Conservationist	6	B.S. Ag. Education	13	
L. Rex McAliley, Wildlife Biologist	3	Ph.D. Biology	22	
Angela Moody, Archeologist	4	B.A. Anthropology M.A. Museum Sciences	16	
Ryan McCloud, Economist	3	B.S. Ag. Economics	7	
David Buland, Economist	1	B.A. & M.A. Economics	40	
Omri Bein, Economist	1	B.A. Economics M.S. Applied Ag. Economics	1	
Texas State Soil and Water Conservation Board				
Steve Bednarz, Program Administrator/Engineer	9	B.S. Ag. Engineering	47	P.E.
Ronnie Skala, Engineer	4	B.S. Ag. Engineering	44	P.E.,CFM
Allen Nash, Engineer	3	B.S. Env. Engineering	13	P.E.,CFM
AECOM Staff				
Jeff Irvin, Project Principal	36	MSCE Water Resources Engineering, MSCE Geotechnical Engineering, BS	48	P.E.
Monica Wedo, Project Manager, Hydrology/ SITES, Alternatives Analysis	20	B.S. Civil Engineering, M.S. Environmental and Water Resources Engineering	21	P.E.
Clifton Dorrance, Planning Lead	14	B.S. Agricultural Engineering	14	P.E.
Milena Spirova, H&H Modeling & Alternatives Analysis	2	B.S. Civil Engineering, M.S. Environmental and Water Resources Engineering	5	E.I.T
Ryan Pohl, Breach Modeling	5	B.S. Civil Engineering, M.S. Civil Engineering	5	E.I.T.
Matthew Engel, Alternative Analysis CADD and Cost Estimates	6	B.S. Civil Engineering	12	P.E.
Alyssa Ruiz, Risk Assessment Worksheets	6	B.S. Environmental Engineering	6	E.I.T
Jason Weiss, Economic Analysis	22	MS, Resource Economics and Policy; BIE, Industrial Engineering,	26	

Name / Title	Current Position (Years)	Education	Total Experience (Years)	Applicable Certifications
Thomas Redstone, Economic Analysis	4	BA Economics & Environmental Studies; Masters in Planning, Policy, & Management	6	AICP, ENV SP
Kendall Myers, Economic Analysis	1	B.S. Business & Economics; M.A. Economics	3	
Frida Cruz, Economic Analysis	3	B.S. Integrated Environmental Science; M.S. Agricultural and Applied Economics	3	ENV SP
Jennifer Oakley, Ecologist	8	B.S. Biology, B.S. Environmental Science, M.S. Wildlife Ecology	13	Wetland Training
Joseph Jandle, Ecologist	6	B.S. Wildlife Biology, M.S. Wildlife Ecology	7	Wetland Training
Amanda Hargrave, Ecologist	6	B.S. Wildlife Biology, M.S. Wildlife Ecology	7	Wetland Training
Steve Ahr, Cultural Resources	13	B.A. Anthropology, M.A. Anthropology, PhD Geology	25	RPA
Beth Reed, Cultural Resources	4.5	B.A. History M.S. Architecture	21	
Shelley Hartsfield, Cultural Resources	17	M.A. Anthropology	17	
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10.0 DISTRIBUTION LIST

Comments were requested on the Draft Supplemental Plan IV – 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, Texas

Texas Historical Commission, Austin, Texas

10.3 Other

Comal-Guadalupe SWCD #306, Seguin, Texas

Comal County, County Judges Office, New Braunfels, Texas

Edwards Aquifer Authority, San Antonio, Texas

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Appendix A Comments and Responses on Draft Plan-EA

No comments were received from the public review of the Draft Supplemental Watershed Plan No. IV and EA for Comal River Watershed FRS No. 4.

Appendix B Project Map

Appendix C Support Maps

Appendix D Investigation and Analysis Report

Appendix E Other Supporting Information