USDA United States Department of Agriculture

Warner Draw Watershed

Draft Supplemental Watershed Plan No. 10 and Environmental Impact Statement

Gould Wash Flood Protection Project Washington County, Utah

Lead Federal Agency: USDA Natural Resources Conservation Services

Cooperating Agencies: Bureau of Land Management, U.S. Army Corps of Engineers & U.S. Environmental Protection Agency

Sponsoring Local Organization: Washington County & Hurricane City

September 2025

Utah State Office
Natural Resources Conservation Service
nrcs.usda.gov/

Draft

Warner Draw Watershed Supplemental Watershed Plan No. 10 and Environmental Impact Statement for the Gould Wash Flood Protection Project Washington County, Utah

Lead Agency: U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)

Sponsoring Local Organization: Washington County and Hurricane City

Cooperating Agency: Bureau of Land Management (BLM), U.S. Army Corps of Engineers (USACE), and U.S. Environmental Protection Agency (EPA)

Congressional District: Utah Congressional District 2

Authority: This Supplemental Watershed Plan No. 10 and Environmental Impact Statement (Plan-EIS) for the Warner Draw Watershed has been prepared under the authority of the NRCS Watershed and Flood Prevention Operations Program, which includes the Flood Prevention Operations Program authorized by the Flood Control Act of 1944 (Public Law [PL] 78-534) and the provisions of the Watershed Protection and Flood Prevention Act of 1954 [Public Law 83-566 (PL 83-566) Stat. 666 as amended (16 U.S.C Section 1001 et seq.).

Abstract: The Gould Wash Flood Protection Project (Project) is located in and near Hurricane City within the Warner Draw Watershed in Washington County, Utah. The purpose of the project is to provide flood prevention (flood damage reduction) to reduce damage caused by floodwater from the Gould Wash drainage in Hurricane City. There is a need to protect people, structures, transportation infrastructure, public utilities, and property within the developed areas of Hurricane City that are exposed to flooding. The NRCS preferred alternative for the Project is the New Detention Dam and 3,000 cfs Channel Modifications Alternative. Proposed modifications would include constructing a dry detention dam along Gould Wash upstream of Hurricane City to trap sediment and attenuate large flood flows. Grading of Gould Wash would also occur along 12,540 linear feet the channel through Hurricane City to safely convey flood flows and the channel banks armored to protect from erosion. The installation cost estimate for this alternative is $62,677,000 with NRCS contributing $57,743,000 and the Sponsor contributing $4,934,000.

Comments: NRCS has completed this Draft Supplemental Watershed Plan and Environmental Impact Statement (Plan-EIS) in accordance with the National Environmental Policy Act (NEPA) and NRCS guidelines and standards. Reviewers should provide their comments to NRCS during the allotted Draft Plan-EIS review period. Comments need to be submitted by November 6, 2025, to become part of the Administrative Record. Please send comments or questions to:

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385-245-7709; anders.fillerup@usda.gov

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Ancestral Land Acknowledgement

The National Resources Conservation Service, through the review of the National Park Service Native American Graves Protection and Repatriation Act Native American Consultation Database, the BLM St. George Field Office tribal consultation list, the U.S. Department of Housing and Urban Development Tribal Directory Assessment Tool, the BIA website, the Utah Division of Indian Affairs website; and through previous National Environmental Policy Act and National Historic Policy Act consultation, identified 15 Native Hawaiian Organizations/Native Villages/ Tribes with ancestral land, traditional use, and/or traditional cultural property claims within the Area of Potential Effect and the immediate vicinity. These 15 entities include Cedar Band of Paiutes, Chemehuevi Indian Tribe, Hopi Tribe, Kanosh Band of Paiutes, Kaibab Band of Paiute Indians of the Kaibab Indian Reservation, Koosharem Band of Paiutes, Las Vegas Tribe of Paiute Indians of the Las Vegas Indian Colony, Moapa Band of Paiute Indians of the Moapa River Indian Reservation, Navajo Nation, Navajo Utah Commission, Paiute Indian Tribe of Utah, Pueblo of Zuni , San Juan Southern Paiute Tribe of Arizona, Shivwits Band of Paiute Indians, and Ute Indian Tribe of the Uintah and Ouray Reservation. Consultation with these 15 entities continued throughout this Plan-EIS development. Correspondence with the entities is included in Appendix A.

SUPPLEMENTAL WATERSHED PLAN AGREEMENT #10

(*TO BE INCLUDED IN FINAL PLAN-EIS*)

Summary (Office of Management and Budget Fact Sheet)

Title of Proposed Action

Warner Draw Watershed Draft Supplemental Watershed Plan No. 10 and Environmental Impact Statement (Plan-EIS) for the Gould Wash Flood Protection Project (Project)

Watershed Name

Warner Draw Watershed

County, State

Washington County, Utah

Congressional District

Utah Congressional District 2

Sponsoring Local Organizations

The Sponsoring Local Organizations (SLOs) for the Project are Washington County and Hurricane City.

Cooperating Agency

The Bureau of Land Management (BLM), U.S. Army Corps of Engineers (USACE), and U.S. Environmental Protection Agency (EPA) have accepted cooperating agency status on the Project.

Authority

This Plan-EIS has been prepared under the authority of United States Department of Agriculture Natural Resources Conservation Service (NRCS) Watershed and Flood Prevention Operations (WFPO) Program, which authorizes funding to help urban and rural communities protect, improve, and develop land resources in watersheds up to 250,000 acres in size. The WFPO Program includes the Flood Prevention Operations Program authorized by Flood Control Act of 1944 (Public Law [PL] 78-534) and the provisions of the Watershed Protection and Flood Prevention Act of 1954 (PL 83-566) Stat. 666 as amended (16 U.S.C. Section 1001 et seq.). The Plan-EIS has been prepared in accordance with Section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969, Public Law 91-190, as amended (42 U.S.C. 43221 et seq.).

Purpose and Need for Action

The purpose of the project is to provide flood prevention (flood damage reduction) to reduce damage caused by floodwater from the Gould Wash drainage in Hurricane City. There is a need to protect people, structures, transportation infrastructure, public utilities, and property within the developed areas of Hurricane City that are exposed to flooding.

Description of Preferred Alternative

The preferred alternative (New Detention Dam and 3,000 cfs Channel Modifications Alternative) includes structural and nonstructural measures. Structural measures consist of constructing a dry

detention dam along Gould Wash upstream of Hurricane City to trap sediment and attenuate large flood flows. Gould Wash would also be graded along 12,540 linear feet the channel through Hurricane City to safely convey flood flows and the channel banks armored to protect from erosion. Nonstructural measures include implementing building restrictions in the remaining regulated floodplain, purchasing easements along the modified channel corridor through Hurricane City to protect and maintain the channel for flood conveyance, and securing a long-term right-of-way on BLM-managed lands for the duration of the project life at the detention dam and for the upstream basin area.

Resource Information

Table S-1. Existing Resoure Information

Resource	Description
Latitude / Longitude (WGS84)	37.169753 / -113.297279
Hydrologic Unit Name / Code[1]	Gould Wash-Virgin River / 1501000809
Hurricane City Climate[2]	July average high/low: 98°F / 68°F January average high/low: 52°F / 29°F
Watershed Topography	Steep mountainous terrain with flat-topped mesas (east of Hurricane Cliffs) / Lowlands with floodplains and alluvial fans surrounded by badland-type topography (west of Hurricane Cliffs) Elevation Range: 2,500 to 8,000 feet
Average Annual Precipitation[2]	11.64 inches
Warner Draw Watershed Area	298 square miles
Land Uses of Watershed[3]	Undeveloped Open Land/Water 84% Developed 14% Agricultural 2%
Land Ownership of Watershed[4]	Private 43% Federal 47% State 10%
Population (Washington County / Hurricane City)[5]	191,226 (Washington County) / 21,808 (Hurricane City)
Farms Present (Washington County)[6]	537 Farms
Land in Farms (Washington County)[6]	155,047 acres
Average Farm Size (Washington County)[6]	289 acres

1 - Source: U.S. Environmental Protection Agency (EPA) 2023a
2 - Source: National Oceanic Atmospheric Administration (NOAA) Regional Climate Centers 2020
3 – National Land Cover Database (Multi-Resolution Land Characteristics Consortium [MRLC] 2019)
4 - Utah Trust Lands Administration (TLA) and BLM 2022
5 - U.S. Census Bureau (USCB) 2021
6 – U.S. Department of Agriculture 2017a

Alternative Plans Considered

Alternative plans considered in detailed study and evaluated in this Plan-EIS include one No Action Alternative and two proposed Action Alternatives (Increase Channel Capacity Through Hurricane for 8,820 cfs Alternative, and New Detention Dam and 3,000 cfs Channel Modifications Alternative). The New Detention Dam and 3,000 cfs Channel Modifications Alternative is the NRCS preferred alternative, and the USACE Least Environmentally Damaging Practicable Alternative (LEDPA) for the Project. Sixteen (16) additional alternatives with structural and nonstructural measures were considered during the planning process but were eliminated from detailed study due to environmental impacts; if they were considered infeasible, had exorbitant costs, did not meet the purpose and need of the Project; or other critical factors.

A description of the alternatives analyzed in detailed study are included below. The installation and operations and maintenance (O&M) costs for the alternatives were prepared to equal levels of detail judged appropriate for identification of the NRCS preferred alternative. Installation costs include construction, engineering, permitting, real property rights, and administration.

No Action Alternative – The No Action Alternative considers the actions that would take place if no federal action or federal funding were provided for the Project. The No Action Alternative would consist of continued O&M on the Gould Wash channel through Hurricane City to maintain the existing capacities. There is no installation cost associated with this alternative. The annualized O&M costs are estimated at $16,000 per year.

Increase Channel Capacity Through Hurricane for 8,820 cfs Alternative – This alternative would increase the channel capacity of Gould Wash through Hurricane City to safely pass the 1 percent annual chance flood, which produces a peak flood flow of 8,820 cubic feet per second (cfs). Modifications would be required along approximately 13,100 linear feet of the channel consisting of: channel widening; installation of grade control structures to maintain an open channel bottom; installing an engineered block flood wall along approximately 8,440 linear feet; and placing riprap on the channel banks then covering it with native soil for aesthetics along approximately 4,660 linear feet. Three bridges and four culverts would need to be replaced to increase capacity for safe conveyance of 8,820 cfs. Nonstructural measures include implementing building restrictions in the remaining regulated floodplain and purchasing easements along the modified channel corridor through Hurricane City to protect and maintain the channel for flood conveyance. The total installation cost is estimated at $75,220,000 with annualized O&M estimated at $8,900 per year.

New Detention Dam and 3,000 cfs Channel Modifications Alternative – This alternative would construct a flood attenuation dam upstream of Hurricane City along Gould Wash to reduce the peak flood flow of the 1 percent annual chance flood through Hurricane City down to 3,000 cfs. The dam would not store water permanently and only temporarily hold water to reduce the peak flood flows downstream during large flood events. Flood events less than an approximate 10-year flood would pass through the dam without attenuation of flow and continue down Gould Wash as they do currently. Modifications along approximately 12,540 linear feet of Gould Wash through Hurricane City would be required consisting of: recontouring the channel as needed; installation of grade control structures to maintain an open channel bottom; installing an engineered block flood wall along approximately 3,200 linear feet; and placing riprap on the channel banks then covering it with native soil for aesthetics along approximately 9,340 linear feet. The invert at three bridge locations would need to be lowered and two culverts replaced to safely pass the 3,000 cfs

flood flow. Nonstructural measures include implementing building restrictions in the remaining regulated floodplain, purchasing easements along the modified channel corridor through Hurricane City to protect and maintain the channel for flood conveyance, and securing a long-term right-of-way on BLM-managed lands for the duration of the project life at the detention dam and for the upstream basin area. The total installation cost is estimated at $62,677,000 with annualized O&M estimated at $17,000 per year.

Preferred Alternative Project Costs and Funding Source

The breakdown of the estimated installation cost for the preferred alternative (New Detention Dam and 3,000 cfs Channel Modifications Alternative) is provided in Table S-2. NRCS provides 100 percent PL 83-566 funding for engineering and construction of alternative measures meeting the NRCS flood prevention authorized purpose. However, the SLOs are responsible for funding construction measures associated with replacement of culverts needed for safe conveyance of flood flows. The SLO construction cost for culverts has been included as real property rights in Table S-2. The SLOs are also responsible for easement real property rights, permitting, and costs associated with their own administrative time to install the Project. NRCS is responsible for their own administrative time as well to install the Project measures.

Table S-2. Estimated Project Installation Cost

Item	PL 83-566 Funds		Other Funds		Total	
Construction	$50,777,000	100%	$0	0%	$50,777,000	81%
Engineering	$6,531,000	100%	$0	0%	$6,531,000	10%
Permits	$0	0%	$100,000	100%	$100,000	<1%
Project Administration	$435,000	N/A	$871,000	N/A	$1,306,000	2%
Real Property Rights (culvert replacements)	$0	0%	$1,475,000	100%	$1,475,000	2%
Real Property Rights (easements)	$0	0%	$2,488,000	100%	$2,488,000	4%
Total	**$57,743,000**	92%	**$4,934,000**	8%	**$62,677,000**	100%

Project Benefits

Monetary annual flood damage reduction benefits of the preferred alternative are estimated at $2,444,300. Nonmonetary benefits consist of environmental and social benefits in which the cost of the benefit cannot be reasonably calculated. This includes improved mental/physical well-being and safety for all people who inhabit the floodplain whose lives and safety are currently at risk. The alternative benefits the daily lives, source of income, and the peace of mind of the community. There is a decreased risk of contamination entering the Virgin River during flooding events.

Net Economic Benefits

All costs and benefits over the period of analysis were discounted to a net present value. The annual cost for the Project is estimated at $1,881,300. Comparing the average annual benefits of $2,444,300 to the annual cost results in a net annual benefit of $563,000 (see Table S-3).

Table S-3. Estimated Annual Net Economic Benefits

Total Annual Costs	Total Annual Benefits	Benefit-Cost Ratio	Net Economic Benefits
$1,881,300	$2,444,300	1.3	$563,000

Project Life, Period of Analysis, and Discount Rate

The period of analysis is the time required for installation of the Project plus the evaluated life of the Project (project life). All alternatives were evaluated with a period of analysis of 102 years (100-year project life plus 2 years for installation). The 2025 discount rate of 3.0 percent was used for economic cost and benefit calculations.

Environmental Impacts

Table S-4 lists the resources of concern and associated environmental consequences associated with the preferred alternative. Resources that would not be impacted by the preferred alternative are not listed in this table.

Table S-4. Preferred Alternatve Summary of Resource Concerns and Impacts

Resource Concern	Summary of Concern	Consequence
Soil		
Upland Erosion	Construction soil disturbance from alternative measures	A direct short-term impact of increased erosion potential would occur on disturbed areas during construction, including 44.2 acres in the western segment of the Project area and 111.3 acres in the eastern segment. Impacts would be minimized through implementation of BMPs[1] that would be installed during and after construction. The short-term impacts would be minor based on implementation of BMPs[1] and restoration/stabilization measures after construction is completed with no long-term direct impacts. The alternative would provide long-term indirect benefits of reduced channel erosion potential during future flood events.
Sedimentation	Sediment deposition in Hurricane City during flooding and changed sediment transport for the Virgin River	Indirect long-term moderate benefits are anticipated that would reduce sediment deposition in developed areas of Hurricane City and in the Gould Wash channel during future flood events. No measurable net change of sediment transported to the Virgin River is expected due to the transfer of sediment trapping benefits from the developed Hurricane City floodplain to the proposed detention dam.
Prime and Unique Farmland	Flooding and construction disturbance to prime and unique farmland	Minor direct impacts would occur from temporary disturbance on 3.66 acres of prime farmland over the short term, but the areas would be restored after the preferred alternative is installed and no direct long-term impacts would occur to these soils. Indirect moderate long-term benefits to farmland production would occur on 177.26 acres of prime farmland and 1.24 acres of farmland of statewide importance from the removed risk of future flooding for up to and including a 500-year flood.

Resource Concern	Summary of Concern	Consequence
Water		
Surface Water Quality	Degraded surface water quality from contaminated floodwater and construction disturbance	Construction activities are anticipated to have negligible direct impacts on surface water quality based on the normally dry condition of the Gould Wash, naturally large sediment loads from soil conditions of the Gould Wash drainage area, implementation of BMPs[1], negligible amount of the disturbed area at 0.4% of the area that contributes to sediment load, and avoiding work during precipitation events. The BMPs[1] would reduce the quantity of sediment entering drainages or flowing downstream and violating any federal or state water quality rules and regulations. An indirect benefit to water quality of the Virgin River and downstream water uses may occur over the long term from the reduction in future overland flooding and associated risk of contamination to surface water.
Surface Water Quantity and Flow	Gould Wash limited channel conveyance capacity, an increase in extreme precipitation, and modifications to surface water flow	There would be no change to water quantities, but the developed Hurricane City floodplain would be transferred to the new upstream detention dam, changing the timing for passage of flood flows through Gould Wash. This would have an indirect moderate benefit to future flood flow conditions providing better management for conveyance of flood flows through Gould Wash over the long term. The measures also increase resilience to the projected rise in flood frequency and intensity.
Waters of the U.S.	Disturbance within Gould Wash which is a jurisdictional waters of the U.S.	Short-term minor impacts would occur along 12,540 linear feet of Gould Wash in Hurricane City from construction disturbance. Permanent modifications would occur along 710 linear feet of the ephemeral channel upstream of Hurricane City to pipe channel flow through a proposed detention dam and armor the pipe outfall as needed. An alternative analysis was also completed to comply with Section 404(b)(1) of the CWA[1]. The preferred alternative measures were determined to maintain the existing stream channel functions and the alternative was selected as the LEDPA[1] in the 404(b)(1) Alternatives Analysis completed for the Project (attached in Appendix E). Therefore, no measurable long-term change to the existing stream function of waters of the U.S. would occur. There would be an indirect minor benefit to Gould Wash through Hurricane City over the long term from decreased frequency of future sediment O&M removal activities in the channel.

Resource Concern	Summary of Concern	Consequence
Floodplain Management	Flooding to developed areas of Hurricane City and increasing frequency and intensity of flooding	Hurricane City would see an indirect moderate long-term benefit from protection of future flooding for a 100-year flood and substantially reduced flooding for a 500-year flood. The community within the benefited area would no longer be at risk of injury or death and buildings, lands, roads, infrastructure, and utilities would be protected during a 100-year flood. The measures increase resilience to the projected rise in flood frequency and intensity.
Air		
Air Quality	Emissions from construction activities	No short-term adverse effects to air quality or GHGs[1] would occur for construction of the preferred alternative based on negligible construction emissions, emission values under the EPA general conformity de minimis thresholds, no requirements for air quality permits, GHG[1] emissions below the EPA reportable limits, the location of the Project outside of nonattainment or maintenance areas, implementation of BMPs[1], and the short-term of construction. Measurable long-term impacts to air quality are not expected from continuation of O&M activities.
Plants		
Vegetation Communities	Disturbance to vegetation	Direct short-term impacts would occur from temporary construction disturbance to approximately 3.4 acres of vegetated land in the western segment of the Project area and 107.9 acres in the eastern segment. Short-term adverse impacts to vegetation would occur from vegetation removal in disturbed areas, but these areas would be restored upon construction completion with a native weed free seed mix to match the existing surrounding plant communities (determined by NRCS, BLM and USACE as applicable). Short-term impacts would be minor based on the lack of presence of sensitive plant communities (sensitive plant species, protected natural areas, conservation areas, or ecologically critical areas), vegetation restoration measures, and N&I[1] management measures. No measurable direct long-term impacts are expected. There would be an indirect minor benefit to vegetation in Gould Wash through Hurricane City over the long term from decreased frequency of future sediment O&M removal activities in the channel.
Special Status Plant Species	No Concerns	There would be no impacts to special status plant species or suitable habitat because none are present within the areas proposed for installation of alternative measures or for O&M activities as documented in the BA[1] (attached in Appendix E). In accordance with Section 12 of PL 83-566, a letter was sent to the USFWS on May 17, 2024 to welcome their participation in preparation of the Plan-EIS (Appendix A). A BA[1] was submitted to the USFWS on February 11, 2025 to comply with Section 7 of the ESA[1] (Appendix A).

Resource Concern	Summary of Concern	Consequence
Noxious Weeds and Invasive Plant Species	Increases risk of noxious weeds and invasive species from ground disturbance.	Short-term direct impacts for risk of invasion of N&I weeds is anticipated during construction from temporary disturbance to 111.3 acres of vegetated land. These impacts would be minor based on vegetation restoration after construction, development of a PCRP[1], and implementation of BMPs[1] during construction. A direct long-term benefit would be achieved from native (weed free) vegetation restoration measures and implementation of a PCRP[1] that would reduce N&I and other weeds in restored/revegetated areas over the long term. An indirect minor benefit of reduced N&I weeds and future risk of invasion is expected over the long term from less frequent O&M disturbance activities along Gould Wash through Hurricane City and implementation of a PCRP[1].
Riparian Areas	Disturbance to riparian areas	Direct short-term impacts would occur from temporary construction disturbance to approximately 2.5 acres of poor-quality riparian communities that are artificially supported. Riparian areas are dominated by herbaceous species including saltgrass (*Distichlis spicata*), perennial sorghum (*Sorghum halepense*), and Baltic rush (*Juncus balticus*) with patches of shrubs including narrowleaf willow (*Salix exigua*), five-stamen tamarisk (*Tamarix chinensis*), and cottonwood saplings (*Populus fremontii*). Disturbed riparian areas would be restored by seeding or hydroseeding with a NRCS and USACE approved native riparian seed mix. Short-term impacts would be minor based on temporary disturbance, reestablishment of riparian vegetation, poor quality of the existing riparian corridor, and minimal amount of area disturbed. No direct long-term impacts are expected. There would be an indirect minor benefit to riparian vegetation in Gould Wash through Hurricane City over the long term from decreased frequency of future sediment O&M removal activities in the channel that disturb vegetation.

Resource Concern	Summary of Concern	Consequence
Animals		
Fish and Wildlife	Disturbance to fish and wildlife species/ habitat	No direct impacts to fish or aquatic habitat would occur because aquatic habitat is not present within the Project area due to lack of water. Direct short-term impacts would occur on 3.4 acres of low-quality habitat in Hurricane City and 107.9 acres of desert shrub and grassland habitat in the eastern segment of the Project area. Short-term impacts would be minor based on implementation of bird and special status animal species avoidance/minimization measures, lack of sensitive habitats (protected natural areas, conservation areas, ecologically critical areas, or ESA[1] critical habitat), short duration of construction, and restoration of disturbed areas. No measurable direct long-term impacts are expected. There would be an indirect minor benefit to habitat in Gould Wash through Hurricane City over the long term from decreased frequency of future sediment O&M removal activities in the channel that disturb habitat. Indirect long-term term benefits to species and habitat in Gould Wash downstream of the channel improvements may occur from reduction in future damaging flood flows at larger flood events. Indirect benefits to aquatic/terrestrial wildlife species and habitat in the Virgin River are also expected over the long term from the reduced threat of floodwater contamination to the river.
Special Status Animal Species (ESA[1])	Disturbance to ESA[1] animal species/habitat	One ESA species, desert tortoise (*Gopherus agassizii*), has the potential to occur in or near the Project area. Construction activities would not disturb designated critical habitat for ESA[1]-listed desert tortoise. Based on the surveyed lack of presence or signs of presence in the Project area and implementation of conservation measures, this alternative including future O&M activities is not anticipated to have direct adverse effects on desert tortoises. Indirect long-term benefits to ESA species (if present) in Gould Wash downstream of the channel improvements and at the Virgin River confluence may occur from reduction in future damaging flood flows at larger flood events. In accordance with Section 12 of PL 83-566, a letter was sent to the USFWS[1] on May 17, 2024 to welcome their participation in preparation of the Plan-EIS (Appendix A). A BA[1] was submitted to the USFWS on February 11, 2025 to comply with Section 7 of the ESA (Appendix A) with a **May Effect, Not Likely to Adversely Affect** determination for desert tortoise and **No Effect** determination for all other ESA[1] species/designated critical habitat. USFWS concurrence was received on February 26, 2025 (Appendix A).

Resource Concern	Summary of Concern	Consequence
Special Status Animal Species (SGCN[1])	Disturbance to SGCN[1] animal species/habitat	Suitable habitat for BLM sensitive species/Utah SGCN[1] Arizona toad (*Bufo microscaphus*) and burrowing owl (*Athene cunicularia*) would be disturbed during construction activities but would be restored after construction completion. Conservation measures would be implemented to avoid and minimize impacts to the species. Short-term impacts to BLM sensitive species/Utah SGCN[1] are not expected with implementation of conservation measures and restoration of disturbed areas. No measurable long-term direct impacts to burrowing owl or Arizona toad are anticipated from future O&M activities because the activities would be performed outside of the nesting season for burrowing owl and when water is not present in the channel. Indirect long-term benefits to SGCN[1] (if present) may occur downstream of the channel improvements in Gould Wash and at the Virgin River confluence from reduction in future damaging flood flows at larger flood events.
Migratory Birds / Bald and Golden Eagles	Construction disturbance in potential habitat	Direct short-term impacts would occur from construction disturbance on 3.4 acres of vegetated areas in the western segment of the Project area and 111.3 acres in the eastern segment that would discourage birds from foraging and nesting in the active construction areas. Conservation measures would be implemented to comply with the MBTA[1] and disturbed areas would be restored after construction. Short-term impacts would be minor based on short duration of construction, implementation of conservation measures, and restoration of disturbed areas. Measurable direct long-term impacts to migratory birds or bald/golden eagles are not anticipated for alternative measures based on restoration of disturbed areas. Indirect long-term benefits to species and habitat in Gould Wash downstream of the channel improvements may occur from reduction in future damaging flood flows at larger flood events. Future activities for O&M along the existing Gould Wash channel are typically timed outside of the bird breeding season and are not anticipated to have measurable indirect impacts to migratory birds.

Resource Concern	Summary of Concern	Consequence
Human		
Social Issues and Economy	Flooding threatens the social and economic wellbeing of Hurricane City and its residents	The alternatives would have an indirect moderate benefit to Hurricane City residents over the long term from flood protection associated with Gould Wash for a 100-year flood and substantial reduction in flooding at a 500-year flood. The flood damage reduction costs after implementation of this alternative were estimated at $2,444,300 annually. Flooding from a 100-year flood would no longer threaten the social wellbeing and prosperity of the community and would be substantially reduced for a 500-year flood. Direct moderate benefits for social issues are expected over the long term from structures being removed from SFHAs[1] that eliminate political turmoil/community unrest surrounding FEMA[1] regulations for the recently mapped SFHAs[1].
Historic / Cultural Resources	Flooding threatens historic structures	Cultural resources and historic properties listed or eligible for listing in the NRHP would be avoided during construction, except for historic roads (sites 42W4397 and 42WS6188). These sites are existing active roads that would be used for construction access. The roads would not be improved over their existing condition except for light grading to smooth the road surface, where necessary. A moderate indirect benefit to historic properties within the benefited area would be achieved over the long term due to the reduced risk of flooding to 101 historic properties in Hurricane City. NRCS determined there would be **No Adverse Effect to Historic Properties** from alternative actions and submitted the determination to the SHPO[1] on November 6, 2024 to comply with Section 106 of the NHPA[1]. The SHPO[1] concurred with the determination in a letter dated December 24, 2024 (Appendix A). Fifteen tribes were consulted pursuant to EO 13007, EO 13175, the NHPA[1], and the AIRFA[1] (Appendix A). No Native American religious concerns were identified by the tribes.
Public Health and Safety	Flooding threatens Hurricane City resident's physical/mental health and their safety with injury and potential loss of life.	Moderate indirect benefits to the health and safety of Hurricane City residents would be achieved from the reduced risk of future flooding over the long term. The community would no longer be at risk of injury and loss of life for all flood events up to and including a 100-year flood. The physical and mental health of the community would be improved following a large flood event due to avoided flooding and safe flood routing through the city.
Recreation	No concerns	No measurable short- or long-term impacts to recreation are anticipated.
Land Use	Land use changes	No short-term or long-term adverse effects on land use are expected with proper establishment and purchase of easements to construct and maintain the installed measures.

Resource Concern	Summary of Concern	Consequence
Visual Resources	Construction disturbance and alternative components	Minor direct short-term impacts to visual quality would occur during construction from construction equipment and disturbance but these areas would be restored after construction completion with no long-term impacts. Short-term impacts would be minor based on lack of scenic views, lack of unique visual qualities, and/or location on previously disturbed lands, and restoration measures after construction. No measurable direct long-term impacts to visual quality are expected because the alternative incorporates aesthetic features, restores/vegetates disturbed lands, and does not obstruct scenic views. Alterations on BLM managed lands would comply with the BLM designated Visual Resource Management Class III.
Transportation Infrastructure	Flooding risk to transportation infrastructure and construction work within transportation corridors	Direct shorter-term impacts would occur for two culvert replacements. Based on the duration of closure, estimated at one month per culvert and the type of roads as minor collectors, the closures would pose a minor nuisance that could delay local traffic. A minor long-term indirect benefit to transportation infrastructure would occur from future flood protection to roads for a 100-year flood and substantial reduction in flooding at a 500-year flood.
Noise and Vibration	Construction activities would produce noise	A short-term direct increase in noise and vibration would occur during installation of alternative measures. Proper BMPs would be implemented to reduce noise and vibration impacts. Applicable noise regulations would be adhered to for construction activities. Impacts in the western segment of the Project area would be moderate due to the proximity of the construction area adjoining sensitive receptors (primarily residences). Impacts in the eastern segment of the Project area would be minor based on the closest sensitive noise receptor at ¾ miles from the construction site. Noise levels would return to normal after construction completion with no direct long-term impacts. An indirect minor benefit is expected in Hurricane City from a decrease in future O&M activities along Gould Wash, which would reduce O&M noise from the baseline condition near sensitive receptors over the long term. The new O&M activities at the detention dam would have negligible noise increases. This is based on the distance of the dam from sensitive noise receptors at over 1-mile and minimal maintenance activities required with no noticeable vehicle traffic changes from existing conditions.

1- BMPs = Best Management Practices, CWA = Clean Water Act, LEDPA = Least Environmentally Damaging Practicable Alternative, GHG = Greenhouse gas, N&I = Noxious weeds and invasive plants, PCRP = Post Construction Rehabilitation Plan, BA = Biological Assessment, ESA = Endangered Species Act, SGCN = Utah Species of Greatest Conservation Need, USFWS = U.S. Fish and Wildlife Service, MBTA = Migratory Bird Treaty Act, NRHP – National Register of Historic Places, NHPA = National Historic Preservation Act, SHPO = State Historic Preservation Office, AIRFA = American Indian Religious Freedom Act, FEMA = Federal Emergency Management Agency, SFHA = Special Flood Hazard Area

Major Conclusions

The preferred alternative meets the purpose and need of the Project while providing the greatest economic benefits. Short-term adverse effects from alternative construction actions would be offset to the greatest extent reasonable through implementation of conservation measures, avoidance/minimization measures, and BMPs. The preferred alternative measures do not result in measurable long-term adverse impacts and no mitigation measures would be required. Long-term environmental, social, and economic benefits would be realized from implementation of the flood prevention measures.

Areas of Controversy and Issues to be Resolved

There are no known areas of controversy or issues to be resolved.

Evidence of Unusual Congressional or Local Interest

There is no known evidence of unusual congressional or local interest in the Project.

In Compliance

Is this report in compliance with executive orders, public laws, and other statutes governing the formulation of water resource projects? ☒ Yes ☐ No

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0.0 Changes Requiring a Supplement

The Warner Draw Watershed (Watershed) Plan is being supplemented to incorporate the Gould Wash Flood Protection Project (Project) for flood prevention measures along Gould Wash that decrease flooding to Hurricane City. The Project is eligible for PL 83-566 federal assistance as part of the flood prevention (flood damage reduction) NRCS authorized purpose.

Financial assistance for Project planning was requested from the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) in 2017 and funded in 2018 for preparation of Supplemental Watershed Plan No. 9 and Environmental Assessment (Plan-EA). This Gould Wash flood prevention measures were one of six sites proposed for improvements in Supplemental Watershed Plan No 9. After initial evaluations were completed and alternative installation costs formulated, it was determined in 2019 that preparation of a Supplemental Plan and Environmental Impact Statement (Plan-EIS) for the Gould Wash flood prevention measures would be needed based on federal funding thresholds above $25,000,000 requiring congressional approval. Further studies and alternative development were also needed due to the Project complexity. For this reason, the Gould Wash flood prevention measures were removed from further consideration in Supplemental Watershed Plan No 9, which was completed in 2022. A new supplement is required to incorporate the Gould Wash flood prevention measures into the Watershed Plan.

1.0 Watershed Planning Background

As the lead federal agency, the NRCS is proposing to provide funding for flood prevention (flood damage reduction) Project measures within the NRCS Watershed. A Plan-EIS is required for NRCS to comply with U.S. Department of Agriculture (USDA) requirements of the National Environmental Policy Act (NEPA) of 1969 and its implementing regulations at 7 CFR Part 1b; the Principles, Requirements, and Guidelines for Federal Investments in Water Resources (PR&G) (Council on Environmental Quality [CEQ] 2013 and 2014); and NRCS policy and guidelines (NRCS 2010 and 2016a). This section describes the general planning background for NRCS Watershed Program projects and specific planning background and setting for the proposed Project.

1.1 Authority

This Plan-EIS has been prepared under the authority of the NRCS Watershed and Flood Prevention Operations (WFPO) Program, which authorizes funding to help urban and rural communities protect, improve, and develop land resources in watersheds up to 250,000 acres in size. The WFPO Program includes the Flood Prevention Operations Program authorized by Flood Control Act of 1944 (Public Law [PL] 78-534) and the provisions of the Watershed Protection and Flood Prevention Act of 1954 (PL 83-566) Stat. 666 as amended (16 U.S.C. Section 1001 et seq.).

1.2 Sponsor

The Project Sponsoring Local Organizations (SLOs) include Hurricane City and Washington County, Utah.

1.3 Cooperating Agencies

Cooperating agencies on the Project include the Bureau of Land Management (BLM), the U.S. Army Corps of Engineers (USACE), and the U.S. Environmental Protection Agency (EPA). The Project includes measures within lands managed by BLM that are under their jurisdiction and the BLM accepted cooperating agency status in a letter dated February 5, 2020 (Appendix A). The EPA accepted cooperating agency status in a letter dated June 16, 2020 (Appendix A) based on their responsibilities under Section 102(2)(C) of the NEPA and Section 309 of the Clean Air Act (CAA). The USACE has jurisdiction over the Project under the authority of Section 404 of the Clean Water Act (CWA) and accepted cooperating agency status in a letter dated May 20, 2022 (Appendix A).

1.4 Planning Area

1.4.1 Selected Watershed

The Watershed Plan area includes approximately 298 square miles (mi^2) or 190,500 acres of land situated in southern Washington County, Utah (Appendix B, Map B1). It was established in 1968 as part of the Watershed Work Plan to provide watershed protection, flood prevention, and agricultural water management improvements (Dixie Soil Conservation District et al. 1968). Since the original plan was developed, 9 Supplemental Watershed Work Plans have been developed and are summarized below:

- Supplemental Watershed Work Plan No. 1 (Soil Conservation Service (SCS) 1971): This supplement consisted of clarification to cost share for relocation and real property rights costs for measures proposed in the original Watershed Plan. It also included information for SLO adherence to the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (PL 91-646, 84 Sta/ 1894).
- Supplemental Watershed Work Plan No. 2 (SCS 1975): This supplement consisted of removing Little Valley flood prevention measures and the Price Bench irrigation system improvements as well as changed capacity of the St. George-Washington Canal. The associated costs were also updated.
- Supplemental Watershed Work Plan No. 3 (NRCS 2014b): This supplement consisted of removing Washington County, Bloomington Canal Company, St. George-Clara Field Canal Company, and Bench Lake Irrigation Company as SLOs. Washington County Flood Control Authority and Hurricane City were added as SLOs. The Sugarloaf debris basin, Red Hills diversion, Golf Course debris basin, Golf Course North debris basin, Ivins debris basin, Blue Bowl debris basin, St. George-Clara Fields irrigation system improvements, Bloomington Canal Company irrigation system improvements, and Washington Fields drainage system were removed from the plan.
- Supplemental Watershed Work Plan No. 4 (NRCS 2016b): This supplement was for rehabilitation of Gypsum Wash Debris Basin.
- Supplemental Watershed Work Plan No. 5 (NRCS 2017a): This supplement was for rehabilitation of Ivins Debris Basins 1-6.
- Supplemental Watershed Work Plan No. 6 (NRCS 2017b): This supplement was for rehabilitation of Warner Draw Debris Basin.

- Supplemental Watershed Work Plan No. 7 (NRCS 2017c): This supplement was for rehabilitation of Stucki Debris Basin.
- Supplemental Watershed Work Plan No. 8 (NRCS 2019): This supplement was for rehabilitation of Frog Hollow Debris Basin.
- Supplemental Watershed Work Plan No. 9 (NRCS 2022a): This supplement provided flood prevention, watershed protection, public recreation, and agricultural water management improvements.

1.4.2 Study Area

The study area for this Project focuses on the Gould Wash drainage from its upstream extent to its downstream extent at the Virgin River, consisting of the approximate 43 mi^2 Upper Gould Wash subwatershed and approximate 31 mi^2 Lower Gould Wash subwatershed (Hydrologic Unit Codes [HUCs] 150100080901 and 150100080902). The drainage area of Gould Wash considered for hydrologic analysis and flooding conditions includes 64.5 mi^2 upstream of the Hurricane cliffs, which adjoin Hurricane City to the southeast. The drainage area considered for alternative detention dam hydrologic analysis and concept design includes 57.2 mi^2 upstream of the proposed dam location. A map of the subwatersheds and drainage areas is included in Appendix B, Map B1.

Alternatives considered for detailed study and their associated Project area include 608.1 acres of land (Appendix B, Map B1 and B2.1). The Project area encompasses areas proposed for access, borrow material sources, staging, easements, right-of-ways (ROWs), and improvements for alternatives included in detailed study. The Project area is separated into two segments, the western and eastern segment. The western segment consists of 56.0 acres of land along Gould Wash that passes through developed areas of Hurricane City (Appendix B, Map B2.2). The eastern segment is upstream (southeast) of Hurricane City and the Hurricane Cliffs, and includes 552.1 acres of land (Appendix B, Map B2.3).

The benefited area covers approximately 966.5 acres and is depicted in Appendix B, Map B1 and B2.2. It encompasses the area that would benefit from implementation of Project flood prevention measures. The benefited area was determined as the maximum combined extent of existing conditions flooding determined from Bowen Collins and Associates (BC&A) flood modeling (BC&A 2021a) and from the FEMA Federal Insurance Rate Map (FIRM) Special Flood Hazard Areas (SFHAs).

1.4.3 Area of Potential Effect

The Area of Potential Effect (APE) for Section 106 of the National Historic Preservation Act of 1966 (NHPA) encompasses the 608.1-acre Project area and 966.5-acre benefited area. It encompasses all potential ground disturbance, staging areas, access, borrow sources, and disposal areas. The APE also includes a 50-foot buffer around anticipated disturbance. Of the 608.1 acres, approximately 438.5 acres are on BLM land, and 169.6 acres are on private/municipal land. No visual APE was established as the proposed dam is not within sight of any historic properties due to line of sight being blocked by terrain. The APE was defined in consultation with the SHPO, cooperating agencies (USACE, BLM, and EPA), and the consulted tribes per 36 CFR 800.4. Refer to Appendix B, Map B1 and Maps B2.1 though B2.3 that depict the Project area and benefited area making up the APE. These extents encompass all areas that

may be disturbed or changed from their current conditions with potential to affect historic properties. Historic properties per 36 CFR 800.16 are defined as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP) maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria.

1.5 Planning Process and Study Scope

This document follows the areawide planning process as outlined in the NRCS National Planning Procedures Handbook (NPPH), Amendment 9 (NRCS 2021). Areawide plans are voluntary, comprehensive plans for a watershed or other large geographic area. The geographic area for this plan consists of the Gould Wash drainage, which is part of the larger Warner Draw Watershed. Planning policy for areawide plans require consideration of all natural resources within a planning area, as well as social and economic considerations. Areawide plans are developed through a voluntary locally led effort to achieve the following:

- Assess natural resource conditions and needs;
- Set goals;
- Identify programs;
- Alternative actions and other resources to solve those needs;
- Develop proposals and recommendations to solve those needs;
- Implement solutions; and
- Measure success.

The format of this document follows the plan format that must be followed for Supplemental Watershed Project Plans as outlined in the NRCS National Watershed Program Manual (NWPM) Parts 500 through 506 (NRCS 2015 and 2024), National Watershed Program Handbook (NWPH), Parts 600 through 606 (NRCS 2014a), and National Environmental Compliance Handbook (NECH), Part 610 (NRCS 2016a). The planning and decision-making process followed Principles, Requirements, and Guidelines for Federal Investments in Water Resources (PR&G) (CEQ 2013 and 2014), NRCS Department Manual (DM) 95000-013 (USDA 2017b), the PR&G eight step evaluation process (refer to the PR&G Analysis Report included in Appendix E), and the nine-step planning procedures from the NPPH (NRCS 2021).

1.5.1 Stepwise Planning Process

The NRCS planning process consists of nine steps, divided into three phases covering development, implementation, and evaluation of an areawide plan. The nine-step planning process as presented in the NRCS NPPH (NRCS 2021) was considered and incorporated into this Plan-EIS as identified below.

Phase 1 - Collection and Analysis

- Step 1 - Identify Problems and Opportunities: Problems and opportunities were identified during the Project scoping process and are included in Section 2.2 (Need). Input from the Sponsors, agencies, the public, organizations, and tribes were solicited as described in Sections 1.5.5 (External Scoping) and Section 7.3 (Public Involvement) to help identify problems and opportunities. Engineering analysis was completed to further identify and

evaluate problems as documented in the engineering technical memorandums (TMs) included in Appendix E.

- Step 2 - Determine objectives: The purpose and need statement for the project was formulated with the problems and opportunities in consideration. Where the "purpose" identifies the fundamental reason why the action is being proposed and the "need" describes the problem/s that the proposed action is intended to address and explains the underlying causes of the problem/s. The purpose and need statement was also agreed upon in cooperation with the EPA, USACE, and BLM. Section 2.0 (Purpose and Need) identifies the purpose, objectives, and need to support step 2.
- Step 3 – Inventory Resources: Resources and ecosystem services relevant to the alternative actions were determined during the scoping process as described in Section 3.1 (Resource Categories of Concern). The resource conditions determined to be relevant are described in Section 3.2 (Inventory of Existing Resources and Conditions).
- Step 4 – Analyze Resource Data: The environmental baseline conditions for resources to be evaluated against alternative actions were identified and are included in Section 3.2 (Inventory of Existing Resources and Conditions). The best available data and science was used to inventory the existing resource conditions at the level and scale of analysis determined reasonable for evaluating alternatives and impacts during the planning stage.

Phase 2 Decision Support

- Step 5 – Formulate Alternatives: Project alternatives were formulated in consideration of the federal objective as set forth in the Water Resources Development Act of 2007, the PL 83-566 general purposes, and the Project purpose and need. Alternatives were formulated following procedures outlined in the NWPM, NWPH, DM 95000-013, and PR&G. Alternatives formulated are described in Section 4.0 (Formation of Alternatives).
- Step 6 – Evaluate Alternatives: The effects of alternatives included in detailed study were determined for each resource relevant to the alternative actions. The evaluation of alternatives is included in Section 5.0 (Environmental Consequences) and assessed the proposed alternatives against the baseline data presented in Section 3.2 (Inventory of Existing Resources and Conditions).
- Step 7 - Make Decisions: A NRCS preferred alternative, was selected based on the evaluation performed. The selection was made for the alternative that best maximized public benefits (environmental, economic, and social) with appropriate consideration of costs. Section 6.0 (Preferred Alternative) provides information on the decision-making process for selection of the preferred alternative. The preferred alternative was also agreed upon in cooperation with the Project SLOs, NRCS, EPA, USACE, and BLM.

Phase 3 Application and Evaluation (Future Work)

- Step 8 – Implement the Plan: The Plan-EIS is the first phase of three phases to be completed for implementation of the preferred alternative. After the Final Plan-EIS is completed, phase 2 would consist of final design, and phase 3 installation of the Project measures.
- Step 9 – Monitor the Plan: After the installation of measures from phase 3, NRCS and the Sponsors would evaluate the effectiveness of the plan in solving the resource concerns. Adjustments to the plan would be made as needed.

1.5.2 Ecosystem Services Framework

An ecosystem services framework is required by the PR&G and provides for an integrated approach that allows consideration and transparent evaluation of the benefits (both tangible and intangible) and tradeoffs of potential alternatives. Four categories of ecosystem services are described in the PR&G and are included below for reference.

1) **Provisioning services** are tangible goods provided for direct human use and consumption, such as food, fiber, water, timber, or biomass.
2) **Regulating services** maintain a world in which it is possible for people to live, providing critical benefits that buffer against environmental catastrophe – examples include flood and disease control, water filtrations, climate stabilization or crop pollination.
3) **Supporting services** refer to the underlying processes maintaining conditions for life on earth, including nutrient cycling, soil formation, and primary production.
4) **Culture services** make the world a place in which people want to live – recreational use, spiritual, aesthetic viewsheds, or tribal values.

The project scoping process identified resources relevant to the proposed action that were considered for the determination of applicable ecosystem services (see Section 3.1). Ecosystem service benefits can be both monetary and nonmonetary. Appropriate metrics should be based on current methodology to quantify impacted services over time for determination of project- and/or regional-specific effects. For reference, a list of ecosystem service categories and their subcategories is provided in Figure 1-1. The ecosystem service categories/subcategories relevant to this Project and the applicable resources pertinent to each subcategory that were analyzed in this document are provided in Table 3-2 of Section 3.1.

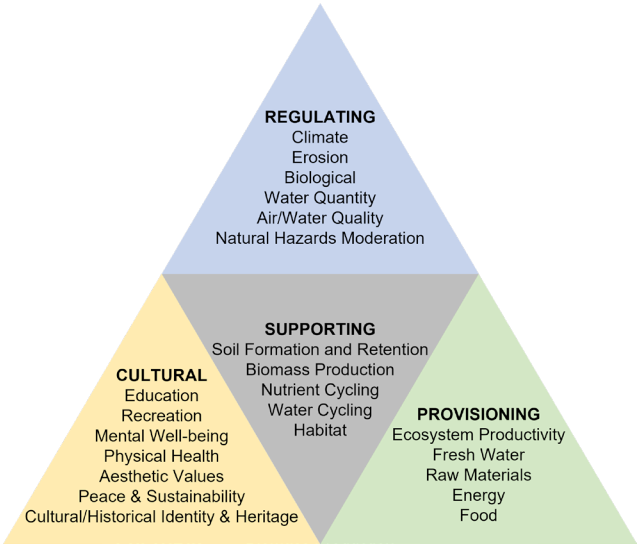

Figure 1-1. Ecosystem Services

The applicable ecosystem services from above were evaluated as part of the PR&G eight-step evaluation process. This process includes consideration of the federal objective, PL 83-566 general purposes, guiding principles, and ecosystem services to assist in decision-making. Refer to the PR&G Analysis Report included in Appendix E for documentation of the PR&G eight-step

evaluation process used for decision-making and the Ecosystem Services Tradeoff Analysis Evaluation Table included in Appendix E.

1.5.3 Period of Analysis

The NRCS period of analysis is the time required for implementation (design and construction) plus the evaluated life of the project. The evaluated life is the time over which an alternative will have significant beneficial or adverse effects when the work(s) of improvement function successfully with prescribed operations, maintenance, and replacement (OM&R). The evaluated life is used for discounting and amortizing project benefits and costs. It is also used to determine the duration of operations and maintenance (O&M) agreements for the Project works of improvement.

The NRCS period of analysis for this Project is 102 years, which includes 100 years for the evaluated life and 2 years to install the Project measures.

1.5.4 Project Scope

Areawide Watershed Plans are limited for watershed size and structure size. The maximum watershed size allowed is 250,000 acres and structures cannot provide more than 12,500 acre-feet (ac-ft) of floodwater detention capacity or more than 25,000 ac-ft of total capacity. The existing Watershed covers an area of 298 mi^2 or approximately 190,500 acres and is within the limit established for Areawide Watershed Plans. No changes have been made to the watershed size to date and none are proposed for this Project. In addition, floodwater detention capacities for alternative measures are within the required capacity limits.

This Project includes measures within an approximate 74-acre drainage area that consists of two HUC 12 subwatersheds (see Section 1.4.2) located within the greater Watershed boundary. The focus for this Plan-EIS analysis is specific to the 74-acre drainage area and the downstream receiving water of the drainage area, the Virgin River.

1.5.5 External Scoping

An external scoping process was performed so that those who were interested in or potentially affected by proposed alternatives had an opportunity to share their concerns and provide input regarding the Plan-EIS during the initial stages of the process. Project scoping questions, comments, and concerns were requested from the public, SLOs, stakeholders, tribes, organizations, and agencies during the external scoping period, both orally at public meetings and via written submittal of comments. A scoping meeting for the Project was held on February 4, 2020. The meeting presented the overall Project and Plan-EIS process. A Notice of Intent (NOI) to prepare the Plan-EIS was published in the Federal Register on June 3, 2021. The open comment period extended from January 21, 2020 through July 21, 2021. Thirteen (13) scoping comments were received during the open comment period. These comments were considered in preparation of the Plan-EIS. A Scoping Report was prepared summarizing the scoping process and is included in Appendix A. The scoping report includes documentation of the scoping announcements and activities that occurred during the external scoping process.

1.6 Related Projects and Studies

Actions and studies within the Project vicinity occurring in the past, present, and reasonably foreseeable future were identified to define the scope of issues to be addressed in this

Supplemental Watershed Plan. Those found relevant to this Project were used in describing the resources in Section 3.0 (Affected Environment) and in determining direct, indirect, and cumulative impacts addressed in Section 5.0 (Environmental Consequences). Studies are referenced, where applicable, throughout Section 3.0 and Section 5.0. Section 8.0 (References) provides information on the references and where they can be found. Non-Project actions in the Watershed that were determined relevant to the Project effects analysis and associated cumulative effects are identified in Section 5.24.

2.0 Purpose and Need

2.1 Purpose

The purpose of the project is to provide flood prevention (flood damage reduction) to reduce damage caused by floodwater from the Gould Wash drainage in Hurricane City. There is a need to protect people, structures, transportation infrastructure, public utilities, and property within the developed areas of Hurricane City that are exposed to flooding.

2.1.1 Federal Objective

Water resources investments shall reflect national priorities, encourage economic development, and protect the environment by:

1) Seeking to maximize sustainable economic development;
2) Seeking to avoid the unwise use of floodplains and flood-prone areas and minimizing adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used; and
3) Protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems.

2.1.2 Project Objectives

Project objectives were formulated at the start of the planning process by the SLO and NRCS based on documented historic flooding of Gould Wash and recent FEMA floodplain mapping, regulations, and studies. The main Project objective is to formulate feasible alternatives that would reduce flooding to Hurricane City from Gould Wash with a preferred level of flood protection for a 100-year flood. The additional goals listed below were also established through input from NRCS, SLOs, and cooperating agencies.

- Improve public safety and reduce the risk to loss of life in Hurricane City at a 100-year flood.
- Provide alternative measures that have a net economic benefit and/or provide sufficient positive environmental or social effects.
- Avoid/minimize modifications along the Gould Wash channel bottom that could adversely impact existing channel infiltration conditions or stream functions.
- Ensure Section 404 permitting compliance for selection of the USACE Least Environmentally Damaging Practicable Alternative (LEDPA).

2.1.3 Constraints and Considerations

Constraints were identified in the planning area that influenced the alternative analysis. These constraints limit the extent to which the objectives could be achieved. A description of the constraints is provided below.

- Sediment Transport: Changes in sediment transport should be minimized to avoid downstream impacts to the Virgin River. The combination of intense rainfall on highly erodible soils lacking vegetative cover from arid conditions in the Gould Wash drainage area results in large sediment loads for Gould Wash. This sediment transport is a natural process of the ephemeral system and changes in sediment transport could have adverse implications to the Virgin River.
- Sediment Management: Due to the high sediment loads in Gould Wash, some alternative sediment management options become exorbitant for the SLOs. Alternatives should consider feasible and affordable options for SLO sediment O&M management.
- Topography and Development: The generally flat topography through Hurricane City and heavy residential development surrounding Gould Wash increases the cost and complexity of providing safe conveyance for flood flows. The topography transitions abruptly from a vertical drop out of a deeply incised channel upstream at the Hurricane Cliffs to a generally flat gradient with no incised channel through Hurricane City. The topographic conditions result in large volumes of water introduced over the Hurricane Cliffs during floods with conveyance complications through the low gradient topography in Hurricane City that result in widespread flooding of developed areas.
- Channel Erosion: Due to unique site conditions, maintaining stability of the Gould Wash channel through Hurricane City during floods is not feasible without some level of bank armoring. Arid conditions, lack of hydrology, presence of loose noncohesive soils, and severe water shortage conditions do not allow for successful bioengineering techniques that could prevent erosion.

2.2 Need

Developed areas of Hurricane City are at risk for substantial flooding from Gould Wash. This flooding has the potential to destroy or cause damage to residences, community buildings, and city infrastructure. The floodplain in Hurricane City was developed prior to identification of the Gould Wash floodplain in 2009 from Federal Emergency Management Agency [FEMA] floodplain mapping. Flooding could cause serious injury and death adversely impacting the physical and mental well-being of the community. The developed areas within the Gould Wash alluvial flat floodplain no longer provide beneficial ecological floodplain functions and there is risk for harmful contaminants entering the Virgin River during flood events. The problems leading to these issues and opportunities that could be realized by addressing them are described in the subsections below.

2.2.1 Problems

Developed areas of Hurricane City are at risk of flood damage from Gould Wash flooding and flash flooding. This flooding has the potential to destroy or cause damage to residences, community buildings, and city infrastructure, and poses a safety risk for those located within the floodplain.

Gould Wash is an ephemeral stream, meaning that water only flows in the stream channel after a precipitation event and for a short duration after any given event. When a significant amount of rain falls in the Gould Wash drainage area, flash flooding conditions can occur. Hurricane City sits at the base of the Hurricane Cliffs with Gould Wash conveying flows over the cliffs and into the city, entering at the east edge of the city. The channel continues generally northwest downstream through the developed areas of Hurricane City and discharges into the Virgin River (Appendix B, Map B2). The uncontrolled[1] Gould Wash drainage area upstream of Hurricane City includes approximately 64.5 square miles (Appendix B, Map B1).

Large and damaging flash floods have occurred in Hurricane City documented in 1930, 1955, and 1981 (Federal Emergency Management Agency [FEMA] 1981). Additional anecdotal information provided from resident interviews (Eitel 2011) suggest that several other smaller floods may have occurred along Gould Wash around 1936, 1939, 1959, the mid 1960's, the mid 1970's, and 1989. The flood in 1956 inundated several residences and damaged three bridges along the Gould Wash alignment based on anecdotal information provided by multiple residents (Eitel 2011). A photograph from 1956 provided by Hurricane City noted debris and flooding as high as 12 feet at a power pole adjoining the S 700 W bridge over the channel (Figure 2-1). Anecdotal information provided by several residences for the 1981 flood event noted flooding of residential areas of town.

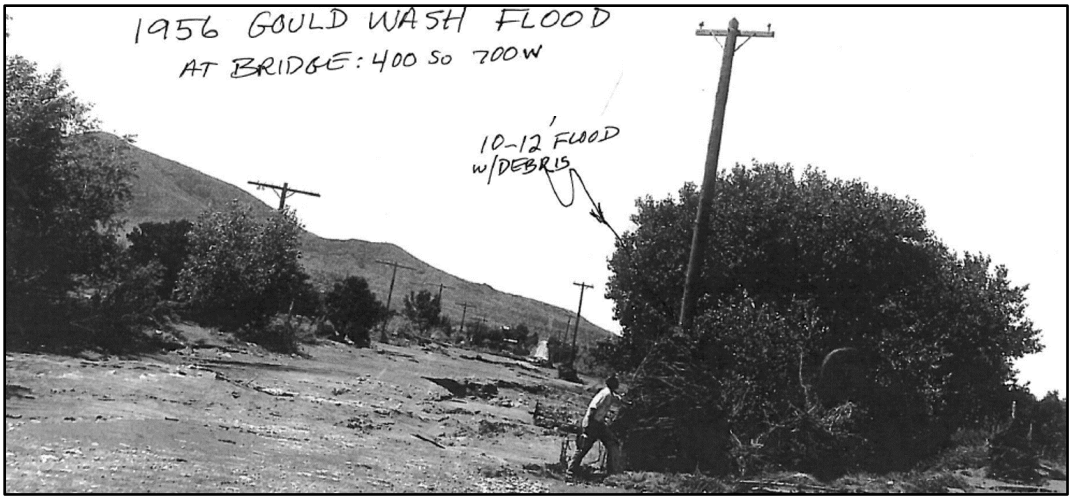

Figure 2-1. Photo from 1956 Gould Wash Flood

Since the 1981 flood event, agricultural lands have been developed with hundreds of residences and other city infrastructure that adjoin the Gould Wash alignment which are exposed to flooding hazards. Figure 2-2 depicts the developed condition along Gould Wash in Hurricane City in 1981 and 2021. Because FEMA flood maps did not show Special Flood Hazard Areas (SFHAs) from Gould Wash until the Flood Insurance Rate Maps (FIRMs) became effective in 2009 (FEMA 2009), development unknowingly occurred in areas of the floodway and floodplain prior to 2009. The FEMA floodway and floodplains were further revised in 2017 and in 2021 (FEMA 2017 and 2021) through a Letter of Map Revision (LOMR). Hurricane City has followed FEMA floodplain guidance and restrictions for development within SFHAs since the FIRMS became effective in

[1] Uncontrolled indicates that precipitation or snowmelt in in the drainage area is not regulated by a controlling structure such as a dam.

2009. However, the FEMA floodplain restrictions do not reduce the risk of flooding to the hundreds of structures that were developed in the floodplain prior to FEMA mapping.

Hurricane City has grown at a rapid rate, increasing potential damages to property, structures, and city infrastructure if another large flood were to occur. The population of Hurricane City around the time of the 1981 flood was approximately 2,660 people (U.S. Decennial Census for 1980) and has risen to 21,808 people (U.S. Census Bureau [USCB] 2021). There are now a greater number of people that would be at risk if another large flood occurred. Additionally, extreme precipitation is projected to increase, potentially increasing the frequency and intensity of floods in Washington County (NRCS 2023a).

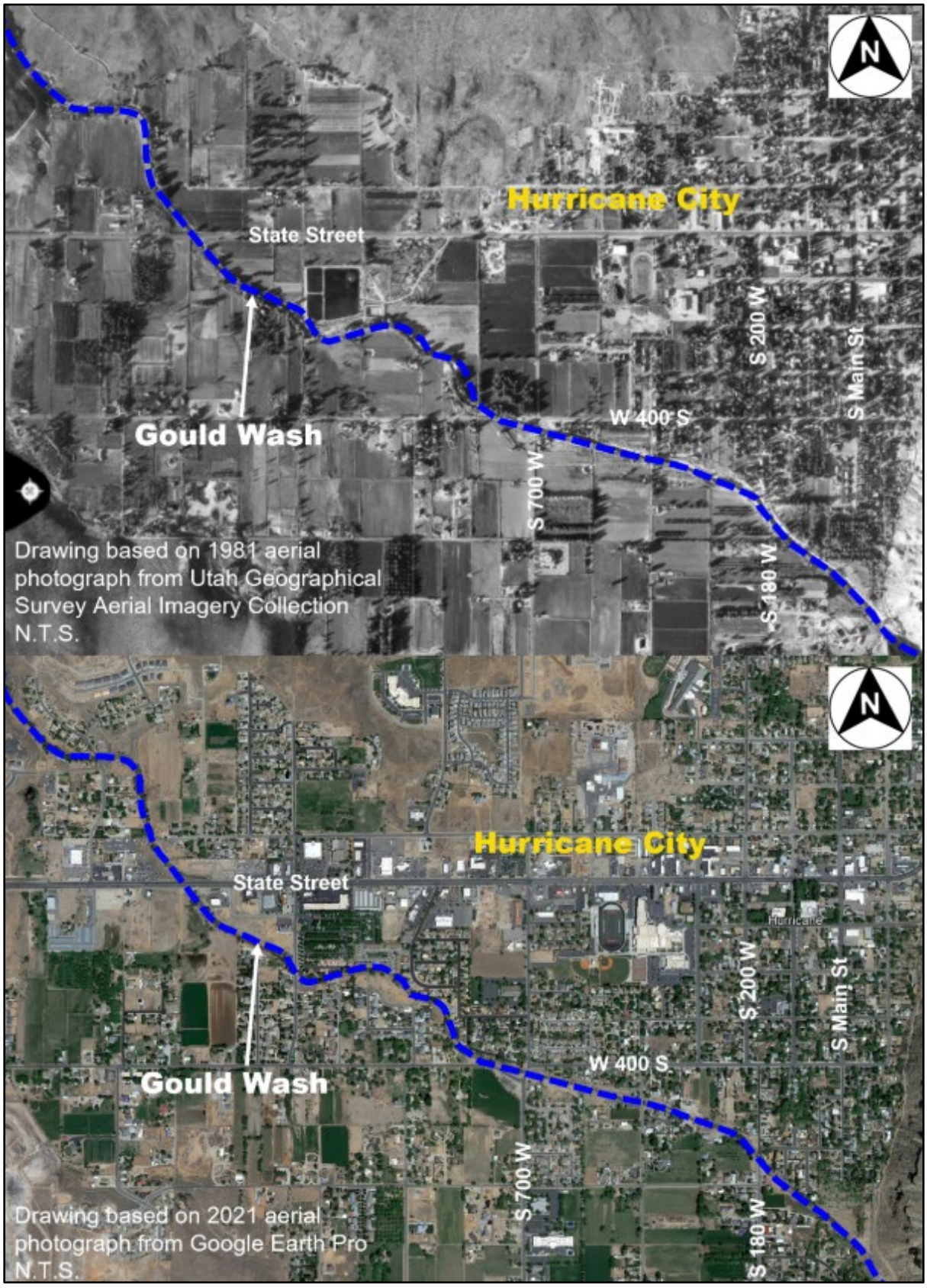

Figure 2-2. Hurricane City Development 1981 and 2021

Recent analyses have been conducted that identify the extent and impacts of flooding to Hurricane City from Gould Wash. A hydraulic and hydrology analysis was completed by Bowen Collins and Associates (BC&A) for the Project to determine the existing Gould Wash channel capacity, model storm events, and map flooding conditions (BC&A 2021a, Attached in Appendix E). The analysis found the current capacity of Gould Wash through Hurricane City to range from 1,600 cubic feet per second (cfs) to 6,700 cfs, with road crossings (culverts/bridges) ranging from 24 cfs to 6,943 cfs. The peak flood flow of Gould Wash into Hurricane City for a 1 percent annual chance flood was estimated at 8,820 cfs, exceeding the capacity of Gould Wash through Hurricane City. The modeled flooding produced from this event covers approximately 651 acres within Hurricane City inundating an estimated 650 residences, 99 commercial/office buildings, one (1) school, five (5) churches, one (1) post office, and 82 roads (Appendix C, Map C8.1).

Modeling was also performed by BC&A for several other 24-hour storm events including the 2-, 5-, 10-, 25-, 50- and 500-year floods (BC&A 2021a, Attached in Appendix E). The modeling showed flooding outside of the Gould Wash channel beginning to occur at a 2-year flood (50 percent annual chance flood). The 2-year flood has minimal flooding covering 29 acres but increases greatly by the 25-year flood (4 percent annual chance flood) which covers much of Hurricane City (433 acres). Analysis of flood depth and velocities by NRCS determined that there is a risk to loss of life from flood events greater than a 25-year flood (see Section 2.3.2 of Appendix D).

In addition to flood damage in Hurricane City, there are concerns with the current floodplain function and water quality. Hurricane City lies on an alluvial flat that has experienced widespread flooding from Gould Wash in its historic and geologic past. This is evidenced by the alluvial deposits and eolian deposits reworked by alluvial processes that cover an approximate mile-wide corridor along Gould Wash extending from the Hurricane Cliffs to the northwest edge of Hurricane City (Appendix C, Map C2.1). The alluvial flat along Gould Wash is now heavily developed and no longer maintains its natural functions. Flooding of the now developed alluvial flat in Hurricane City could introduce several contaminants (chemicals, fuel, animal waste, bacteria, and other harmful substances) into floodwaters which ultimately drain back into Gould Wash then to the Virgin River. Contaminated floodwaters could impact water quality and multiple sensitive species and habitats that occupy the downstream receiving waters of the Virgin River.

2.2.2 Opportunities

Solutions to reduce the adverse flooding conditions along Gould Wash through Hurricane City have been a priority for the community since the first documented occurrences of flooding in the early 1930's. The priority substantially increased after identification of the potential flood hazards through the 2009 FEMA flood mapping and based on the recent upsurge in development. As a rural community (population of less than 50,000), Hurricane City recognizes the limited city funds available for analysis, design, and construction of measures at the scale required to benefit the community.

Through PL 83-566 funding program, there are opportunities for NRCS to assist the SLOs in developing, designing, and installing positive solutions for the program's authorized purpose of flood prevention (flood damage reduction). The PL 83-566 set forth three general purposes for Watershed Program projects (NWPM 2024):

1) flood prevention (including structural and land treatment measures;
2) the conservation, development, utilization, and disposal of water; or

3) the conservation and proper utilization of land in watershed or subwatershed area.

The flood prevention authorized purpose, as included in the NWPM, allows for flood damage reduction measures to reduce or prevent floodwater damages by reducing runoff, erosion, and sediment through; modifying the susceptibility of improvements in the floodplain to damage; removing damageable property from the floodplain; or reducing the frequency, depth, or velocity of flooding. Measures may also include actions that prevent encroachment into the floodplain (NRCS 2015).

The flood prevention project has the opportunity to provide long-term positive benefits of:

- Improved stability and prosperity for the impacted community of Hurricane City.
- Improved public safety and social wellbeing.
- Reduced physical and mental health stressors that impact communities in the wake of flooding.
- Reduced risk of contamination to surface water and associated impacts to sensitive species and habitats in the Virgin River.

3.0 Affected Environment

3.1 Resource Categories of Concern

A scoping process was completed to identify relevant resources, environmental concerns, and ecosystem services to be analyzed in detail and to determine which could be eliminated from detailed study. These items were identified for the Project based on required scoping concerns outlined in the NWPM Section 501.24 B (NRCS 2015) and from any additional concerns identified by the public, SLOs, stakeholders, tribes, agencies, and cooperating agencies during the scoping process.

Table 3-1 below provides a list of resources and their relevancy to the Project. Items determined not relevant to the proposed action have been eliminated from detailed study. Items determined to be relevant to the proposed action are detailed in this Plan-EIS and addressed in Section 3.2 and in Section 5.0.

Table 3-1. Identified Resource Categories of Concern and Ecosystem Services

Item/Concern	Relevant		Rationale
	Yes	No	
Soil			
Upland Erosion	X		Construction disturbance could increase erosion potential.
Sedimentation	X		Alternative measures would change sediment transport conditions.
Prime and Unique Farmland	X		Prime farmland is located in the Project area.

Item/Concern	Relevant		Rationale
	Yes	No	
Water			
Surface Water/Groundwater Quality	X		Alternative measures could affect surface water quality. No measurable changes to groundwater quality are anticipated.
Surface Water Quantity and Flow	X		Alternative measures could alter stream flow patterns.
Ground Water Quantity and Flow		X	No measurable changes to groundwater conditions are anticipated. Refer to Appendix D for supporting information.
Waters of the U.S. and Wetlands	X		Jurisdictional waters of the U.S. are located within the Project area. No wetlands were identified in the Project area based on review of an aquatic resource survey conducted and included in Appendix E.
Regional Water Mgt. Plans and Coastal Zone Management Areas		X	No regional water management plans are in place for the area. Coastal Zone Management Areas are not applicable (N/A).
Floodplain Management	X		Changes to water conveyance for alternative measures would affect floodplain management.
Wild and Scenic Rivers		X	None in or near the Project area according to National Wild and Scenic Rivers System (NWSRS) interactive map (NWSRS 2023).
Sole Source Aquifers		X	None in or near the Project area according to EPA Sole Source Aquifer interactive map (EPA 2023b).
Air			
Air Quality	X		Alternative construction activities would produce emissions and fugitive dust.
Clean Air Act		X	Alternative actions would not generate long-term emissions. Permits would not be required.
Greenhouse Gases / Climate	X		Alternative construction activities would produce greenhouse gas emissions.
Plants			
Vegetation Communities	X		Alternative actions occur in vegetated areas.
Special Status Plant Species	X		Endangered Species Act (ESA) and BLM-listed species/suitable habitat may be present in or near the Project area.
Forest Resources		X	There are no forest resources in or near the Project area.
Noxious Weeds and Invasive Plant Species	X		Alternative construction disturbance increases risk of invasive plant species becoming established.
Protected Natural Areas/ Conservation Areas		X	There are no protected natural areas or conservation areas located in the Project area based on review of BLM conservation areas (BLM 2023), USFWS wilderness area (Wilderness Connect 2024), Research Natural Areas (RNAs) (U.S. Forest Service 2024), and wildlife refuges (USFWS 2021).

Item/Concern	Relevant		Rationale
	Yes	No	
Riparian Areas	X		Riparian habitat is present within the Project area.
Animals			
Essential Fish Habitat		X	There is no essential fish habitat located in the Project area based on National Oceanic and Atmospheric Administration (NOAA) fisheries Essential Fish Habitat Mapper (NOAA 2023).
National Wildlife Refuges / Wilderness Areas		X	There are no Wildlife Refuges or Wilderness Areas that would be impacted from alternative measures based on USFWS wilderness area (Wilderness Connect 2024) and wildlife refuges (USFWS 2021).
Fish and Wildlife	X		Wildlife habitat is present within areas proposed for alternative measures, but fish habitat is not. However, alternative actions could impact fish habitat downstream of the Project area.
Coral Reefs		X	No coral reefs are present within the landlocked state.
Special Status Animal Species	X		Habitat for ESA, BLM-listed, and state-listed Species of Greatest Conservation Need (SGCN) may occur in the Project area.
Invasive Animal Species		X	No potential for introduction of invasive animal species.
Migratory Birds / Bald and Golden Eagles	X		Habitat for migratory birds and bald/golden eagles are present within the Project area.
Human			
Social Issues and Local Economy	X		The Project is located in a populated area and Project measures could impact local social and economic conditions.
Regional and National Economy		X	The Project is not anticipated to have impacts to regional or national economy.
Historic Properties / Cultural Resources	X		Historic/cultural resources are present within the Project area.
Hazardous Materials		X	Hazardous materials within the Project area do not appear to be a concern at this time, but on-site surveys would be necessary to ensure the absence of potential hazardous materials prior to construction. Equipment and associated fuels would be working/stored on-site during construction, but effects would be negligible based on adherence to applicable laws and regulations. See Section 6.3 for avoidance and minimization measures.
Public Health and Safety	X		The public is at risk from flooding and alternative measures would change flood conditions.
Recreation	X		Recreation activities occur on BLM and state lands within the Project area.
Land Use / Public Access	X		Alternative measures would impact land use.

Item/Concern	Relevant		Rationale
	Yes	No	
Visual Resources	X		Visual/scenic resources are located in the Project area.
National Scenic and Historic Trails		X	There are no National Scenic and Historic Trails (NSHTs) located in or near Project area according to the National Trails System Map (National Park Service [NPS] 2023a).
Parklands (including National Parks, Monuments, and Historical Sites)		X	There are none located within or near the Project area according to National Parks and Monuments Map (NPS 2023b), Utah State Parks Map (Utah Department of Natural Resources [UDNR] 2023a), and the National Natural Landmarks Map (NPS 2023c).
Transportation Infrastructure	X		Alternative disturbance would occur along road corridors.
Noise	X		Alternatives would produce construction-related noise.
Ecological Critical Areas		X	None present in the project area based on review of Areas of Critical Environmental Concern (ACEC) (BLM 2023). The Red Cliffs Desert Reserve is located near the Project area, but would not be impacted by alternative actions. Refer to Appendix D for supporting information.
Scientific Resources		X	There are no scientific resources in the Project area based on a review of the geologic map (Biek et al. 2010), paleontological sites (Paleobiology Database 2024), NPS maps (NPS 2023a, 2023b, 2023c), and lack of the following identified in this table above; ACECs, national landmarks/monuments, parklands, natural areas, protected areas, conservation areas, NSHT, RNAs, refuges, wilderness areas, and wild and scenic rivers.
Ecosystem Services			
Provisioning	X		Project measures could change flooding conditions on agricultural land that influence crop yield.
Regulating	X		Project measures include regulation for water, biology, and flooding that influence ecosystem processes.
Cultural	X		Project is intended to improve safety, wellbeing, and sustainability of the local community in addition to protecting community heritage.
Supporting		X	Project measures would not result in changes to the underlying processes maintaining conditions for life on earth (nutrient cycling, soil formation, and primary production). Refer to Appendix D for supporting information.

An ecosystem services framework is required by the PR&G and provides for an integrated approach that allows consideration and transparent evaluation of the benefits (both tangible and intangible) and tradeoffs of potential alternatives. The four categories of ecosystem services are described in Section 1.5.2 (Ecosystem Services Framework).

Ecosystem service categories overlap with the resource concerns and therefore, are not discussed separately from the resource concerns. For reference, the ecosystem service categories relevant to this Project and the applicable resource concerns that discuss these categories are provided in Table 3-2.

Table 3-2. Applicable Ecosystem Services and Related Resources

Category	Service	Applicable Resources
Provisioning	Food/Biomass (crop yield)	Social Issues and Local Economy, Prime and Unique Farmland
Regulating	Water Regulation (quality and quantity)	Waters of the U.S., Surface Water Quality, Surface Water Quantity and Flow, Floodplain Management
Regulating	Biological Regulation (plants and animals)	Plant and Animal Resources
Regulating	Natural Hazards Moderation (flood)	Floodplain Management, Public Health and Safety, Transportation Infrastructure
Cultural	Cultural/Historical Identity and Heritage	Historic/Cultural Resources/Native American Religious Concerns
Cultural	Peace and Sustainability	Social Issues and Local Economy, Public Health and Safety, Recreation, Visual Resources, Transportation Infrastructure, Noise and Vibration.
Cultural	Well-being and Safety	Floodplain Management, Public Health and Safety

The applicable ecosystem services from above were evaluated as part of the PR&G eight-step evaluation process. This process includes consideration of the federal objective, PL 83-566 general purposes, guiding principles, and ecosystem services to assist in decision making. Refer to the PR&G Analysis Report for documentation of the PR&G eight-step evaluation process used for decision-making and the Ecosystem Services Tradeoff Analysis Evaluation Table included in Appendix E.

3.2 Inventory of Existing Resources and Conditions

This section describes the resources that were determined to be relevant to the proposed action from Table 3-1. Describing the affected environment defines the context in which the impacts could occur. The environmental analysis process has been conducted in compliance with applicable federal, state, and local regulations. Resources relevant to the Project are described in this section. The environmental consequences to resources are included in Section 0.

Each resource in this Section includes the baseline environmental conditions in the Project area and may extend beyond the Project area as applicable, to include the areas of potential impact for adequately addressing the impacts of alternative measures. Refer to Section 1.4 for a description of the areas used in this study which include the study area, Project area, Gould Wash drainage area, and benefited area. Table 3-3 summarizes the physical setting of the Project area.

Table 3-3. Physical Setting Summary

Physical Setting Information	Information Source
Location	
The Project area is separated into two segments with one segment extending along Gould Wash through Hurricane City, Utah and the other segment located approximately one mile southeast of Hurricane City.	N/A
Size	
608.1 acres	Measured from QGIS version 3.16
Topography	
Elevation 3,140 to 4,400 feet with a general topographic gradient sloping northwest toward the Virgin River	ESRI Topo from QGIS version 3.16
Geologic Units	
River and stream alluvium (Qa), talus (Qmt), alluvium and colluvium (Qac & Qaco), alluvium and eolian sand (Qae), Cinder Pits lava flow and cinder cones (Qbcp), Volcano Mountain lava flow and cinder cone (Qbv), Gould Wash lava flow and cinder cones (Qbgw), Lower Red Member of Moenkopi Formation (TRml), Timpoweap Member of the Moenkopi Formation (TRmt), Brady Canyon Member of the Toroweap Formation (Ptb). Geologic units are depicted in Appendix C, Map C2.1 and C 2.2.	Utah Geological Survey (UGS) Geologic Map (Biek et al. 2010)
Soil Characteristics	
Soil Types	See Table 3-4 in Section 3.2.3
Land Ownership	
Federal (BLM) 438.5 acres (72%) Private 165.4 acres (27%) State 4.2 acres (1%)	Land Ownership GIS Layer (Utah Trust Lands Administration [TLA] and BLM 2022)

3.2.1 Upland Erosion

Soils within the Project area vary and the erosivity is dependent upon soil characteristics and the erosional forces acting on them. Erosion of surface materials occurs from wind and water interaction. Chemical processes can also help breakdown surface materials and contribute to erosion. Water is the most powerful erosive force and does the most damage when combined with steep gradients. The steeper the terrain, the greater the potential for erosion from water interaction due to increased water velocities. Soils on slopes greater than 15 percent would have a greater risk of erosion from water interaction. Additionally, any areas that have been disturbed and/or lack vegetative cover would have an increased susceptibility for erosion.

The topographic gradient through Hurricane City in the western segment of the Project area is relatively flat. However, the channel banks of Gould Wash through the city have slopes greater than 15 percent, increasing erosion susceptibility. The eastern segment of the Project area generally has gentle slopes at less than 15 percent, except along the banks of Gould Wash in the proposed detention dam area. The Gould Wash channel has cut through basalt rock forming a nearly vertical wall. Though the side slopes of the channel are very steep, they are highly resistant to erosion because they are basalt rock.

Soil erosion susceptibility maps show soils along Gould Wash through Hurricane City as alluvial stream deposits that are loose and noncohesive making them highly susceptible to the effects of water and wind erosion, especially when disturbed from their natural conditions (Lund et al. 2008). These soils are generally fine-grained, noncohesive, loose to poorly consolidated sand and silt deposits (Lund et al 2008). Soil susceptibility maps were not available for the Project area upstream of Hurricane City, but geologic units (Biek et al. 2010), provided in Appendix A, Map C2.1 and C2.2, shows the Moenkopi Formation (TRml and TRmt) and alluvial deposits (Qae, Qac, and Qaco) that match geologic deposits identified as highly susceptible to erosion from the erosion susceptibility map. The remainder of the upstream Project area consists of lava flows (Qbgw) that have not been identified as geologic deposits of concern for erosion susceptibility.

The loose and noncohesive soils along Gould Wash through Hurricane City have a high erosion potential. Stability and lateral erosion of the stream banks through Hurricane City are a concern. Based on bank stabilization guidelines (Bureau of Reclamation [BOR] 2015), permissible water velocities for bank materials consisting of noncolloidal sediments, like those along Gould Wash through Hurricane City, range from 1.5 to 2.25 feet per second (ft/s). Additionally, Gould Wash is an ephemeral stream system located in an arid climate that is not capable of supporting sufficient bank vegetation to prevent erosion. At a flow of approximately 3,000 cfs, which is similar to the flow produced at an approximate 10-year event, velocities would be 9 to 13 ft/s and greatly exceed the permissible velocity to maintain bank stability.

3.2.2 Sedimentation

Flooding associated with Gould Wash occurs as flash flooding carrying large amounts of sediment. Gould Wash is an ephemeral channel that only flows after precipitation events and for a short duration after any given event. Many events occur as a sudden and very heavy rainfall that hit over a localized area and usually for a short duration of time, also known as a cloudburst. The arid conditions of the Gould Wash drainage area limit vegetative cover, increasing erosion susceptibility. Additionally, many of the soils and geologic deposits of the drainage area are highly erodible. The combination of intense rainfall on highly erodible soils lacking vegetative cover results in large amounts of sediment passing downstream into Gould Wash during flood events.

Unique topographic conditions and lack of channel capacity through Gould Wash result in large amounts of sediment deposition across the alluvial flat floodplain. Hurricane City lies at the base of the Hurricane Cliffs and the topography transitions abruptly from a vertical drop at the cliffs to a relatively flat gradient alluvial flat through Hurricane City (Figure 3-1). During large flood events, sediment laden water flows through the channel and overtops the Gould Wash channel through Hurricane City depositing sediment in the floodplain. Based on a review of BC&A modeled flood events, storms greater than the 10-year flood event begin to inundate much of Hurricane City. Sediments transported by Gould Wash are fine materials (sand/silt/clay) and are suspended during passage of flood events. These suspended sediments are trapped and deposited over the alluvial flat floodplain as evidenced from the alluvial deposits shown on the geologic map (see Appendix C, Map C2.1). Further evidence from residents of Hurricane City recalled mud on streets and in basements during the 1956 and 1981 floods (Eitel 2011). Sediment deposition in the channel through Hurricane City is also a concern and the city conducts regular sediment removal O&M activities to maintain the existing channel capacities through the city. The alluvial flat was estimated to capture an average of approximately 9.4 ac-ft of sediment annually (refer to Section 3.1 of Appendix D).

The Virgin River drainage area, upstream of the Gould Wash confluence, has similar conditions to the Gould Wash drainage area with several ephemeral tributaries providing water and sediment to the Virgin River. The perennial Virgin River has large sediment loads that fluctuate regularly based on intensity, duration, and location of precipitation falling in the drainage area. Based on information provided in a U.S. Geological Survey bed material transport study for the Virgin River (Andrews 2000), sediment loads calculated for a study reach consisting of the East Fork of the Virgin River have a wide range from as low as 28,000 tons per year to as much as 740,000 tons per year (Andrews 2000). The study shows that most of the sediments in the Virgin River are small silt or clay size particles making up 51 percent of the bedload with sand sized particles making up the other 49 percent.

Sediment contribution to the Gould Wash-Virgin River confluence was estimated based on the drainage area and sediment yield rate. A sedimentation study conducted by BC&A (BC&A 2021a – Attached in Appendix E), estimated the sediment yield rate for the Gould Wash drainage area at 0.291 acre-feet/mi^2/year. Using this sedimentation rate and considering sediment trapping in the Hurricane City alluvial flat, the Gould Wash drainage area was determined to contribute 4 percent of the sediment load and the Virgin River 96 percent of the sediment load to the Virgin River at the confluence (refer to Section 3.1 of Appendix D).

Storm events large enough to activate the channel and send flows through Hurricane City to the Virgin River do not necessarily occur on an annual basis and flow is driven by the unpredictable intensity, duration, and location of storm events in the upstream drainage area. Sediment transport conditions through Gould Wash are highly unpredictable based on the uncertainty associated with storm events and lack of a regular flow regime.

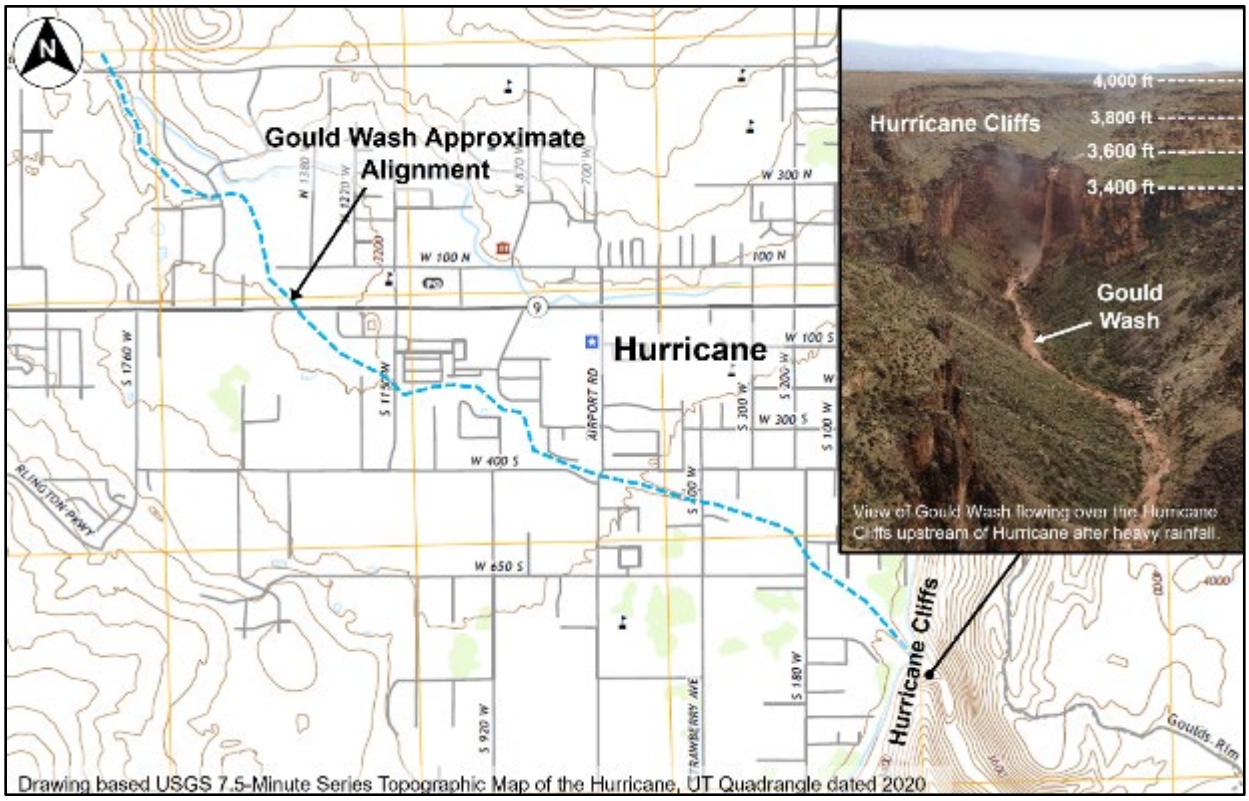

Figure 3-1. Topographic Conditions of Gould Wash in Hurricane City

3.2.3 Prime and Unique Farmland

The NRCS, in cooperation with other interested federal, state, and local governments, has inventoried land that can be used to produce the Nation's food supply. The extent and location of important soils that are best suited for food, feed, fiber, forage, and oilseed crops have been identified and classified as prime farmland, unique farmland, and farmland of statewide or local importance.

Soil information presented in this section has been summarized from NRCS Web Soil Survey data (NRCS 2022b). Soils found within the Project area and in the Gould Wash floodplain within Hurricane City are listed in Table 3-4 and soil maps are included in Appendix C, Maps C1.1 and C1.2. Note that some areas within the Project extents consist of disturbed lands and may not be consistent with the soil descriptions listed below.

Table 3-4. Soil and Farmland Classification Summary

Symbol	Soil Unit Name	Slope	Description	Farmland Classification
EA	Eroded land-shalet complex	NL	Residuum weathered shale erosion remnants.	Not prime farmland
FA	Fluvaquents and torrifluvents, sandy	NL	Sandy alluvium derived from limestone, sandstone and shale found in swales.	Not prime farmland
GA	Gullied land	NL	Gullied land.	Not prime farmland
Ha	Hanz silty clay loam	NL	Mixed alluvium derived from limestone, sandstone, and shale found on alluvial fans.	Prime farmland if irrigated
HbC	Harrisburg fine sandy loam	1-5%	Eolian deposits derived from tuff an/or derived from sandstone and siltstone over residuum weathered from sandstone.	Prime farmland if irrigated
JaC	Junction fine sandy loam	2-5%	Fine sandy loam found on alluvial fans and hills.	Prime farmland if irrigated
LeB	Leeds silty clay loam	1-2%	Alluvium derived from limestone, sandstone, and shale found on floodplains.	Prime farmland if irrigated
LeD	Leeds silty clay loam	5-10%	Alluvium derived from limestone, sandstone, and shale found on alluvial flats.	Prime farmland if irrigated
PED	Pastura-Esplin complex	0-10%	Pastura is Eolian deposits derived from sandstone and shale over residuum weathered from basalt on lava flows. Esplin is residuum weathered from basalt and alluvium weathered from basalt, quartzite, limestone and shale on lava flows.	Not prime farmland
PnC	Pintura loamy fine sand	1-5%	Eolian sands derived from sandstone found on mountain slopes.	Farmland of statewide importance
RP	Rock land, stony	NL	Stony rock land found on mountain slopes.	Not prime farmland
RT	Rock outcrop	NL	Rock outcrop.	Not prime farmland
Sc	St. George silty clay loam	NL	Alluvium derived from sandstone, siltstone, and shale found on floodplains.	Prime farmland if irrigated

Symbol	Soil Unit Name	Slope	Description	Farmland Classification
SH	Schmutz loam	NL	Alluvium derived from sandstone, gypsiferous siltstone, and shale found on alluvial fans.	Not prime farmland
SY	Stony colluvial land	NL	Stony colluvial land	Not prime farmland
Tc	Tobler fine sandy loam	NL	Alluvium derived from sandstone and shale found on alluvial fans and hills	Prime farmland if irrigated
Td	Tobler clay loam	NL	Alluvium derived from sandstone and shale found on valleys and floodplains	Prime farmland if irrigated
WCF	Winkel-rock outcrop complex	8-30%	Calcareous material weathered from basalt, limestone, and wind-deposited sand found on mesas.	Not prime farmland
YZE	Yaki-Zukan complex	1-35%	Material weathered from limestone and shale found on ridges and mountain slopes.	Not prime farmland

Prime and unique farmland in the Project area and Gould Wash floodplain (benefited area) was identified. The benefited area covers approximately 966.5 acres and is heavily developed or disturbed. For this reason, soils within developed/disturbed areas would no longer meet the definition for prime and unique farmland classification. Additionally, areas within the Gould Wash channel would also not meet the definition as these areas would never be farmed nor are they irrigated. The disturbed and developed areas were removed from prime and unique farmland classifications within the benefited area and Project area, and the results are depicted in Appendix C, Map C1.1. Additionally, a 0.03-acre area was removed from the prime and unique farmland classification that was located within the Gould Wash channel banks. Note that areas outside of the Project area and benefited area footprints were not modified to remove developed and disturbed lands because they are not included in the assessed area extents for this resource. The assessed area contains approximately 177.26 acres of soil classified as “prime farmland if irrigated” and 1.24 acres classified as “farmland of statewide importance.” No Prime and unique farmlands are present in the eastern segment of the Project area (Appendix C, Map C1.2).

3.2.4 Surface Water Quality

Surface water in Utah is protected, maintained, and restored through Utah’s water quality standards regulated through the CWA and Utah Water Quality Act (UWQA). These include establishment of designated uses, water quality criteria, and antidegradation policy. Utah’s antidegradation policy (Rule R317-2-3; Utah Office of Administrative Rules 2018) does not prohibit degradation of water quality unless the Water Quality Board has previously considered the water to be of exceptional recreational or ecological significance (Category 1 or Category 2 waters). Category 1 or Category 2 waters do not exist within or near the project area (Utah Department of Environmental Quality [UDEQ] 2023a); therefore, the antidegradation policy does not apply.

An assessment of the water quality of surface waters in the State of Utah was performed in 2022 (UDEQ 2022). The Project area and associated ephemeral streams as well as the downstream receiving water (Virgin River) are located within the Virgin River 2 Assessment Unit (AU). Refer to Figure 3-2 depicting the location of the Virgin River AU2. The 2022 assessment assigned the AU as category 5, meaning impaired for one or more beneficial uses by a pollutant requiring the development of a total maximum daily load (TMDL) (UDEQ 2022). The AU does not meet criteria

for temperature, total dissolved solids (TDSs), and boron with a 303(d) status of TMDL needed. The 303(d) priority was listed as low. Impairments were for the identified use of agricultural (boron and TDS parameters) and aquatic wildlife (temperature parameter).

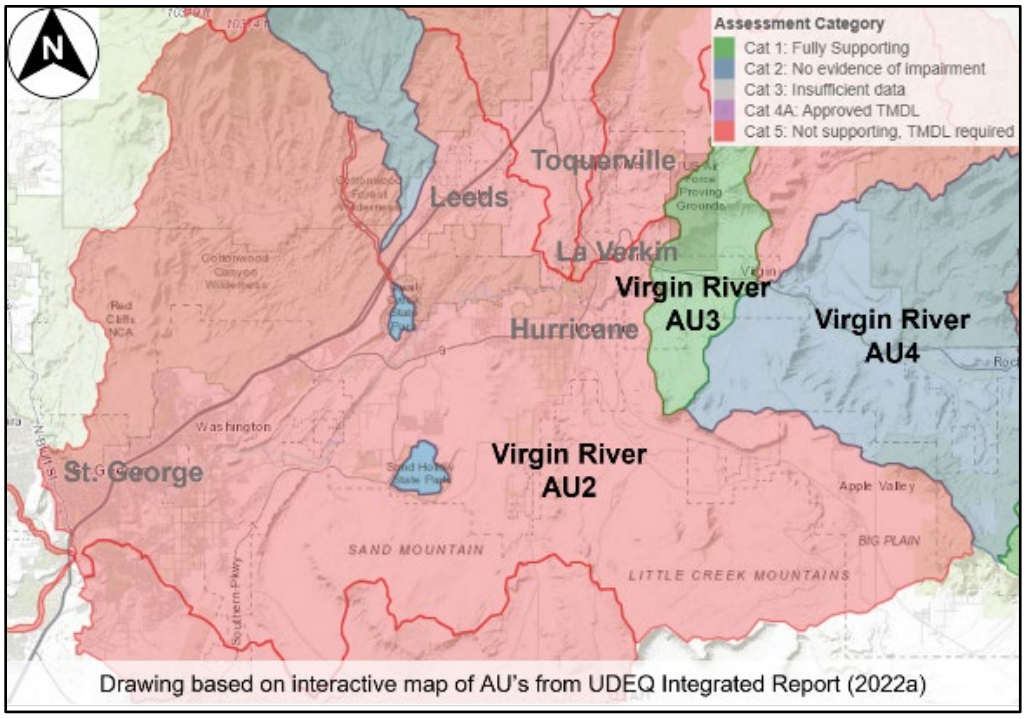

Figure 3-2. Virgin River AU

Much of the temperature, TDS, and boron water quality issues of the Virgin River can be attributed to a natural hot springs, Pah Tempe Hot Springs, which is located approximately ½-mile upstream of the Highway 9 bridge that passes over the Virgin River in Hurricane City. Based on a water quality study conducted for the Virgin River, Pah Tempe Hot Springs is the main source of contamination in the Virgin River from La Verkin Creek confluence to the Santa Clara River confluence (Tetra Tech, Inc. 2004). Pah Tempe Hot Springs discharges directly into the Virgin River and contributes strongly saline water to the river. The TDS data indicates that almost all average values at stations below Pah Tempe Hot Springs are above the 1200 milligrams per liter (mg/l) statewide standard, whereas average concentrations above the springs are below the standard (Tetra Tech, Inc. 2004). Based on the U.S. Department of the Interior study (BOR 1973 as reported in Tetra Tech, Inc. 2004) the average load of TDS contributed by Pah Tempe Hot Springs is 100,000,000 kilograms (110,231 tons) per year or approximately 60 percent of the total loading in this segment of the river. Temperature measurements documented in the Virgin River Watershed Management Plan show temperatures at 79.7°F upstream of the springs and at 86°F downstream of the springs in August (Washington County Water Conservancy District [WCWCD] 2006). Additionally, the spring discharge is reported to have high dissolved solids content and high boron concentrations (about 5 parts per million) (U.S. Geological Survey 1970).

Flooding of Gould Wash could impact water quality conditions of the Virgin River and Virgin River 2 AU. There are 11 stream channels within the project area, but no permanent surface waters are present due to their ephemeral nature. If a storm event large enough to activate flow in the channels were to occur, water has the potential to reach the Virgin River. Contamination in floodwaters is well documented. Several agencies including FEMA (2024), U.S. Centers for

Disease Control and Prevention (2024), National Institute of Environmental Health and Sciences (2022), and the EPA (EPA 2024a), provide information and public warnings to avoid contact with floodwater because they are frequently contaminated.

Storm events large enough to overflow Gould Wash and flood Hurricane City could pick up contaminants from water flowing over lawns, farmlands, parking lots, etc. and convey them downstream to the Virgin River. Based on a review of hazardous waste facilities through UDEQ (UDEQ 2024), 16 petroleum storage tank facilities, two oil release sites, and one diesel spill site are within the Gould Wash floodplain. Chemicals, fuel, animal waste, bacteria, and other harmful substances are commonly present in floodwater that sweeps over farmlands and developed areas. The Gould Wash channel through Hurricane City begins to overflow at a 2-year flood (50 percent annual chance flood) covering 29 acres but increases greatly by the 25-year flood (4 percent annual chance flood) covering much of Hurricane City (433 acres). Flooding of Hurricane City could introduce several contaminants into floodwaters which ultimately drain back into Gould Wash then to the Virgin River. This could result in degradation of water quality in the Virgin River with adverse effects to downstream water uses, ecosystems, and aquatic/terrestrial wildlife species.

3.2.5 Surface Water Quantity and Flow

There are no permanent surface waters within the Project area and the drainages are ephemeral. A map of delineated ephemeral drainages in the Project area is included in Appendix C, Maps C3.1, C3.2, and C3.3. As described in an EPA report on the ecological and hydrological significance of ephemeral streams (EPA 2008), ephemeral stream channels are characterized by sizable transmission losses when they flow. The report identified numerous authors who have documented substantial transmission losses in ephemeral streams, frequently to such an extent that flows infiltrate completely before reaching the watershed outlet (EPA 2008). This is common in ephemeral systems in arid environments. Gould Wash and its tributaries are an example of this type of system where flow is dependent on large storms occurring in the upstream drainage area. Gould Wash and its upstream tributaries in the Project area only flow water after large precipitation events, and for a short duration after any given event. Flows in Gould Wash are subject to downstream volume decreases due to transmission losses and in some years sections of Gould Wash may not flow at all. Based on information provided by the city engineer, Arthur LeBaron, who grew up in Hurricane City and has a house adjoining Gould Wash “upstream of his house there are extended periods of zero flow. Those extended periods vary from months to years depending on climate patterns” (personal communication, May 1, 2024).

Water flow in Gould Wash through Hurricane City can occur naturally because of precipitation runoff during a storm event, or from artificially introduced irrigation return flows. The segments of Gould Wash that see natural flow and the amount of flow is highly variable and mostly dependent on the location and intensity of isolated rainfall events that occur in the drainage area, though widespread and large precipitation events could also provide sufficient water to activate flow in the wash. Some precipitation runoff in Hurricane City is conveyed to Gould Wash through stormwater systems. However, there is an approximate 3-hour gap in peak flows between the runoff from the Gould Wash drainage area and the urban runoff from Hurricane City (see Section 2.2.2 of Appendix D).

Segments of Gould Wash through Hurricane City see more regular water flow during the irrigation season due to introduced irrigation return flows from flood irrigation practices. Based on a water

conservation study conducted for Hurricane City, there are approximately 700 acres of flood irrigated land (WestWater Research 2024). Estimated irrigation return flow to the Virgin River and Gould Wash through deep percolation and surface flow is estimated at 5.2 cfs during the irrigation season. However, the return flow amount reaching Gould Wash as surface flow would be much less and would be from either a direct flow connection to Gould Wash or from percolation from fields directly adjoining the wash. It is reasonable to consider that irrigated lands within a quarter mile of Gould Wash may contribute to return flow in the wash. With approximately 127 acres of irrigated lands within a quarter mile, or 20 percent of the total return flow, it is estimated that an average of 1 cfs may reach the wash. This minimal amount of irrigation return flow reaching Gould Wash commonly infiltrates, evaporates, or is consumed by phreatophytes before reaching the Virgin River.

It is important to note that Hurricane City is working to provide a pressurized irrigation system to its residents and convert from flood irrigation to sprinkler irrigation for water conservation. This conversion is anticipated to be completed in December of 2025 and would likely eliminate irrigation return flows in Gould Wash from the Hurricane Cliffs downstream to approximately 600 N Street. The water savings from the conversion would allow for less water diversions from the Virgin River benefiting Virgin River flow. Instream flow benefits to the Virgin River from the water conservation measures were estimated between 0.3 to 6.5 cfs (varies by month) during the irrigation season from April through November if all 700 acres are converted (WestWater Research 2024).

Temperature trends have also influenced surface water quantities and flows. When large storms occur in the Gould Wash drainage area, they can quickly produce flash flooding and send large amounts of sediment laden water down the wash and into the Virgin River. Studies indicate that more intense droughts and floods are expected in the future (Utah Division of Water Resources 2020). Extreme precipitation is projected to increase, potentially increasing the frequency and intensity of floods in Washington County (NRCS 2023a).

A hydrology and hydraulic analysis was completed by BC&A (BC&A 2021a – Attached in Appendix E) to evaluate conveyance of flow through Gould Wash from various precipitation events. Peak flood flows from the precipitation (storm) events through Gould Wash were determined and are provided in Table 3-5. The existing capacities along Gould Wash through Hurricane City were also calculated and compared to peak flood flows.

Bank full capacities through Hurricane City were estimated between 1,600 cfs and 6,700 cfs (Figure 3-3). Some bank full flows are further constricted by culvert or bridge crossings (Figure 3-3). Based on the hydrology and hydraulic results, there are sections of Gould Wash through Hurricane City that don’t have enough capacity to safely pass a flood from even a 2-year storm event. The 100-year flood event with a flow of 8,820 cfs, exceeds the capacity of all segments of Gould Wash through Hurricane City. If such a flow were to occur, water would overtop Gould Wash, inundating much of Hurricane City. As seen in Table 3-5, the flood flows in Gould Wash are substantially less as they pass 600 N Street than what enters Hurricane City over the cliffs due to flows overtopping the channel.

Table 3-5. Storm Events and Peak Flood Flows

24-Hour Storm Event	Frequency[1]	Peak Flow at Mouth of Hurricane Cliffs (cfs)	Peak Flow at 600 N Culvert Mouth (cfs)
2-Year	25%	852	852
5-Year	20%	1,912	1,622
10-Year	10%	3,047	2,365
25-Year	4%	5,036	2,914
50-Year	2%	6,896	3,591
100-Year	1%	8,820	4,630
500-Year	0.2%	15,400	4,900

1 – percent probability of storm occurring in any given year.

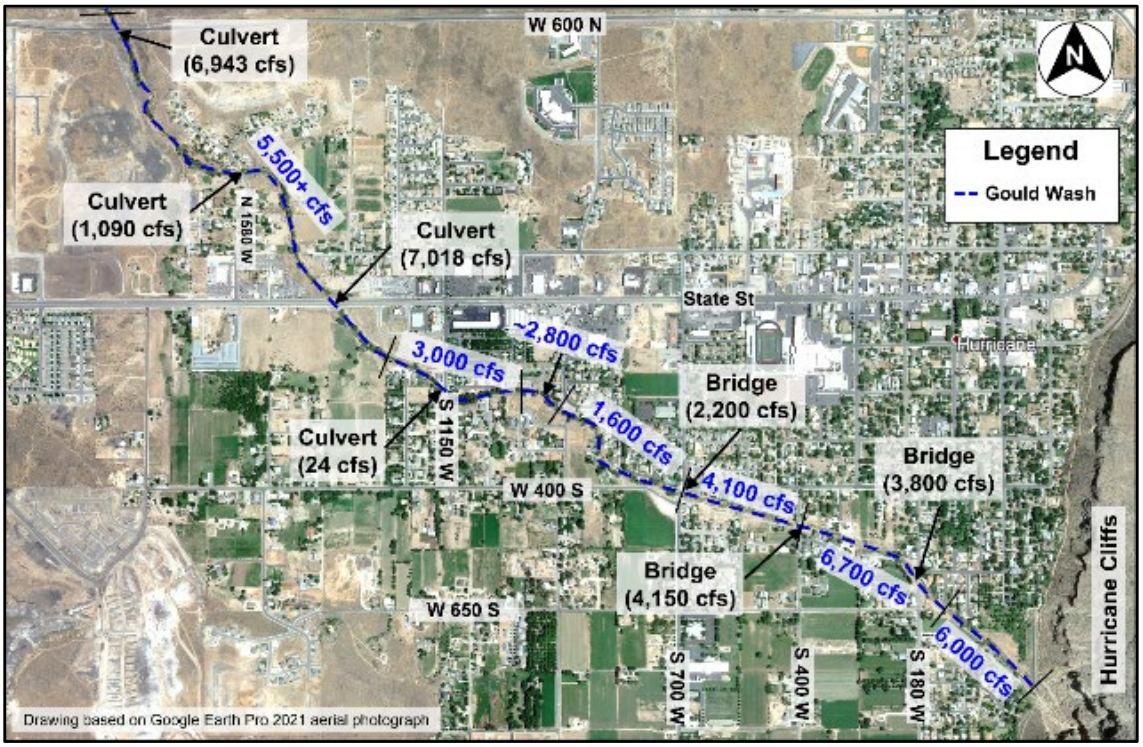

Figure 3-3. Gould Wash Capacities Through Hurricane City

3.2.6 Waters of the U.S.

Section 404 of the CWA regulates the discharge of dredged or fill material into waters of the U.S. and requires a permit for these activities, unless the activities are exempt from Section 404 regulation. An aquatic resources report was completed (BC&A 2021b – Attached in Appendix E) to identify aquatic resources that could be considered jurisdictional waters of the U.S. The Ordinary High Water Mark (OHWM) of several features were delineated in the Project area including 11 ephemeral streams (Gould Wash and 10 associated unnamed tributaries). Refer to Table 3-6 below for a summary of delineated ephemeral streams and refer to Maps C3.1, C3.2, and C3.3 in Appendix C for their locations within the Project area. No wetlands were identified within the Project area.

A USACE jurisdictional determination was requested to support required USACE Section 404 permitting. The USACE issued a jurisdictional determination on April 14, 2022, determining all delineated ephemeral streams in the Project area are considered jurisdictional waters of the U.S. (Appendix A). These ephemeral streams are tributaries to the Virgin River, an interstate jurisdictional water of the U.S. that is tributary to the Colorado River.

Waters of the U.S. were classified according to the Cowardin classification system (Cowardin et al. 1979). These features and their Cowardin classifications, as identified in the aquatic resources report (BC&A 2021b), are listed in Table 3-6. The Cowardin classification system does not have a class for ephemeral streams and therefore the intermittent class is required to be used. However, this is only for the purpose of assigning the stream a classification and the streams were determined to be ephemeral. The length of each ephemeral stream delineated is also identified.

Table 3-6. Waters of the U.S. in Project Area

Site Name	Cowardin Class	Length in Project Area (LF)
Gould Wash*	Riverine, Intermittent, Stream Bed, Sand (R4SB4)	21,196
Ephemeral Stream 1	R4SB4	536
Ephemeral Stream 2	R4SB4	415
Ephemeral Stream 3	R4SB4	91
Ephemeral Stream 4	R4SB4	2,408
Ephemeral Stream 5	R4SB4	3,848
Ephemeral Stream 6	R4SB4	1,311
Ephemeral Stream 7	R4SB4	1,041
Ephemeral Stream 8	R4SB4	4,375
Ephemeral Stream 9	R4SB4	5,828
Ephemeral Stream 10	R4SB4	5,783
	TOTAL	**46,832**

LF = Linear feet

** Several segments of Gould Wash were delineated. Refer to Appendix C, Maps C3.1-C3.3 to view the segments delineated.*

3.2.7 Floodplain Management

The FEMA coordinates the federal government's role in preparing for, preventing, mitigating, the effects of, responding to, and recovering from all domestic disasters, whether natural or man-made, including acts of terror. The FEMA has developed floodplain regulations through the National Flood Insurance Program (NFIP) that are adopted by communities to enforce floodplain management regulations that help mitigate flooding effects.

The first FIRM maps showing flooding in Hurricane City were not available until 2009 (FEMA 2009). Hurricane City has followed FEMA floodplain guidance and restrictions for development within SFHAs since the FIRMS became effective in 2009. The FEMA floodway and floodplains

were further revised in 2017 and 2021 (FEMA 2017 and 2021) through a LOMR. Additional revisions to the FEMA maps are underway in 2024 but are currently in draft. The Gould Wash floodplain through Hurricane City was developed with residences and other supporting community buildings/infrastructure prior to the release of the FEMA FIRMS. Based on review of the recent FEMA FIRMS and LOMR, much of the developed area of Hurricane City is located with SFHAs in addition to Gould Wash upstream of Hurricane City. Flood zones within the benefited area of Hurricane City and within the Project area consist of Zones A, AE, and X (Shaded and Unshaded), which are further described below. Maps depicting the SFHAs within Hurricane City and the Project area are included in Appendix C, Maps 4.1 and C 4.2.

Residents of Gould Wash unknowingly purchased and developed land within the regulated floodplain that may now be required to obtain additional insurance coverage through the NFIP. There are approximately 26 structures currently located with Zone AE (high-risk zone) that would require purchase of flood insurance for federally backed mortgages. Additionally, there are hundreds of other structures (residences, office, commercial, churches, schools, etc.) that are located within moderate-risk zones that should consider purchase of flood insurance, or may be required to purchase it by their lender.

- Regulatory Floodway: The channel of a river or other watercourse and the adjacent land areas that must be reserved to discharge the base flood without cumulatively increasing the water surface elevations more than a designated height.
- Zone AE: The base floodplain where base flood elevations are provided.
- Zone A: Areas with a 1 percent annual chance of flooding and a 26 percent chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.
- Zone X (Shaded): Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods.
- Zone X (Unshaded): Area of minimal flood hazard, usually depicted on FIRMS as above the 500-year flood level. The area determined to be outside of the 500-year flood and protected by levee from the 100-year flood.

As discussed in Section 3.2.5, temperature trends increased the occurrence and intensity of flooding in Washington County. This should be considered in future FEMA planning as it increases the threat to people and property located within SFHAs.

3.2.8 Air Quality and Climate

3.2.8.1 Air Quality

The EPA has established health-based National Ambient Air Quality Standards (NAAQS) for six pollutants considered harmful to public health and the environment, known as criteria pollutants. The NAAQS pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM), sulfur dioxide (SO_2), and lead (Pb). To ensure compliance with the CAA and with the EPA NAAQs, the Utah Division of Air Quality (UDAQ) monitors NAAQS pollutants in Utah. The UDAQ has fixed air quality monitoring stations throughout the state of Utah that monitor the NAAQS pollutants and monitoring results are reported annually in air quality reports. The most recent report published the findings of monitoring conducted in 2022 (UDEQ 2023b). A description

of the NAAQs pollutants from the UDEQ 2023 Annual Report is provided below and their established ambient air quality standards are included in Table 3-7 (UDEQ 2023b).

- CO: Sources include burning of gasoline, wood, natural gas, coal, oil, etc. The contaminant reduces the ability of blood to transport oxygen to body cells and tissues. It may be particularly hazardous to people who have heart or circulatory problems and people who have damaged lungs or breathing passages.
- NO_2: Sources include burning of gasoline, natural gas, coal, oil, and other fuels. Cars are also in important source. The contaminant can cause lung damage, illness of breathing passages and lungs. It is an ingredient of acid rain which can damage trees, lakes, flora, and fauna. Acid aerosols can also reduce visibility.
- O_3: Comes from a chemical reaction of pollutants consisting of Volatile Organic Compounds (VOCs) and NO_X. The contaminant can cause breathing problems, reducing lung function, asthma, irritated eyes, stuffy nose, and reduced resistance to colds and other infections. It may also speed up aging of lung tissue. The contaminant can damage plants and trees, and smog can cause reduced visibility.
- PM: Sources include burning of gasoline, natural gas, coal, oil, and other fuels; industrial plants; agriculture (plowing or burning fields); unpaved roads, mining, construction activities. Particles can be formed from the reaction of VOCs, NO_X, SO_X, and other pollutants in the air. The contaminant can cause breathing problems and may cause permanent damage to lungs. It is also an ingredient of acid rain which can damage trees, lakes, flora, and fauna. Acid aerosols can also reduce visibility.
- SO_2: Sources include burning of coal and oil (including diesel and gasoline), and industrial processes. The contaminant can cause breathing problems and may cause permanent damage to lungs. It is also an ingredient of acid rain which can damage trees, lakes, flora, and fauna. Acid aerosols can also reduce visibility.
- Pb: Sources include paint, smelters, and manufacture of lead storage batteries. The contaminant can cause damages to the nervous systems, including the brain, and causes digestive system damage. Children are at special risk. Some lead-containing chemicals cause cancer in animals. It can also harm wildlife.

Table 3-7. Ambient Air Quality Standards for Criteria Air Pollutants

Pollutant	Averaging Time	Primary / Secondary	Standard	Form
CO	1-Hour	Primary	35 ppm	Not to be exceeded more than once per year.
CO	8-Hour	Primary	9 ppm	Not to be exceeded more than once per year.
NO_2	1-Hour	Primary and Secondary	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years.
NO_2	Annual	Primary and Secondary	53 ppm	Annual mean.
O_3	8-Hour	Primary and Secondary	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years.
$PM_{2.5}$	24-Hour	Primary and Secondary	35 µg/m^3	98th percentile, averaged over 3 years.

Pollutant	Averaging Time	Primary / Secondary	Standard	Form
$PM_{2.5}$	Annual	Primary	12 µg/m^3	Annual mean, averaged over 3 years.
		Secondary	15 µg/m^3	Annual mean, averaged over 3 years.
PM_{10}	24-Hour	Primary and Secondary	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years.
SO_2	1-Hour	Primary	75 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years.
SO_2	3-Hour	Secondary	0.5 ppm	Not to be exceeded more than once per year.
Pb	Rolling 3-month average	Primary and Secondary	0.15 µg/m^3	Not to be exceeded.

ppm = parts per million, ppb = parts per billion, µg/m3 = micrograms per cubic meter, PM_{10} = PM of 10 micrometers or less in diameter, $PM_{2.5}$ = PM of 2.5 micrometers or less in diameter
Source: UDEQ 2023b

The UDAQ has a fixed monitoring station located in Hurricane City at 150 N 870 W. This station was monitored for NO_2, O_3, and $PM_{2.5}$ in 2022. Results for the Hurricane station show that all monitored constituents were in compliance with air quality standards and Hurricane City or Washington County are not located within a non-attainment area.

Under Title R307 of the Utah Administrative Code, emission inventories must be undertaken to further characterize air quality throughout Utah. Emission inventories are conducted every 3 years, during which UDAQ collects information about the types and quantities of compounds released by all emission sources in the state. The 2020 triennial inventory is the most recent state-wide inventory available. The data collected are used by UDAQ to review trends over time and manage the air quality program. Results in tons of compound emitted per year for Washington County are shown in Table 3-8. No specific air quality issues were identified for the Project area based on a review of available air quality information.

Table 3-8. 2020 UDAQ Emissions Inventory (tons/year)

County	CO	NO_x	PM10	PM2.5	SO_2	VOC
Washington	23,008.6	3,370.4	5,682.7	1,354.6	123.4	14,466.1

UDEQ 2023b; VOC = volatile organic compound

3.2.8.2 Greenhouse Gasses and Climate

Gases that trap heat in the atmosphere are called greenhouse gases (GHG) and include carbon dioxide (CO_2, methane (CH_4), nitrous oxide (N_2O), and fluorinated gases (hydroflorocarbons, perflorocarbons, sulfur hexafloride, and nitrogen trifluoride). These GHGs are introduced into the atmosphere by a variety of sources including production of electricity, private and commercial transportation, industry practices, commercial and residential practices, agriculture, land use, and forestry. The largest source of GHG emissions from human activities in the U.S. is from burning fossil fuels for electricity, heat, and transportation (EPA 2024b).

The total gross GHG emissions by gas for the nation in 2021 was reported at 6,340.23 million metric tons of carbon dioxide equivalent (MMT CO_2 eq.) with Utah contributing 79.19 MMT CO_2 eq., or 1.2% of the nation's MMT CO_2 eq (EPA 2021). From 1990 to 2021, the national GHG

emissions had a total gross decrease of 2.3% while Utah had a total gross increase of 17.7% (EPA 2021). In 2021 the primary economic sectors contributing GHG in Utah include transportation contributing 28.5%, electric power industry contributing 25%, and industry contributing 23.5%.

The average temperature in Utah has increased more than 2.5°F since the beginning of the 20th century, and over the last 50 years, Utah temperatures have risen about twice the global average (University of Utah 2024). The state is already experiencing increased drought, wildfires, flash floods, and extreme heat waves from rising temperatures. In Washington County, projections show that more winter precipitation will fall as rain instead of snow, which will decrease snowpack water storage (NRCS 2023a). Extreme precipitation is projected to increase, potentially increasing the frequency and intensity of floods (NRCS 2023a).

3.2.9 Vegetation Communities

Vegetation cover was classified according to the National Land Cover Database (NLCD) classes (Multi-Resolution Land Characteristics Consortium [MRLC] 2019). Land cover in the Project area consist of developed, shrub/scrub, herbaceous, and pasture/hay classes. The NLCD classes did not identify riparian areas within the Project area, but riparian areas were observed. The NLCD data set was adjusted to incorporate the observed spatial extent of the riparian areas (See Section 13.1.2 of Appendix D). Dominant species within the NLCD classes were determined based on vegetation observations conducted by Adaptive Environmental Planning, LLC (AEP) as described in Section 13.1 of Appendix D. A description of each NLCD class (MRLC 2019), dominant species observed, and the acres of each are provided below and depicted in Appendix C, Maps C5.1 and C5.2.

Developed (73.9 acres or 12.1 percent of Project area): This includes:

- Open Space consisting of areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses with impervious surfaces accounting for less than 20 percent of total cover.
- Low Intensity and Medium Intensity consisting of areas with a mixture of constructed materials and vegetation with impervious surfaces accounting for 20 percent to 49 percent total cover for Low Intensity and 50 percent to 79 percent for Medium Intensity.
- High Intensity consisting of highly developed areas where people reside or work in high numbers with impervious surfaces accounting for 80 percent to 100 percent of the total cover. These areas were observed to be highly disturbed with very limited vegetation, except for open space areas.

Open space areas were dominated by cheatgrass (*Bromus tectorum*) and a mix of other various upland grasses and weeds. Scattered shrubs consisting primarily of yellow rabbitbrush (*Chrysothamnus viscidiflorus*), tamarix (*Tamarix chinensis*) and big sagebrush (*Artemisia tridentata*) were present as well as scattered trees and saplings consisting of elm (*Ulmus pumila*), cottonwood (*Populus fremontii*), and black locust (*Robinia pseudoacacia*).

Shrub/Scrub (518.8 acres or 85.3 percent of Project area): This includes NLCD Shrub/Scrub consisting of areas dominated by shrubs that are less than 5 meters tall with shrub canopy typically greater than 20 percent of the total vegetation (MRLC 2019). These areas were observed to be dominated by big sagebrush, yellow rabbitbrush, snakeweed (*Gutierrezia microcephala*),

and blackbrush (*Coleogyne ramossissima*) with an understory of limited herbaceous vegetation, primarily cheatgrass.

Grassland (12.2 acres or 2 percent of Project area): This includes NLCD Grassland/Herbaceous consisting of areas dominated by graminoid or herbaceous vegetation that generally make up 80 percent of the total vegetation (MRLC 2019). These areas were observed to be dominated by cheatgrass or other herbaceous plants with some small, scattered shrubs, primarily snakeweed and blackbush (less than 2 feet tall).

Pasture/Hay (0.4 acres or 0.1 percent of Project area): This includes NLCD Pasture/Hay consisting of grasses, legumes, or gras-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture or hay vegetation typically accounts for greater than 20 percent of the total vegetation (MRLC 2019).

Riparian (2.8 acres or 0.5 percent of Project area): These areas were observed along the bottom of the Gould Wash channel through Hurricane City where the channel is influenced by seasonal irrigation return flows. Vegetation varies and transitions from upland to riparian species along the channel bottom length, but patches of dominant riparian species include reed canary grass (*Phalaris arundinacea*), salt grass (*Distichlis spicata*), narrowleaf willow (*salix exigua*), and cottonwood. Refer to Section 3.2.12 for a detailed description of riparian areas.

The Project area in Hurricane City is located within developed and highly disturbed areas with limited natural vegetation. There are no sensitive plant species, protected natural areas, conservation areas, or ecologically critical areas in the western segment of the Project area. Developed land cover is present over 84.3 percent of the western segment of the Project area. The remaining portion of the western segment is 10 percent shrub/scrub, 5 percent riparian, and 0.7 percent pasture/hay. Hurricane City performs regular O&M activities for sediment removal along the Gould Wash channel through the city to maintain the channel capacities. Vegetation along the channel corridor is regularly disturbed and is dominated by forbs and grasses, most of which are non-native and problematic species (refer to Section 3.2.11).

The eastern segment of the Project area is located on mostly undeveloped lands with vegetative cover; however, vegetative cover is limited due to the arid climate. The eastern segment has 93 percent shrub/scrub cover, 2.2 percent herbaceous cover, and 4.8 percent developed areas. Developed lands in the eastern segment consist of existing roads and disturbed areas. There are no sensitive plant species, protected natural areas, conservation areas, or ecologically critical areas in the eastern segment of the Project area.

3.2.10 Special Status Plant Species

The ESA was established to protect endangered and threatened species and their habitats. Section 7 of the Act requires federal agencies to ensure that federal actions do not jeopardize the existence of listed species. This is accomplished through Section 7 consultation with USFWS. Based on USFWS coordination (Glisson 2021a – Attached to the BA in Appendix E), ESA-listed species for the area were determined to include Gierisch's globemallow (*Sphaeralcea gierischii*), Holmgren's milkvetch (*Astragalus holmgreniorum*), and Fickeisen plains cactus (*Pediocactus peeblesianus* var. *fickeisenae*).

The BLM also maintains a list of sensitive species, which are species not protected under the ESA but warrant special attention and management to keep them from becoming listed in the future. Based on coordination with the BLM (Glisson 2021a – Attached to the BA in Appendix E),

sensitive species for the area were determined to include Parry's sandpaper plant (*Petalonyx parryi*), Virgin thistle (*Cirsium virginense*), and Baird evening primrose (*Camissonia bairdii*).

Several surveys for ESA and BLM special status plant species listed above were performed in coordination with the USFWS and BLM (Bruce Glisson 2021a and 2021b – Attached to the BA in Appendix E). Based on habitat requirements and the results of the surveys performed, no ESA-listed or BLM sensitive species are anticipated to be present within the Project area. A Biological Assessment (BA) was completed for the Project (refer to Appendix E for the BA), which concluded that ESA plant species, designated critical habitat, or suitable habitat were not present. The BA was submitted for Section 7 Consultation and the results are described in Section 5.10.

3.2.11 Noxious Weeds and Invasive Plants

Executive Order 13122 states that "a federal agency shall not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction and spread of invasive species in the U.S. or elsewhere." Noxious and invasive weeds (N&I) are non-native plant species designated by state law or county ordinance because they cause, or have the potential to cause, extraordinary negative economic and ecological impacts.

Utah has 54 plant species listed as N&I weeds in the state of Utah (Utah Department of Agriculture and Food [UDAF] 2022). Utah's weed plan includes a list of weeds that are to be controlled per Utah Noxious Weet Act and are separated into the classes described below. Washington County has adopted the Utah N&I weeds list and has also declared three additional N&I weeds for the County (UDAF 2015), however, they have not been assigned classes.

- Class 1A (Early Detection Rapid Response): Declared N&I weeds not native to Utah and not known to exist in the state but pose a serious threat to the state and should be considered as a very high priority.
- Class 1 B (Early Detection Rapid Response): Declared N&I weeds not native to Utah and known to exist in the state in very limited populations but pose a serious threat to the state and should be considered as a very high priority.
- Class 2 (Control): Declared N&I weeds not native to Utah and known to exist in varying population throughout the state that pose a threat to the state and should be considered a high priority for control. The concentration of these N&I weeds is at a level where control or eradication may be possible.
- Class 3 (Containment): Declared N&I weeds not native to Utah that are widely spread and known to exist in various populations throughout the state. These N&I weeds pose a threat to the agricultural industry and agricultural products. Weed control efforts may be directed at reducing or eliminating new or expanding populations through the state. Known and established weed populations may be managed by any approved weed control methodology, as determined by the weed control authority.
- Class 4 (Prohibited): Declared N&I weeds not native to Utah that pose a threat to the state through the retail sale or propagation in the nursery and greenhouse industry. The weeds are annual, biennial, or perennial plants that the commissioner designates as having potential or are known to be detrimental to human or animal health, the environment, public roads, crops, or other property.

The western segment of the Project area is located in highly disturbed and developed areas of Hurricane City. The eastern segment is primarily within BLM-managed lands where disturbance occurs from recreation activities and grazing. Soil disturbance and seed dispersal from vehicles, foot traffic, livestock, wildlife, and other activities increase risk for invasion of N&I weeds. N&I weeds were observed in the Project area during site visits conducted by AEP between 2019 and 2022. Additionally N&I species were documented during botanical surveys conducted between 2018 and 2021 (Glisson 2021a and 2021b – Attached to the BA in Appendix E). The N&I weeds observed are included in Table 3-9.

Many other weeds and non-native plant species were observed in addition to those listed as N&I. The dominant and most problematic weeds observed include Russian thistle (*Salsola iberica*) and cheatgrass. Russian thistle, also known as tumbleweed, was observed as dominant in portions of the Project area. It poses fire hazards, vehicle safety hazards, and threatens native plant ecosystems. Cheatgrass was the dominant herbaceous species across most of the Project area and can diminish recreational opportunities, reduce available forage, degrade wildlife diversity/habitat, and decrease land values (NRCS 2014c). The channel banks along Gould Wash in the western segment of the Project area were dominated by non-native and problematic weed species. Grass cover across the eastern segment of the Project area was dominated by cheatgrass.

Table 3-9. N&I Weeds Observed in Project Area

Scientific Name	Common Name	Weed Class
Convolvulus spp.	Field bindweed	3
Elaeagnus angustifolia	Russian olive	4
Onopordum acanthium	Scotch thistle	3
Tribulus terrestris	Puncturevine	3

3.2.12 Riparian Areas

Riparian Areas exist in the transitional zone between aquatic and terrestrial ecosystems. They feature different vegetative species than the adjoining ecosystems and exhibit more vigorous growth due to shallow groundwater interaction. They generally consist of long strips of vegetation adjacent to streams, rivers, lakes, reservoirs, and other inland aquatic systems that affect or are affected by the presence of water (Fischer et al. 2000). These areas typically harbor many wildlife species and perform numerous ecological functions. Riparian vegetation conditions were observed during several site visits performed by AEP (Refer to Section 13.0 of Appendix D) and observations have been incorporated into this section.

The stream channels in the Project area are ephemeral and do not have enough water to support riparian vegetation, except for areas of Gould Wash through Hurricane City. In the eastern portion of the Project area the ephemeral channels are dry with scattered upland plants establishing in the channel bed (Figure 3-4). These areas are void of riparian vegetation in the channel or on the banks due to lack of water.

Figure 3-4. Ephemeral Channels Lacking Riparian Vegetation

Vegetation in arid and semi-arid regions is largely controlled by the availability of water, with flood disturbance and edaphic conditions[2] further shaping plant distribution patterns (EPA 2008). Depending on attributes of the particular stream, the highest density of vegetation may occur along the stream bank or within the channel bed (EPA 2008). Sections of Gould Wash in the Project area upstream of Hurricane City have very limited water resulting in no riparian vegetation growth and those segments contain upland plant species along the channel bed. Gould Wash through Hurricane City has more water availability from introduced irrigation return flows. This has increased the amount of water that would typically be available in the wash, allowing for riparian vegetation to artificially establish in areas, primarily along the channel bed. The artificial support of riparian vegetation is evidenced from historic aerial review, lack of shallow groundwater conditions, and lack of riparian vegetation in the natural channel upstream of introduced irrigation return outfalls. It is important to note that Hurricane City is working to provide a pressurized irrigation system to its residents and irrigation return flows would no longer support establishment of riparian vegetation after completed. This conversion to pressurized irrigation is anticipated for completion in 2025.

Riparian areas of Gould Wash through most of Hurricane City are limited to the flat channel bed that is approximately 10 feet wide, though sometimes narrower or wider in areas. The first occurrence of riparian vegetation occurs at the furthest upstream irrigation return flow outfall. No riparian vegetation is present in the Project area upstream of this outfall. The riparian vegetation along the channel bed is not continuous and transitions back and forth from dry channel with upland vegetation to moist channel with riparian vegetation, depending on the presence of irrigation or stormwater outfalls. The adjoining streambanks of Gould Wash through Hurricane City from the upstream irrigation outfall to 1580 W Street transition abruptly to upland dominant species at the bottom of the channel banks (see Figure 3-5 and Section 13.1.2 of Appendix D). Downstream of 1580 W Street, the riparian vegetation shifts and riparian vegetation is present along the channel banks.

[2] Related to or caused by particular soil conditions rather than the climate.

Riparian vegetation observed along the channel bed from the furthest upstream outfall to 1580 W Street primarily includes herbaceous species with patches of shrubs. Saltgrass (*Distichlis spicata*), perennial sorghum (*Sorghum halepense*), and Baltic rush (*Juncus balticus*) were observed to be the dominant herbaceous species. Dominant shrub species included narrowleaf willow (*Salix exigua*), five-stamen tamarisk (*Tamarix chinensis*), and cottonwood saplings (*Populus fremontii*). Some sporadic larger trees and shrubs are present at the top of the steep channel banks along this segment. However, this vegetation appears to be present from adjoining irrigation practices, yard watering, and landscaping influences from private lands, rather than from water interaction from flow of the ephemeral channel (refer to Section 13.1.2 of Appendix D).

Downstream of 1580 W Street, the herbaceous and shrub species listed above occur in the channel bed with primarily cottonwood sapling and tree cover also occurring along the channel banks. The Project area at the 600 N Street culvert is deeply incised and cottonwood saplings and trees occur in the channel bed with no riparian vegetation along the channel banks (Figure 3-6).

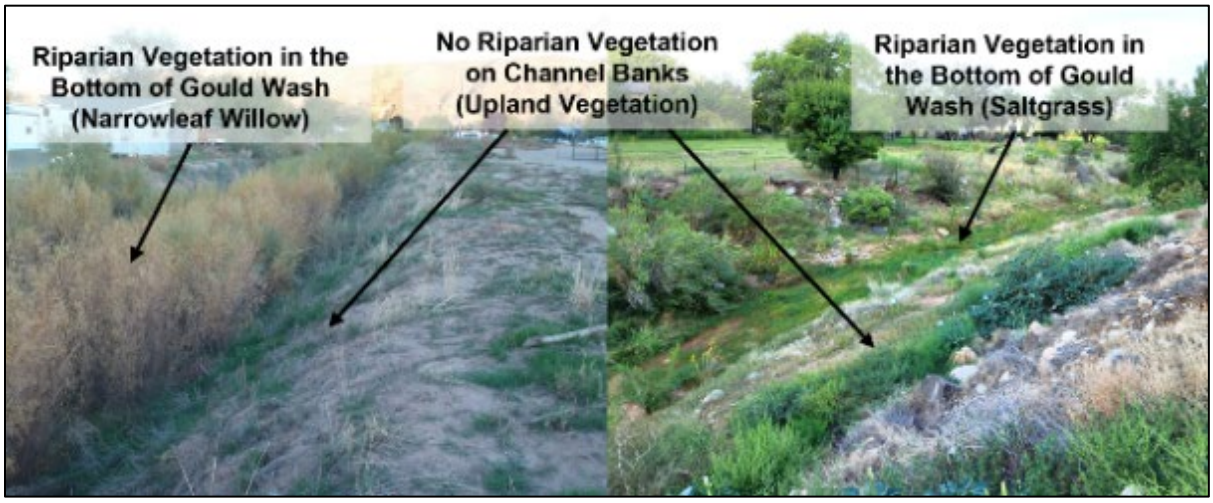

Figure 3-5. Riparian Vegetation in Gould Wash Channel Bottom

Figure 3-6. Riparian Vegetation Corridor (South of 600 N Street)

Regular O&M of the channel is performed by Hurricane City to remove sediment and maintain channel capacity, and riparian vegetation in the channel bed does not typically grow taller than the top of the channel banks. Based on past O&M activities and observations, disturbed riparian vegetation areas along the channel bottom typically begin to reestablish quickly (1-3 months), once irrigation return flows are introduced. At the northern extent of the Project area adjoining 600 N Street, the Gould Wash channel is deeply incised with no adjoining development and regular sediment removal in this section is not required to maintain channel capacity. The artificial riparian area in this section contains larger riparian vegetation with cottonwood trees extending across the channel bottom (Figure 3-6).

The riparian vegetation along Gould Wash through Hurricane City was determined to be of poor quality. This is based on the lack of sufficient natural hydrologic conditions, proximity through developed areas, disturbed condition of the channel, dominant vegetation consisting primarily of herbaceous species providing little to no cover, narrow width of riparian vegetation, and dominant non-native or N&I plants (refer to Section 13.1.2 of Appendix D).

3.2.13 Fish and Wildlife

Wildlife habitat is present within the Project area but varies greatly between the eastern and western segments. Wildlife habitat is limited or not present and of low quality in the western segment of the Project area due to the proximity within highly disturbed and developed areas of Hurricane City. Habitat along most of the channel corridor is frequently disturbed from routine sediment and debris removal activities that the Hurricane City performs to maintain channel conveyance capacities. Wildlife species would generally avoid inhabiting this segment due to lack of available habitat, human presence and associated noise/disturbance, and lack of suitable cover. The types of wildlife more adapted to city environments likely use areas of the western segment such as birds, small mammals, amphibians, and reptiles, but they would occur in limited numbers.

The eastern segment of the Project area is mostly undisturbed desert shrub and grassland habitats. This habitat may support a range of native and non-native migratory birds, resident birds, mammals, and reptiles. However, abundance may be limited due to lack of surface water. Permanent surface waters do not appear to be present within ½-mile of the eastern segment of the Project area, except for one segment along an existing road corridor. A natural spring and associated ponds are present approximately 500 feet from the road corridor and outside of the Project area extent that likely support wildlife in the area.

Fish or aquatic habitat is not present in the Project area due to lack of surface water. Gould Wash and its tributaries are ephemeral and only flow after a large precipitation event occurs in the upstream drainage area. Gould Wash has connectivity to the Virgin River approximately one mile downstream of the Project area. If enough precipitation falls to activate water flow in Gould Wash, the water is discharged into the Virgin River. This typically occurs as flash flooding where large volumes of sediment laden water flow down the wash into the Virgin River typically over a short span of time. The Virgin River is a perennial stream that supports many fish species including ESA-listed and Utah sensitive species. The fish species of the Virgin River have adapted to arduous conditions such as extensive floods, low flows, large sediment loads, and high variability in water and air temperatures (The Nature Conservancy 2023). It is not possible for fish or aquatic species in the Virgin River to migrate upstream in Gould Wash due to lack of surface water in

Gould Wash, steep channel gradient, and high flow velocities during passage of the flash flood flows.

Wildlife populations that are the most documented and understood include special status species including those that are listed for protection under the ESA or are a state/federal species of concern, and desired game or furbearers. No sensitive habitats (protected natural areas, conservation areas, ecologically critical areas, or ESA critical habitat) are present across most of the Project area except for 7.4 acres of desert tortoise critical habitat located at the northern edge in the western segment of the Project area. Please refer to Section 3.2.14 for information on special status animal species. The UDNR has mapped seasonal habitats for 23 wildlife game species within Utah (UDNR 2023b). However, the state does not regulate these habitats, and no threat is present for the species continued existence by the state or by federally agencies. Crucial and Substantial value habitats for wildlife game species exist in the Project area and are defined below (UDNR 2023b). Wildlife game species with Crucial or Substantial value habitats within the Project area and the approximate acreage of habitat within the Project area is provided in Table 3-10. Maps depicting Substantial and Crucial value habitats are provided in Appendix C, Map C6.1 and C6.2.

- Crucial – habitat on which the local population of a wildlife species depends for survival because there are not alternative ranges or habitats available. Crucial value habitat is essential to the life history requirements of a wildlife species. Degradation or unavailability of crucial habitat will lead to significant declines in carrying capacity and/or numbers of wildlife species in question.
- Substantial – Habitat used by a wildlife species but is not crucial for population survival. Degradation or unavailability of substantial value habitat will not lead to significant declines in carrying capacity and/or numbers of the wildlife species in question.

Table 3-10. State Crucial and Substantial Wildlife Habitat

Wildlife Species	Substantial Habitat (acres)	Crucial Habitat (acres)	Season
Gambel's quail (*Callipepla gambelii*)	-	608.0	Year-long
Mule deer (*Odocoileus hemionus*)	45.6	-	Winter
Ringneck pheasant (*Phasianus colchicus*)	56.0	-	Year-long
White winged dove (*Zenaida asiatica*)	599.3	-	Summer/fall

Substantial habitat for mule deer and ringneck pheasant in the Project area is located within and adjoining heavily developed/disturbed areas within Hurricane City where habitat is very limited or not present. Similarly, Gambel's quail crucial habitat in the western segment of the Project area is also located within these developed/disturbed areas. These species are not anticipated to be regularly present in the developed city corridor based on lack of available habitat, human presence and associated noise, and lack of suitable cover.

Gambel's quail crucial habitat and white winged dove substantial habitat is located in the eastern segment of the Project area. Though lack of permanent surface water may limit the species from using this habitat, the area does offer undeveloped natural areas.

3.2.14 Special Status Animal Species

The ESA was established to protect endangered and threatened species and their habitats.

Section 7 of the Act requires federal agencies to ensure that federal actions do not jeopardize the existence of any listed species. This is accomplished through Section 7 consultation with USFWS. A BA was completed for the Project (Refer to Appendix E for the BA), which identified one ESA-listed animal species, desert tortoise (*Gopherus agassizii*), with potential to occur within the Project area. Desert tortoise critical habitat was also identified within the Project area. Section 7 consultation was completed for the Project, and the results of the consultation are discussed in Section 5.14 of the Environmental Consequences section.

The BLM maintains a list of sensitive species which are species not protected under the ESA but warrant special attention and management to keep them from becoming listed in the future. The eastern segment of the Project area is located primarily on BLM-managed lands where BLM sensitive species should be considered. Based on correspondence with BLM (Appendix A), there are three BLM sensitive species that are likely to inhabit the Project area. These include Arizona toad (*Bufo microscaphus*), burrowing owl (*Athene cunicularia*), and kit fox (*Vulpes macrotis*).

The state of Utah has developed a Wildlife Action Plan with the purpose and goal to manage native wildlife species and their habitats, sufficient to prevent the need for additional listings under the ESA (Utah Division of Wildlife Resources [UDWR] 2015). The Wildlife Action Plan identifies Species of Greatest Conservation Need (SGCN) that are considered jurisdictional wildlife under the plan. The UDWR did not have concerns for SGCN or habitat in the Project vicinity for consideration based on email communications (Appendix A). However, the BLM listed species included above (Arizona toad, burrowing owl, and kit fox), are also listed as SGCN.

Descriptions of the USFWS ESA, BLM sensitive species, and Utah SGCN with potential occurrence and habitat within the Project area are described in Sections 3.2.14.1 through 3.2.14.4.

It is also important to note that Gould Wash is a tributary of the Virgin River and several SGCN and ESA-listed species, in addition to designated critical habitat, occur along the Virgin River downstream of the Project area. The most important of note include southwestern willow flycatcher (*Empidonax traillii extimus*), yellow-billed cuckoo (*Coccyzus americanus*), Virgin River chub (*Gila seminuda*), woundfin (*Plagopterus argentissimus*), Virgin spinedace (*Lepidomeda mollispinis*), desert sucker (*Catostomus clarkia*), and flannelmouth sucker (*Catostomus latipinnis*). Designated critical habitat for Virgin River chub and woundfin is also present along the Virgin River at the Gould Wash confluence.

3.2.14.1 Desert Tortoise (ESA Listed)

The desert tortoise was listed as an ESA threatened species on April 2, 1990 (55 FR 12178 12191) and designated critical habitat was established on February 8, 1994 (59 FR 5820 5866). The northern extent of the Project area is located within the Upper Virgin River Recovery unit for desert tortoise and within designated critical habitat for the species (Appendix C, Map C7).

In Utah, the desert tortoise is restricted to the southern half of Washington County in the southwestern corner of the state (UDWR 2023a). Habitat consists of diverse desert scrub habitats, including those dominated by creosote bush, white bursage, blackbrush, and sagebrush (UDWR 2023a). Location distribution is determined in part by the availability of natural recesses suitable for use as den sites (UDWR 2023a). To regulate body temperature and reduce water loss, they spend the majority of time in shelters such as soil burrows, caves, rock shelters, and pallets (UDWR 2023a).

A desert tortoise survey was conducted by Derek Hamilton with NRCS in 2024 (Hamilton 2024 – Attached to the BA in Appendix E) to identify presence/absence of the species within the Project area. No live desert tortoise individuals, carcasses (including carapaces and scutes), scats, tracks, courtship rings, burrows, caliche caves, or other evidence that would indicate the presence of desert tortoises were discovered during the survey. The survey memo noted sheltering habitat may be limited due to bedrock near or at the soil surface and/or friable soils collapse too easily which limit the ability to dig burrows (Hamilton 2024). Based on the lack of presence or signs of presence, desert tortoises are not expected to be present in the Project area.

3.2.14.2 Arizona Toad (BLM Sensitive Species and Utah SGCN)

In Utah, the Arizona toad is found only in the southwestern portion of the state (UDWR 2023a). The species inhabit streams, washes, irrigated crop lands, reservoirs, and uplands that are adjacent to water. Breeding habitat consists of aquatic and riparian habitats, and nonbreeding habitats include intermittent or temporary plains streams, mountain tributaries, rain pools, marshes, ponds, stock tanks, irrigation ditches, spring-fed seeps, small creeks with permanent flow, open water zones or permanent lakes, reservoirs, ponds, marshes, wetlands, swampy river bottoms, lake/reservoir shorelines where rooted aquatic plants occur, permanent streams or rivers in broad valleys and plains (UDWR 2023a). Threats to the species population and viability are diverse including: livestock grazing; habitat fragmentation and loss through development; increased predation rates by common ravens; prevalence of upper respiratory tract disease; predation by domestic dogs; road mortality; and illegal collection (UDWR 2023a).

The eastern segment of the Project area contains dry washes with no permanent or intermittent surface waters, wetlands, springs, or riparian areas in or adjoining them, which are necessary for Arizona toad habitat. Due to lack of suitable habitat, the species is not anticipated to be found within the eastern segment of the Project area. Gould Wash through Hurricane City in the western segment of the Project area contains some riparian areas with surface water present during the irrigation season from return flood irrigation flow. Breeding habitat is not present due to irregular irrigation return flow and lack of permanent surface water, but this segment may provide nonbreeding habitat for the species. Based on known occurrence information from the Utah SGCN mapper (UDWR 2023b), Arizona toad has been documented to occur within the Hurricane, Utah quadrangle in which a portion of the Project area lies. Therefore, Arizona has the potential to be present during the nonbreeding season in the western segment of the Project area.

3.2.14.3 Burrowing Owl (BLM Sensitive Species and Utah SGCN)

Burrowing owls occur during summer and in migration in proper habitat throughout Utah (UDWR 2023a). Breeding habitat consists of arid grassland, cold desert shrub (including saltbrush and greasewood), and sagebrush-rabbitbrush (UDWR 2023a). The species nest in a mammal burrow, usually that of a prairie dog, ground squirrel, badger, or armadillo (UDWR 2023a). If a mammal burrow is not available, the owls will sometimes excavate their own nest burrow (UDWR 2023a). Breeding season can be early February to late May, depending on the geographical region (Animal Diversity Web 2023). The greatest threat to the species is loss of habitat to agriculture (UDWR 2023a).

The western segment of the Project area does not contain suitable habitat for the species. The eastern segment of the Project area within BLM-managed lands contains large tracts of suitable sagebrush habitat for the species. Based on known occurrence information from the Utah SGCN

mapper (UDWR 2023b), burrowing owls have been documented to occur within the Hurricane, Utah quadrangle in which a portion of the Project area lies. Therefore, there is potential for burrowing owls to be present within the Project area.

3.2.14.4 Kit Fox (BLM Sensitive Species and Utah SGCN)

Kit fox primarily occur in open desert, shrubby or shrub-grass habitat (UDWR 2023a). The species are nocturnal but individuals may be found outside of their dens during the day (UDWR 2023a). In Utah, dens were on flat, well-drained uplands and several dens may be used, especially during summer (UDWR 2023a). Threats to the species include shooting, trapping, poisoning, and habitat loss from agricultural activities (UDWR 2023a).

The Project area within BLM-managed lands contain large tracts of suitable shrubby and shrub-grass habitat for the species. Based on known occurrence information from the Utah SGCN mapper (UDWR 2023b), kit fox have been documented to occur within the Hurricane, Utah quadrangle in which the western segment of the Project area lies; however the most recent observation was in 1975 and the western segment of the Project area lacks suitable habitat. There were no documented occurrences of the species within the Little Creek Mountain, Utah quadrangle (UDWR 2023b) which includes the portions of the eastern segment of the Project area with suitable habitat. Based on the lack of documented occurrence in the suitable habitat portions of the Project area, the species is not anticipated to be present.

3.2.15 Migratory Birds and Bald/Golden Eagles

3.2.15.1 Migratory Birds

Migratory birds are afforded protection under authority of the Migratory Bird Treaty Act (MBTA) (16 U.S.C 703-712). Under the MBTA, it is unlawful to take, kill, or possess migratory birds, their parts, nests, or eggs. Under the MBTA, the term *take* is defined as any attempt or success at pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting. Migratory bird permits must be obtained through the USFWS Migratory Bird Permit Office for any requested waiver or exception to the MBTA. The Project area contains suitable breeding and foraging habitat for several migratory birds and they are anticipated to occur in the Project area.

The USFWS maintains a list of Migratory Birds of Conservation Concern (MBCC), which are migratory non-game birds that are likely to become candidates for listing under the ESA without additional conservation actions. According to the USFWS Information for Planning and Consultation (IPaC) list (USFWS 2023 – included as an attachment to the BA in Appendix E) for the project area, there are eight MBCC expected to occur at this location. These include bald eagle (*Haliaeetus leucocephalus*), black-chinned sparrow (*Spizella atrogularis*), Cassin's finch (*Carpodacus cassinii*), evening grosbeak (*Coccothraustes vespertinus*), Lewis's woodpecker (*Melanerpes lewis*), long-eared owl (*Asio otus*), pinyon jay (*Gymnorhinus cyanocephalus*), and western grebe (*Aechmophorus occidentalis*). It is also important to note that Gould Wash is a tributary of the Virgin River and many migratory bird species, including special status species, use the Virgin River corridor.

3.2.15.2 Bald and Golden Eagles

Eagles are protected under the Eagle Protection Act (16 U.S.C 668), which provides specific protection for bald and golden eagles. The act makes it illegal to take, possess, sell, purchase,

barter, or transport any bald or golden eagle, alive or dead, or any part, nest, or egg thereof. Under the Eagle Protection Act, the term *take* includes pursuing, shooting, shooting at, poisoning, wounding, killing, capturing, trapping, collecting, molesting, or disturbing.

Bald eagles (*Haliaeetus leucocephalus*) are not known to breed in Washington County (UDWR 2023a), but could occur in the area for wintering. Wintering habitats in Utah includes rivers, streams, lakes, reservoirs, ponds, sewage lagoons, montane riparian woodlands, desert riparian woodlands (including Freemont cottonwood, willows, etc.), submontaine shrub, croplands, and orchards (UDWR 2023a). Freemont cottonwood and willows are present in portions of Gould Wash in the western segment of the Project area that may offer suitable wintering habitat. Therefore, the species has the potential to be present in the western segment of the Project area for wintering. Due to lack of habitat, bald eagles are not anticipated to be present in the eastern segment of the Project area.

Golden eagles (*Aquila chrysaetos*) generally inhabit open and semi-open country such as prairies, sagebrush, arctic/alpine tundra, savannah or sparse woodland, and barren areas in areas with sufficient mammalian prey base and near suitable nesting sites (UDWR 2023a). Nests are constructed on cliffs or in large trees. Nesting habitat is not located within the Project area, but there are cliffs providing suitable nesting habitat within one to two miles from the eastern segment of the Project area. Therefore, the species may be present in the western segment of the Project area for foraging. Due to lack of habitat and human disturbance, golden eagles are not anticipated to be present in the western segment of the Project area.

3.2.16 Social Issues and Local Economy

The socioeconomic baseline is characterized by population, demographics, employment, income, and housing. Socioeconomic baseline conditions of Hurricane City are identified in the subsections below, and for comparative purposes, baseline socioeconomic conditions for Washington County and Utah are also provided. In addition, the projected economic flood damages to Hurricane City from Gould Wash are included.

3.2.16.1 Population

Table 3-11 shows population trends from 1980 to 2021 for Hurricane City, Washington County, and Utah. Growth rates are high for Hurricane City's population, with 8.2 times more people in 2021 than in 1980. In comparison, Washington County had a growth of 7.3 times more people and Utah had 2.3 times more people over the same period.

Table 3-11. Population Trends

Year	Hurricane City	Washington County	Utah
1980	2,660	26,065	1,461,037
1990	3,915	48,560	1,722,850
2000	8,250	90,354	2,233,169
2010	13,748	138,115	2,763,885
2020	20,036	180,279	3,271,616
2021 (estimate)	21,808	191,226	3,339,113

Source: U.S. Census Bureau

3.2.16.2 Demographics

Demographic data from Table 3-12 shows that percentage of minority populations in Hurricane City at 4.9 percent are less than the county at 7.1 percent and Utah at 9.7 percent.

Table 3-12. Demographics

Year	Hurricane City	Washington County	Utah
Total Population	21,808	191,226	3,339,113
Percent White	94.1%	92.9%	90.3%
Percent Minority Races	4.9%	7.1%	9.7%

Source: U.S. Census Bureau 2021

3.2.16.3 Employment and Income

Employment and income data is summarized in Table 3-13. The data shows Hurricane City has a very low unemployment rate at 1.5 percent when compared to the county and state at 4.4 percent and 3.5 percent, respectively. While the percentage of individuals below the poverty level varies minimally between the three, Hurricane City has a much lower median household income that is $7,631 less than the county and $21,724 less than the state.

Table 3-13. Employment and Income Summary

Item	Hurricane City		Washington County		Utah	
	Estimate	%	Estimate	%	Estimate	%
Civilian labor force	8,380	100	83,958	100	1,648,313	100
Employed	8,256	98.5	80,238	95.6	1,590,163	96.5
Unemployed	124	1.5	3,720	4.4	58,170	3.5
Median Household Income	$57,409	-	$65,040	-	$79,133	-
Percentage Below Poverty Level	-	10.6	-	9.4	-	8.6

Source: U.S. Census Bureau 2021

3.2.16.4 Housing

Housing characteristics are summarized in Table 3-14. The data shows Hurricane City has more renter-occupied units than the county or state. Median home values for Hurricane City are significantly less than Washington County and Utah, however, it is important to note that the home values are not in align with the home selling prices. Based on housing market data the median home sale price ranged monthly from $345,000 to $578,000 in 2021, averaging $454,625 for the year (Redfin 2021). In 2022 the median home sale price ranged monthly from $390,000 to $709,000, averaging $535,048 for the year (Redfin 2022). A large drop in median home sale price occurred between May 2022 when the median home sale price hit an all-time high of $729,000 to July 2022 when the sale price hit the annual low of $390,000. This drop coincides with the federal interest rate increase in June and July 2022 where interest rates were raised from the range of 0.25 to 0.5 percent to a range of 2.25 to 2.5 percent in efforts to help curb inflation.

Table 3-14. Housing Characteristics

Item	Hurricane City		Washington County		Utah	
	Estimate	%	Estimate	%	Estimate	%
Total Housing Units	7,791	100	72,586	100	1,133,558	100
Occupied Housing Units	6,817	87.5	61,377	84.6	1,033,651	91.2
Vacant Housing Units	974	12.5	11,209	15.4	99,907	8.8
Owner-Occupied Units	4,616	67.7	42,772	69.7	729,074	70.5
Renter-Occupied Units	2,201	32.3	18,605	30.3	304,577	29.5
Median Home Value*	$286,400	-	$443,200	-	$421,700	-

Source: U.S. Census Bureau 2021
** Median home value of owner-occupied units.*

3.2.16.5 Economy and Flooding

Flooding of communities incurs more than just the cost of damage alone. Flood risk threatens social wellbeing and the prosperity of the community. Flooding losses may include property damage, environmental degradation, and interruption in business operations. Flooding also often takes a mental health toll on those impacted.

Flood damages were calculated for Gould Wash using a cumulative probability method for numerous flooding events between the 2-year and 500-year floods, as described in the PR&G Report included in Appendix E. Flood modeling performed by BC&A (BC&A 2021a – Attached in Appendix E) was used to determine depth of inundation to structures, transportation infrastructure, and lands. The cost of damage was calculated by Long Watershed Planning Economics, LLC then annualized over the 102-year period of analysis using the 2023 Federal Water Resources Discount Rate of 2.5 percent (NRCS 2023b). The annualized damage costs were updated from the PR&G Analysis to the 2025 discount rate of 3.0 percent for reporting in the Plan-EIS. Total annual damage associated with Gould Wash flooding was calculated at $2,642,600. Refer to Section 18.0 of Appendix D.

Flooding can also result in mental health issues with associated costs. Floods destroy livelihoods, can result in fatality, can damage building/homes, and ruin possessions, turning lives upside down and disrupting communities. Increases in depression, post-traumatic stress disorder, and substance abuse are well documented in the aftermath of floods and can persist for years afterward (MarshMcLennan 2021). These costs were not calculated for flood damages due to uncertainties in calculation methods, but they are important to note as they influence impacted individuals financially.

3.2.16.6 Social Issues and Flooding

Hurricane City has experienced social issues from the recent FEMA mapping and identification of the Gould Wash floodplain. Political turmoil and unrest in the community has risen with citizens' concern regarding the new FEMA floodplain regulations. Many people of the community bought and/or developed land in Hurricane City before the floodplain and associated risks were identified. Property owners are not aware of the regulations associated with SFHA's and purchase property unknowing of the development and improvement restrictions. Hurricane City has experienced political repercussions as the community becomes increasingly frustrated with the FEMA floodplain regulations on their land. FEMA is currently working on floodplain mapping updates in Hurricane City which is further increasing political turmoil. During a City Council Meeting held on

February 17, 2022, where FEMA mapping was discussed, many members of the public attended and expressed concern and dissatisfaction to Hurricane City Councill that FEMA is regulating unnecessarily. When FEMA releases the updated maps, the adoption process by the City of Hurricane is anticipated to be onerous based on the political turmoil and backlash.

3.2.17 Historic / Cultural Resources / Native American Religious Concerns

Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended (54 U.S.C. 300101), requires federal agencies to consider the effects of their undertakings on historic properties.

A Cultural Resource Assessment was completed for the APE (see Section 1.4.3 for APE description) to identify and document cultural resources with potential to be affected by alternative measures. An intensive pedestrian inventory was completed of the 608.1-acre APE by Sheri Murray Ellis (Certus Environmental Solutions), who exceeds the Secretary of the Interior Standards in Archeology and Architectural History. Cultural resources include archaeological sites, historic structures, sacred sites, and TCPs that are important to a community's practices and beliefs, and are necessary to maintain a community's cultural identity. The Cultural Resource Assessment (Certus Environmental Solutions [Certus] 2024) is included in Appendix E.

The NRCS evaluated the identified cultural resource sites within the 608.1-acre disturbance footprint of the APE for their eligibility to the NRHP. Cultural resources identified that meet the specific criteria outlined in 36 CFR Part 60.4 for listing on the NRHP are referred to as "historic properties." The criteria for evaluating the eligibility of a cultural resources site for the eligibility to the NRHP is summarized as:

The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, material, workmanship, feeling, and association, and that they:

- Criterion A – Are associated with events that have made a significant contribution to the broad patterns of our history.
- Criterion B – Are associated with the lives of significant persons in or past.
- Criterion C – Have distinctive characteristics of a type, period, or methods of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D – Yielded or may be likely to yield information important in prehistory or history.

Table 3-15 provides a summary of sites and the NRCSs NRHP eligibility determinations within the surveyed 608.1-acre APE based on the Cultural Resource Assessment (Certus 2024 – Attached in Appendix E). The location of the sites is not disclosed due to their sensitive nature, but their presence in either the western or eastern segment of the Project area has been noted.

Table 3-15. Documented Cultural Resources within the APE

Site No.	NRHP Status	Description
Western Segment of the Project Area		
42WS2552	Not Eligible	Historic ditch
42WS4931	Listed	Hurricane Canal & lateral ditches
Eastern Segment of the Project Area		
42WS2713	Not Eligible	Prehistoric camp & historical trash scatter
42WS3448	Not Eligible	Historical rock features & artifact scatter
42WS3460	Not Eligible	Prehistoric camp
42WS3481	Not Eligible	Prehistoric camp
42WS4397	Eligible	Historical Road to Virgin City
42WS4400	Eligible	Prehistoric camp
42WS5323	Eligible	Gould's Shearing Corral & prehistoric camp
42WS5325	Not Eligible	Prehistoric lithic scatter & historical trash scatter
42WS5326	Not Eligible	Historical camp/artifact scatter
42WS5327	Not Eligible	Historical trash scatter
42WS5328	Eligible	Prehistoric camp & historical trash scatter
42WS5329	Not Eligible	Historical artifact scatter
42WS6188	Eligible	Historical Toquerville to Arizona Road
42WS6988	Not Eligible	Prehistoric camp
42WS6989	Not Eligible	Prehistoric camp
42WS6990	Eligible	Prehistoric camp
42WS6991	Eligible	Prehistoric camp & possible rock art
42WS6992	Not Eligible	Historical trash scatter
42WS6993	Not Eligible	Historical Gould Wash Road

In addition to the surveyed APE, SHPO archaeological and historic building records were reviewed to identify previously documented sites in the 966.5-acre benefited area of the APE. Compliance for Section 106 is not required for the reduced flooding benefits within the benefited area, but available records were used to identify historic properties and assess beneficial effects from implementation of alternative measures. The benefited area consists of the area that benefits from reduced flooding after implementation of the proposed Action Alternatives. The records search identified 219 buildings/structures and one historic district (Hurricane Historic District) within the benefited area that have been previously documented (Certus 2024). These include 101 historic properties (1 historic district, 2 structures, and 98 buildings). The remaining buildings/structures include 108 that are ineligible or out-of-period, 2 are undetermined, and 8 have been demolished. Many additional historical buildings and structures are located throughout the benefited area but have not been documented yet or evaluated for the NRHP, and thus the specific number of historical buildings cannot be determined (Certus 2024).

The NRCS as the lead federal agency consulted with the SHPO, cooperating agencies (USACE, BLM, and EPA), and tribes on the delineation of the APE and determinations of NRHP site eligibility. A consultation letter was sent to SHPO on November 6, 2024, to tribes on November 12, 2024, and USACE on November 13, 2024 (Appendix A). No consultation response has been

received from the USACE. The EPA declined participation in consultation because they suggested that NRCS rely on the SHPO or THPO for consultation related to the APE and determination of NRHP site eligibility due of lack of expertise (Appendix A). The BLM reviewed the cultural resource report, APE, and determination of NRHP site eligibility, and provided their approval for the documented information (Appendix A). The SHPO concurred with determinations of site eligibility in a letter dated December 24, 2024 (Appendix A). Section 7.1.3 (Tribal Consultation) summarizes the tribal consultation completed to comply with EO 13007, EO 13175, the American Indian Religious Freedom Act (AIRFA), and the NHPA. Three tribe responses have been received as discussed in Section 7.1.3 and are included in Appendix A.

3.2.18 Public Health and Safety

Flooding is the primary public health and safety concern for the Project. Large and damaging flash floods have occurred in Hurricane City as described in Section 2.2.1. Hurricane City has seen a considerable increase in population since the last large, documented flood event in 1981 when the population was approximately 2,660 people. The population has greatly increased to 21,808 people based on USCB estimates (USCB 2021), and a larger population of residents are now subject to public safety hazards from flooding. Additionally, FEMA flood maps showing Gould Wash flooding hazards were not available until 2009 (FEMA 2009), after much of the city development had already occurred. Hurricane City and Washington County have identified a need for flood prevention measures to reduce the public health and safety hazard associated with Gould Wash flooding.

Based on hydrology and hydraulic analysis completed by BC&A (BC&A 2021a – Attached in Appendix E), there are sections of Gould Wash through Hurricane City that don't have enough capacity to safely pass a flood from even a 2-year storm event. The 100-year storm event producing a flow of 8,820 cfs, exceeds the capacity of all segments of Gould Wash through Hurricane City. If such a flow were to occur, water would overtop Gould Wash and flood out much of Hurricane City including 650 homes, 99 commercial businesses/offices, two schools, 5 churches, a post office, and 82 roads. Structures and roads inundated for various storm events were determined from BC&A flood modeling results and are summarized in Table 3-16. Note that the Hurricane Community Center is used by the Hurricane Valley Commonwealth School, which is a homeschool that meets regularly at the center. For this reason, it is counted as a school in the inundated features summary from Table 3-16. Flood mapping is provided in the BC&A TM attached in Appendix E. Additionally, flood maps showing the BC&A flood model results for the 100-year and 500-year floods are provided in Appendix C, Maps C8.1 and C8.2.

Table 3-16. Inundated Features Summary

Flood Event	Homes	Commercial/ Office	Schools	Churches	Post Office	Roads
2-Year	6	-	-	-	-	14
5-Year	70	-	-	-	-	24
10-Year	109	-	-	-	-	30
25-Year	393	30	2	3	1	70
50-Year	529	59	2	3	1	72
100-Year	650	99	2	4	1	82
500-Year	826	130	3	4	1	84

As discussed in Section 3.2.16.5, flooding also has lasting effects to mental health. Many factors such as death, destruction of property, impacts to livelihoods, etc. can increase mental health issues in those impacted. A loss of life analysis was conducted by NRCS to determine the risk to public safety. Based on the analysis there is a risk of loss of life for all flood events greater than the 25-year flood (see Section 2.3.2 of Appendix D). Damage to much of the community would occur during a flood as shown in the numbers of features inundation from Table 3-16. Deterioration of mental health of the individuals of the community would be at risk based on the loss of life and damages anticipated from flooding to homes, commercial businesses, offices, schools, and places of worship.

3.2.19 Recreation

The western segment of the Project area is located on private lands within Hurricane City where public recreation activities do not occur or are not permitted, except for the area adjoining the Hurricane Cliffs. The Three Falls Trailhead is located at the base of the Hurricane Cliffs within TLA owned lands. The Project area intersects the trail and TLA public lands as shown in Appendix C, Map 9. A parking lot is provided at the Three Falls trailhead and the trail extends approximately one-mile up Gould Wash. The trail is restricted to hiking only and motorized or non-motorized vehicles are not permitted on the trail.

Recreation within the Project area occurs on BLM-managed lands in the eastern segment of the Project area. Public recreation does not occur and is not permitted on private lands in the eastern segment. The BLM-managed lands are designated as limited to off highway vehicle (OHV) use where OHV use is only authorized on designated routes. For this area, OHV use would be restricted to motorized roads and trails depicted in Appendix C, Map C9. The access roads in the Project area are existing motorized designated roadways. These roadways are used by recreationists to access BLM-managed lands and non-motorized trails.

There are three BLM-managed trail systems where trailheads can be accessed by motorized roads that run through the Project area. These include Gould's Rim Trail, Gould's Trail, and Frog Hollow Trail. Gould's Rim Trail and Gould's Trail are open to pedestrians and non-mechanized vehicles. They both can be accessed from the Gould's Rim trailhead and parking area located west of Gould Wash Road. Alternatively, Gould's Trail can be accessed where Gould Wash Road and the trail intersect. Frog Hollow trail is only open for pedestrians and the trailhead can be accessed from a motorized dirt road off Gould Wash Road. None of these trails or trailheads are located within the Project area. A map depicting the trails, trailheads, and motorized roadways is provided in Appendix C, Map C9.

3.2.20 Land Use

Land use within the Project area varies between the western segment located in Hurricane City and the eastern segment located primarily within BLM-managed lands. The City of Hurricane General Plan for land use identifies six land use categories for portions of the Project area within city limits (Appendix C, Map C10.1). These include Rural Residential, Natural Open Space, Public, General Commercial, Mixed Use, and Planned Community as defined below (Hurricane City 2021a).

- Rural Residential: These uses should be located near supporting community such as, but not limited to churches, schools, and parks. Appropriate densities for this land use include R1-15, R1-10, R1-8, and R1-6.
- Residential Agriculture: These areas should serve as a transition from agricultural to traditional neighborhoods or commercial uses. Appropriate densities for this land include from one unit per 40 acres to RA-.5 and RA-1.
- Highway Commercial: Commercial uses that provide retail, employment and service uses for the city. These developments should be located along major corridors.
- Natural Open Space: Areas within Hurricane City of undeveloped open space, such as hillsides, ridge lines, river corridors, habitat, and drainage channels left in a predominately undisturbed state with minimal use impacts. These areas may include uses such as trails trailheads, and small pavilions.
- Public: Uses including municipal services, public or private schools and campuses, playing fields, recreational facilities, and similar public facilities.
- General Commercial: Commercial uses that provide retail, employment and service uses for the city. These developments should be located along major corridors.
- Mixed Use: Mixed use areas should be developed as small districts or community centers offering a mix of retail, dining, entertainment, employment, and supporting residential. These developments should be easy and safe to navigate on foot and located in areas with access to major roads and surrounded with appropriate residential densities to support these uses.
- Planned Community: Should be complete communities that offer a mixture of housing types and supporting uses such as neighborhood and supporting commercial uses, offices, churches, schools, and parks. Development in this designation should take into account the character of the existing surrounding development.

The eastern segment of the Project area is located primarily on BLM-managed lands that are used for general recreation (primarily biking and hiking) and grazing. The portions of the Project area on BLM-managed land are within the Hurricane Fault grazing allotment (Allotment No. 14028), in the north pasture (Pasture No. 01 totaling 5,588 acres) and east pasture (Pasture No. 02 totaling 4,882 acres) (BLM 2022). Areas of the eastern segment of the Project areas outside of BLM-managed lands consist of private lands within Hurricane City with a Planned Community land use designation described above and private lands within Washington County jurisdiction. The private lands in Washington County are designated as Open Space Transitional and Open Space Conservation (Washington County 2023a). These are defined from Washington County Code below (Washington County 2023b Section 10-6A and 10-6B). A map depicting these land uses is included in Appendix C, Map C10.2.

- Open Space Transitional: The purpose of this zone is to provide for the protection of primarily undeveloped private land. Permitted uses include accessory dwelling units, farm buildings, farm operations, home occupations, livestock grazing, crops, short-term rentals, single-family dwellings, and undeveloped private land.
- Open Space Conservation: The purpose of this zone is to permit the use of open space land within the county for uses compatible with the protection of the natural and scenic

resources of the county for the benefit of present and future generations. Permitted uses include BLM-managed land, floodplains, livestock grazing, national forests/ parks/ monuments, undeveloped TLA land, designated wilderness/habitat conservation areas/ areas of critical environmental concern, or any other vacant undeveloped land.

3.2.21 Visual Resources

Visual landscape can be influenced by urban development, vegetation, hydraulic features, geologic conditions, topography, wildlife, and recreation. The western segment of the Project area runs through a developed corridor of Hurricane City. The combined gentle sloping topography, geologic conditions, lack of riparian corridor, and presence in disturbed and developed areas do not offer unique or outstanding views, except at the Hurricane Cliffs. The Hurricane Cliffs provide a dramatic topographic shift rising approximately 700 feet from the valley floor to the top of the mesa. The combined topographic gradient and geologic features offer a unique and scenic view from the base of the cliffs in the Project area (Figure 3-7).

Figure 3-7. View of Hurricane Cliffs

The eastern segment of the Project area is located on a mesa and generally contains gentle sloping topographic gradients, with a greater variation in topography along Gould Wash. The area is set in a desert shrub and grassland landscape. Refer to Section 3.2.9 for a description of vegetative cover types within the Project area that contribute to the visual landscape.

The visual quality of Borrow Source Area 1 and Area 2 is low and public access to these areas is not permitted because they are located on private land. A dirt road and disturbed dirt areas run through the middle of Borrow Area 1. The borrow area does not offer scenic views on lands within the Project area, but scenic views of the distant landscape are visible from the area (Figure 3-8). Borrow Area 2 adjoins Highway 59, and based on aerial photography review and site visits conducted by AEP, has been disturbed from past activities. Disturbance appears to include grading, placement of fill, and construction of access roads (Figure 3-9). These ground disturbing activities appeared to have occurred sometime around or prior to 2004 and disturbed areas have since grown in with limited vegetation (Figure 3-9 and Figure 3-10). Scenic views are not visible on lands within the Project area, but scenic views of the distant landscape are visible from the area (Figure 3-10). The Project area along access road alignments similarly do not have scenic

views within the disturbed road corridor, but scenic views are visible in the distance from the roadways.

Figure 3-8. General View of Borrow Area 1

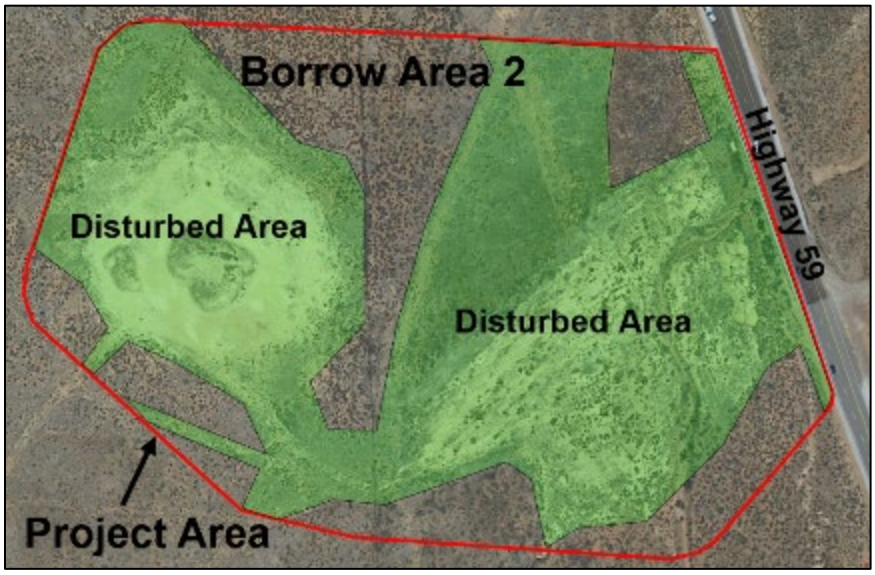

Figure 3-9. Disturbed Areas of Borrow Area 2

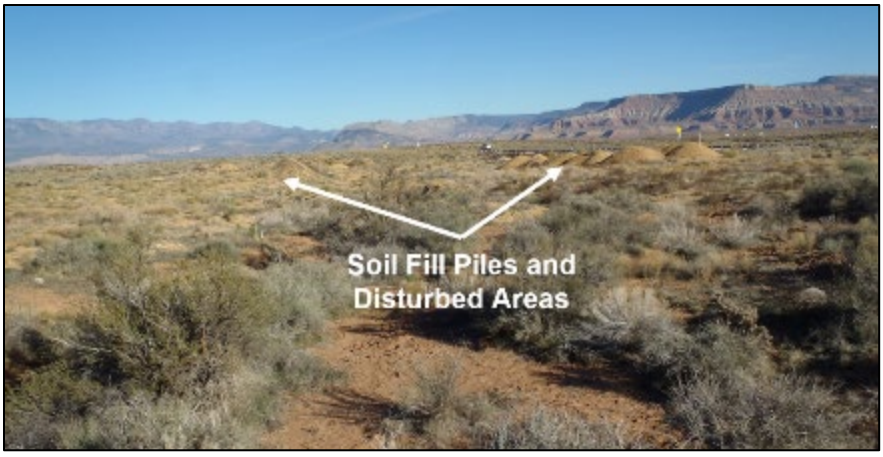

Figure 3-10. General View of Borrow Area 2

Borrow Area 3 and the Dam Embankment Area contain primarily undisturbed desert shrub lands. Even though these lands are located on public BLM-managed lands that are open to public recreation, there are no recreation trails, parking areas, or recreation sites in or near these two areas. Recreation use in this area is mostly passthrough vehicle or OHV traffic along the existing roadways. Therefore, views of these areas by the public would be from the public roadways. Portions of Borrow Area 3 and the Dam Embankment Area are visible from the existing roadway corridors. The topography is gently sloping and scenic views are not visible in the areas, but scenic views of the mesas and their cliffs/slopes are visible in the distance (Figure 3-11 and Figure 3-12).

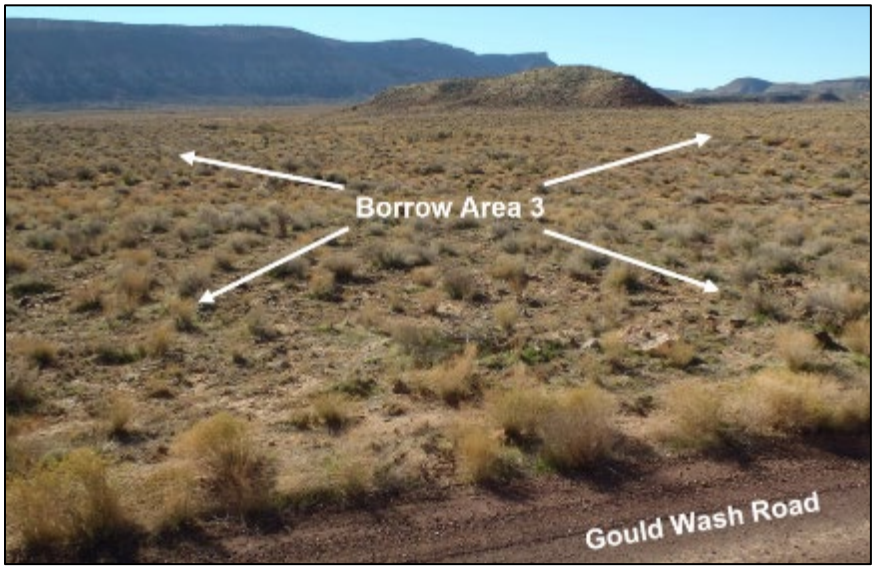

Figure 3-11. General View of Borrow Area 3

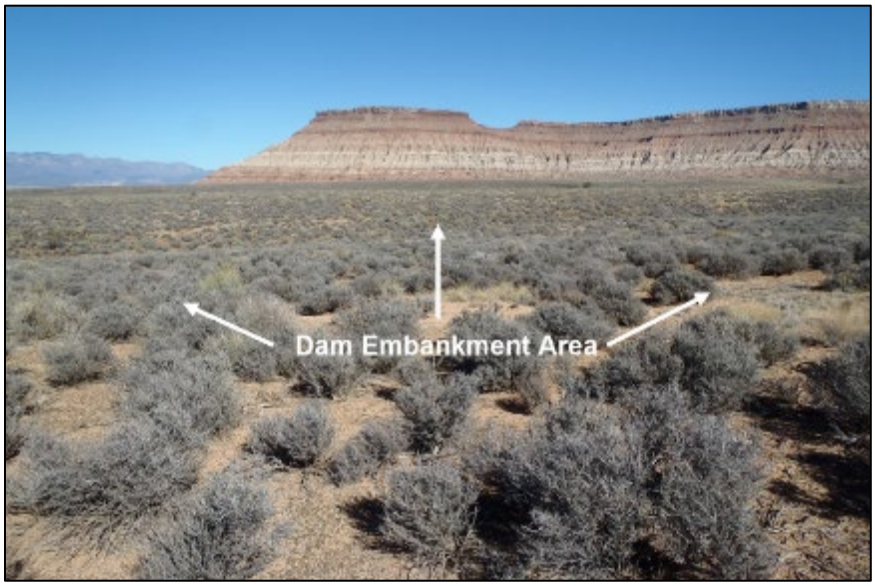

Figure 3-12. General View of Dam Embankment Area

The eastern segment of the Project area within BLM-managed lands are classified as Visual Resource Management Class III. The Class III objective is "*to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape*" (BLM 1999).

In addition to visual and scenic resources viewed in and from the Project area, it is also important to note those views of the Project area from surrounding vantage points. BLM-managed trails systems are present west of Highway 59 and at elevations approximately 200 to 1,000 feet higher than the eastern segment of the Project area. It is likely that portions of the Project area are visible from these public trails which consist of the Hurricane Trail System and the Mesa Trail System, located east and north of Highway 59. The distance of these trails from the eastern segment of the Project area is as close as approximately 0.3 miles to as far as approximately 2 miles.

3.2.22 Transportation Infrastructure and Traffic

Gould Wash through Hurricane City in the western segment of the Project area intersects several paved surface roads and one highway. Culverts or bridges are in place along Gould Wash at the channel intersecting points as depicted in Figure 3-3 of Section 3.2.5 and described in Table 3-17 below. The streets systems in Hurricane City are owned, operated, and maintained by Hurricane City Streets and Drainages Department, and by the Utah Department of Transportation (UDOT) for State Route 9 (SR-9) and State Route 59 (SR-59). Each responsible road department has different permits and requirements for work to be performed within their road right of way (ROW).

The Hurricane City paved surface roads in the Project area consist of local city streets that are minor collector roads, except for S 700 W which is a major collector and 600 N which is a minor arterial. Minor and major collectors provide for traffic movement between local streets and arterial streets and provided access to abutting land uses, while minor arterials provide major through traffic movement between geographic areas (Jones and DeMille Engineering 2019). The UDOT SR-9 is a major arterial accommodating traffic to and from the freeway and providing traffic movement through the community to adjacent cities. The roads in the western segment of the Project area include a minor arterial (SR-59) and paved and unpaved access roads. The path of SR-9 and SR-59 provide access from Interstate-15 to Zion National Park.

Table 3-17. Transportation Infrastructure Summary

Road	Description
Project Area, Western Segment	
S 180 W	Paved 2-lane road with a bridge spanning Gould Wash.
S 400 W	Paved 2-lane road with a bridge spanning Gould Wash.
W 400 S	Paved 2-lane road adjoining Gould Wash.
S 700 W (Airport Road)	Paved 2-lane road with a bridge spanning Gould Wash.
S 1150 W	Paved 2-lane road with ford crossing and one corrugated metal pipe to convey Gould Wash flows.
State Route 9 (State Street)	Paved 4-lane road and center turn lane with three box culverts to convey Gould Wash flows.

Road	Description
1580 W	Paved 2-lane road with two box culverts to convey Gould Wash flows.
600 N	Paved 2-lane road with two box culverts to convey Gould Wash flows.
Project Area, Eastern Segment	
Highway 59	Paved 2-lane road that adjoins Staging Area 2 and provides vehicle access to Gould Wash Road.
Gould Wash Road	Paved approximate 26-foot-wide road from Highway 9 south for approximately 2.25 miles then transitions to an approximate 20-foot-wide gravel road thereafter.
Unnamed Gravel Road	Approximate 20-foot-wide gravel road extending west from Gould Wash Road and adjoining Borrow Area 3.
Unnamed Dirt Road	Approximate 15-foot-wide unimproved dirt road extending from Gould Wash Road northwest to Borrow Area 1.

As described in Section 3.2.18, Gould Wash through Hurricane City has limited capacity and flooding of the City, including transportation infrastructure, would begin to occur at a 2-year flood. This flooding has the potential to damage roadways and road water crossings (culverts, bridges, etc.), If such an event were to occur. Additionally large amounts of sediment would be deposited over the roadways. Based on hydrology and hydraulic analysis completed by BC&A (BC&A 2021a – Attached in Appendix E), up to 82 roads would be flooded during a 100-year flood event. Maps depicting flooding during a 100-year flood are provided in Appendix C, Map C8.1.

3.2.23 Noise and Vibration

Noise- and vibration-sensitive receptors are those facilities, land areas, or wildlife populations that require lower noise levels for health and function. Examples include residential neighborhoods, medical facilities, schools, churches, research facilities, parks, and open space. Noise can be a nuisance, can interfere with normal activities (sleep, speech, learning, etc.), or can cause physiological effects such as hearing loss. Vibration can be a nuisance, can cause structural damage, and interfere with vibration-sensitive activities. Ambient noise and vibration in the Project area has not been measured, and therefore no baseline is available.

General noise and vibration sources in the western segment of the Project area consist of vehicle traffic, agricultural operations, air traffic, and other general community noises (lawn maintenance equipment, radios, shouting, general construction, sporting events, etc.). Routine O&M along the existing Gould Wash channel is also performed that would create noise from construction equipment (excavator, dozer, and dump truck). The western segment of the Project area extends through developed areas of Hurricane City directly adjoining populations that would be sensitive to noise and vibration. These include residences and commercial buildings that directly adjoin the Project area with residential subdivisions, offices, businesses, schools, and other community buildings within a ½-mile radius. Wildlife is limited through this developed corridor and any wildlife species present experience regular noise disruption from daily city operations. Noise ordinances for the western segment of the Project area are regulated by Hurricane City.

Noise and vibrations sources in the eastern segment of the Project area primarily include vehicle traffic along SR-59 and access roads, air traffic, and noises from recreationists using the area. The eastern segment of the Project area is void of buildings and is greater than one mile away from the developed areas of Hurricane City. Noise and vibrations receptors in the eastern

segment of the Project area would include recreationists on BLM-managed lands and occupants of a nearby residential treatment center (Three Point Center). The eastern segment of the Project area is mostly undeveloped and could contain various wildlife species (see Section 3.2.13) that would be sensitive to noise or vibration. Noise ordinances for the eastern segment of the Project area are regulated by BLM for areas within BLM-managed lands, Hurricane City for areas within the incorporated city limits, and Washington County for the remaining areas.

Noise can vary greatly based on a wide range of parameters of each noise producer in addition to the environmental conditions (wind, air temperature, humidity), distance from the noise source, and topography or site geometry. The level of nuisance and interference of noise is somewhat subjective, and therefore, it is helpful to compare the difference in new noise to the existing (ambient) noise which an individual has adapted. A list of common sounds and their typical noise levels in decibels (dB) are provided in Figure 3-13.

dB	Noise Source
PAINFUL & DANGEROUS (use hearing protection or avoid)	
140	Fireworks
	Gun shots
	Custom car stereos (full volume)
130	Jackhammers
	Ambulances
UNCOMFORTABLE (dangerous over 30 seconds)	
120	Jet planes (during takeoff)
VERY LOUD	
	Concerts
110	Car horns
	Sporting events
100	Snowmobiles
	MP3 players (full volume)
90	Lawnmowers
	Power tools
	Blenders
	Hair dryers
Over 85 db for extended periods can cause permanent hearing loss	
LOUD	
80	Alarm clocks
70	Traffic
	Vacuums
MODERATE	
60	Normal conversation
	Dishwashers
50	Moderate rainfall
SOFT	
40	Quiet library
30	Whisper
FAINT	
20	Leaves rustling

Figure 3-13. Common Sounds and Typical Noise Levels

Source: based on levels of noise chart from the American Academy of Audiology 2023

Applicable noise laws in the Project area are summarized below. Noise laws are implemented and regulated at a state and local level per the Noise Control Act of 1972 (42 U.S.C. 4901 et seq.), amended by the Quiet Communities Act of 1978 (42 U.S.C. 4913), which promotes the development of state and local noise control programs.

- Hurricane City Ordinance (Ord. 2017, 2-2-2017 Section 4-9-1): Noises including operation of vehicles, machinery or equipment, and construction activities (among others), are prohibited before 6:00 a.m. and after 10:00 p.m. (Hurricane City 2017).
- Washington County Code: No person, firm, or corporation shall maintain or commit any nuisance or public nuisance. Nuisance is defined as Anything offensive to the sensibilities of reasonable persons, or any act or activity creating a hazard which threatens the health and welfare of inhabitants of the county, or any activity which by its perpetuation can reasonably be said to have a detrimental effect on the property of a person or persons within the county (Washington County 2023b Section 4-1-2). All mining and gravel zone operations shall be conducted between the hours of 6:00 am and 10:00 p.m. (Washington County 2023b Section 10-12-1).
- BLM (43 CFR § 8365.1-4): No person shall cause a public disturbance or create a risk to other persons on public lands by making unreasonable noise.

4.0 Formation of Alternatives

4.1 Alternative Formulation Process

The alternative formulation process followed an eight-step watershed planning process for PR&G and the NRCS nine-step planning process as described in Section 1.5. The PR&G eight-step evaluation process includes consideration of the federal objective (see section 2.1.1), PL 83-566 general purposes (see Section 2.2.2), guiding principles (see Section 4.1.1), and ecosystem services (see Section 3.1). A framework was developed that included comparison of alternatives against guiding principles, ecosystem services, and economic benefits to select the alternative that maximized public benefits (environmental, economic, and social goals). A PR&G analysis was completed to document the alternative formulation process and framework comparison for Project decision-making. The PR&G Analysis and the Ecosystem Services Tradeoff Analysis Evaluation Table is included in Appendix E.

4.1.1 Guiding Principles

Guiding principles were used to assist in decision-making and weighing tradeoffs of Project alternatives. The guiding principles were included in a comparison framework as documented in the PR&G Analysis (see Appendix E) and are listed below.

1) Healthy and Resilient Ecosystems
2) Sustainable Economic Development
3) Floodplains (avoiding unwise use of floodplains)
4) Public Safety (reducing public health and safety risks)
5) Environmental Justice
6) Watershed Approach

4.1.2 Alternative Formulation Criteria

The process of formulating alternatives for the Project followed procedures outlined in the NRCS NWPM (NRCS 2015 and 2024) Parts 500 through 506; NRCS NWPH (NRCS 2014a), Parts 600 through 606; PR&G (CEQ 2013 and 2014); NRCS DM 95000-013 (USDA 2017b), and other NRCS watershed planning policy. Numerous alternatives were developed to meet the project purpose and need by the Project team. The alternatives were developed considering problems and opportunities as presented in Section 2.2, and objectives and constraints as presented in Section 2.1. Alternatives were formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability.

An alternative analysis was also completed to comply with Section 404(b)(1) of the CWA. A 404(b)(1) Analysis has been included in Appendix E. The USACE evaluates applications for Section 404 individual permits under the environmental criteria set forth in the CWA Section 404(b)(1) Guidelines from the EPA Federal Regulations (40 CFR Section 230). The 404(b)(1) analysis identifies the Least Environmentally Damaging Practicable Alternative (LEDPA) for 404 permitting.

4.1.3 Risk and Uncertainty

During the planning process, decisions are made with information that is uncertain, including errors in measurements and climatic changes that could alter rainfall storm events. Assumptions made during the planning process are based on the best available science, technology, and information. Extended delays between the planning process and construction increase the degree of risk and uncertainty. Estimated alternative costs are based on computed work quantities multiplied by the appropriate unit cost for that type of work. Unit costs are based on current market prices from similar projects. Costs can be influenced by economic factors that cannot be predicted between the planning process and construction that could increase the actual cost and decrease the availability of materials.

Additional risk and uncertainties associated with the project decision-making include the following:

- Erosion and Sedimentation: Erosion and sedimentation are dependent upon several unpredictable factors. Sedimentation could vary based on conditions in the drainage area, including construction activity, wildfires, storm events, climate variations, and off-highway vehicle/pedestrian traffic, among others. Erosion can vary based on climactic, hydrological, topographic, soil, geological, and vegetation conditions.
- Sediment Load Estimates: There is a high level of uncertainty when calculating sediment loads in ephemeral streams and in perennial streams fed by flows from ephemeral streams. Based on several unpredictable variables including when/where a cloudburst storm occurs, the intensity of the storm, soil/vegetation/topographic conditions at the site of the cloudburst storm, and other factors listed above for erosion and sedimentation, the level of error for sediment load estimates is high.
- Costs and Benefits: As with all projections of future costs and benefits, there is a degree of uncertainty assumed. Installation costs, O&M costs, crop yields, housing markets, labor markets, and commodity and input prices will all fluctuate.
- Flood Protection: Flood frequencies and magnitudes used in the analysis always carry a degree of uncertainty. Economic estimates of flood control measures are not precise. The intention is that they are reasonably accurate and can assist in making good decisions.

4.2 Alternatives Considered

The project team considered two proposed Action Alternatives and one No Action Alternative in detailed study. Multiple additional alternatives were formulated but were eliminated from further study as documented in the PR&G Analysis included in Appendix E and described in Section 4.3. Nonstructural alternatives were developed and evaluated for feasibility including full nonstructural alternatives and combination structural and nonstructural alternatives. The Action Alternatives considered in detail study incorporate a combination of structural and nonstructural measures. Alternatives with only nonstructural measures were determined to be not feasible and eliminated from detailed study. Concurrences from cooperating agencies (BLM, EPA, and USACE) was received for the alternatives included in detailed study and eliminated from detailed study in this Plan-EIS.

The cost estimates for the alternatives provide a level of detail judged appropriate for the purpose of identifying the NRCS preferred alternative among the alternatives considered. Project costs provided for alternatives selected for detailed study incorporate installation and O&M costs. Installation costs are the costs to be incurred for installing the works of improvement after the Project is authorized for installation. Installation costs include, as applicable, construction, engineering, real property rights, natural resource rights, permitting, replacement in-kind relocation payments, and Project administration costs. Detailed construction cost estimates are provided in the PR&G Analysis Report included in Appendix E.

4.2.1 No Action Alternative

The No Action Alternative considers the actions that would take place if no federal action or federal funding were provided for the Project. The SLO's most likely course of action would be to continue O&M along the Gould Wash channel through Hurricane City as needed to maintain the existing conveyance capacity. The annual O&M costs were estimated by Hurricane City at $16,000 annually.

4.2.2 Action Alternatives

The proposed Action Alternatives include measures to reduce flood damage caused by floodwater to Hurricane City. Several levels of flood protection were considered as part of the alternative formulation including a 2 percent annual chance flood (50-year flood), 1 percent annual chance flood (100-year flood), and 0.2 percent annual chance flood (500-year flood). Available FEMA maps show extensive flooding to Hurricane City at a 100-year flood that would also result in loss of life based on engineering analysis (see Section 3.1 of Appendix D). Based on this information, alternatives for a 50-year flood level of protection were determined insufficient in meeting the Project goals and were not in line with current FEMA floodplain regulations. Therefore, alternatives for a 50-year flood level of protection were removed from further consideration.

The 500-year flood was taken into consideration for sensitive facilities and infrastructure. Modeling results for both Action Alternatives show that minimal flooding would occur outside of the Gould Wash channel after installation of the alternative measures meeting a 100-year level of protection and no sensitive facilities or infrastructure would be flooded during the 500-year flood. Refer to Appendix C, Map C8.3 for flooding at the 500-year flood for alternatives. Therefore, alternatives to protect sensitive facilities were determined not applicable to the alternative formulation process.

A total of 18 Action Alternatives were formulated for the Project. Only two of the Action Alternatives were found to be feasible for implementation based on analysis for determining the LEDPA per Section 404 of the CWA and NRCS screening criteria. A detailed description of the preliminary alternative formulation and decision-making process is included in the PR&G Analysis Report included in Appendix E. A description of the Action Alternatives included in detailed study is provided in Sections 4.2.2.1 and 4.2.2.2 below and concept design drawings are provided in Appendix E. Action Alternatives eliminated from detailed study are included in Section 4.3. An Ecosystem Services Tradeoff Analysis Evaluation was completed for the Action Alternatives included in detailed study and is provided in Appendix E.

4.2.2.1 Increase Channel Capacity Through Hurricane for 8,820 cfs

This alternative includes structural and nonstructural measures. Nonstructural flood prevention measures include purchasing and easements for the modified channel and implementing building restrictions in the remaining floodplain. A detailed description of the structural and nonstructural alternative measures is provided below. Alternative measures including temporary construction disturbance limits, borrow areas, access, and staging are depicted in Appendix B, Map B3.

Structural Flood Prevention Measures

This alternative increases the Gould Wash channel capacity through Hurricane City to safely pass the 100-year frequency flood (100-year flood) with a maximum flood flow of 8,820 cfs. Modifications along approximately 13,100 linear feet of channel would be required which includes channel widening, constructing an engineered block flood wall (40 feet wide and 13 feet deep) along approximately 7,590 linear feet, and placing riprap along approximately 5,510 linear feet of channel banks. Approximately 1,005 linear feet of riprap channel along the northern-most modified segment would be constructed with a 100-foot bottom width and the remaining modified segments would be constructed with a 30-foot bottom width with 2:1 side slopes. The riprap would be covered with sediment excavated from the channel during construction, to match the look (color/texture) and characteristics of the existing Gould Wash channel banks. Channel improvements are depicted in Figure 4-1. All improvements including temporary construction disturbance limits, access, and staging are depicted in Appendix B, Map B3.

To maintain the same ephemeral stream function for water infiltration, the channel bottom would be left open along the entire modified length, but would require grouted rock boulder grade control structures to prevent head cutting. These grade control structures would be placed every 200 to 400 feet in the bottom of the channel for the flood wall section. Grade control structures for the riprap sections would be placed every 300 to 500 feet for 0.01 channel slopes and placed every 800 to 1,000 feet for 0.004 channel slopes. Cross sections of the engineered flood wall and riprap channel are provided in Figure 4-2 and Figure 4-3.

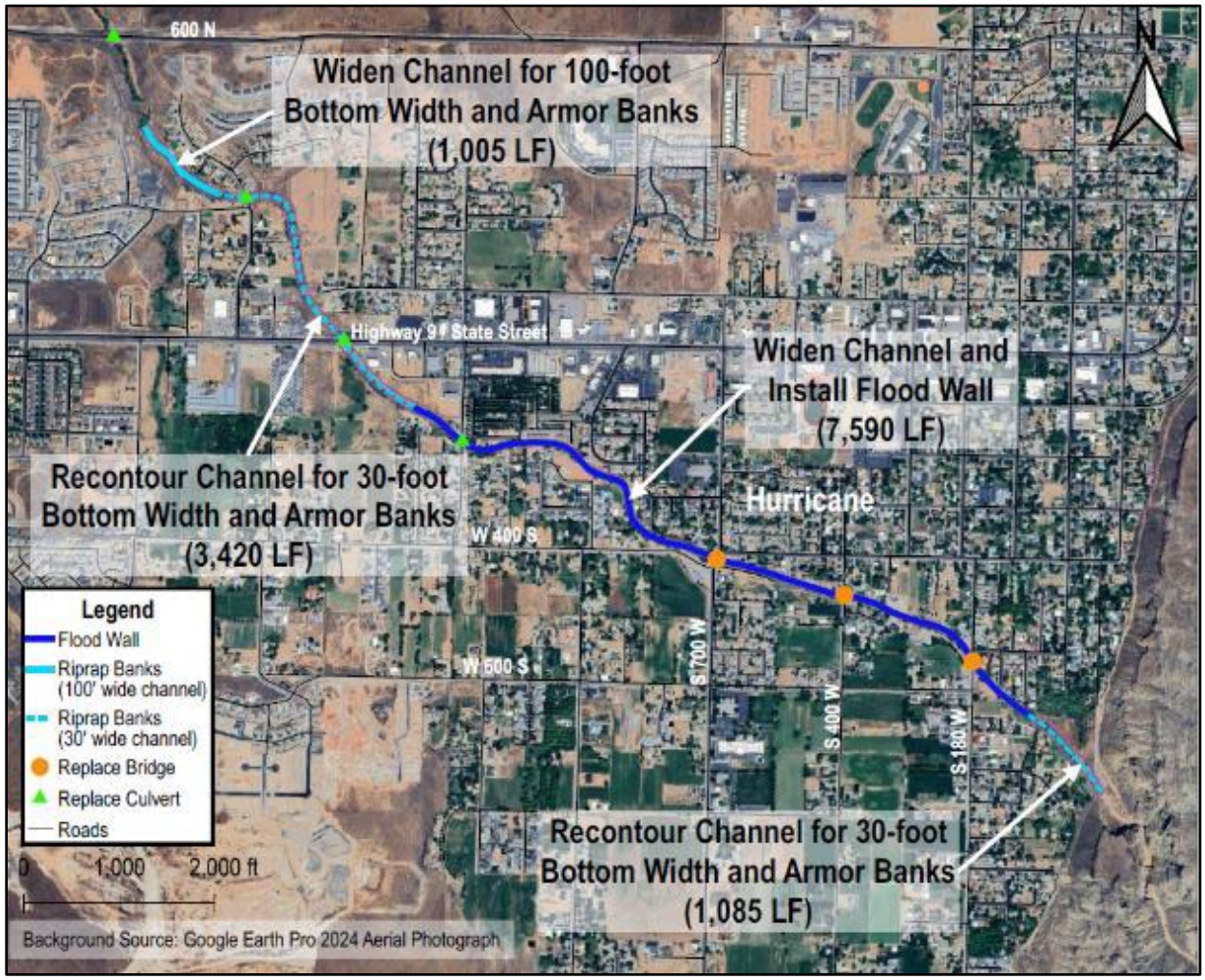

Figure 4-1. Gould Wash Channel Improvements for 8,820 cfs

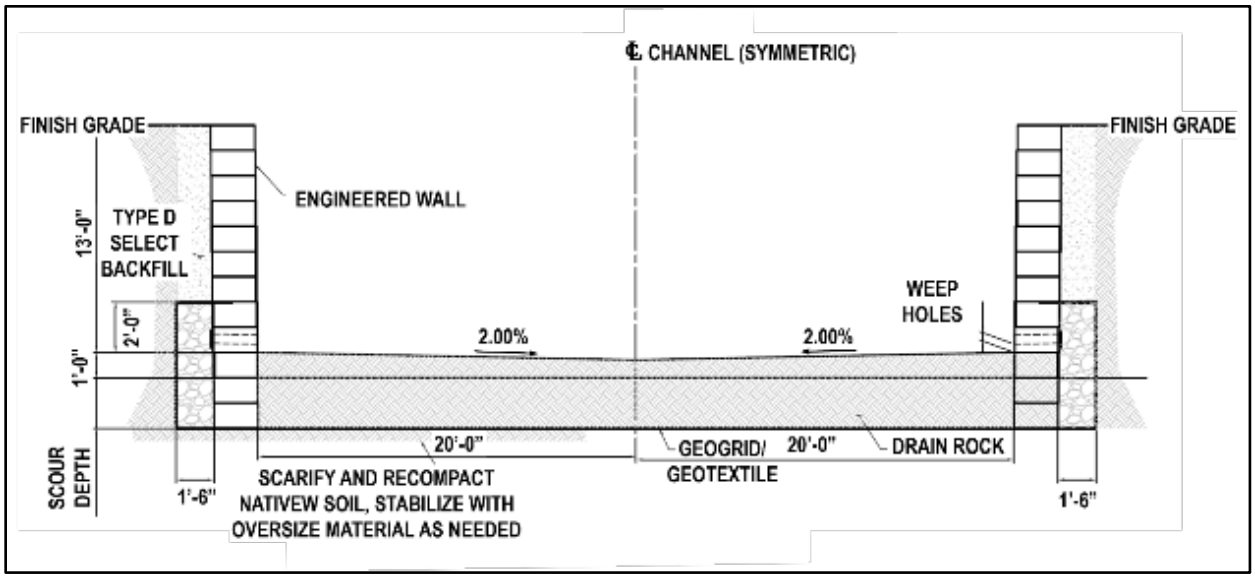

Figure 4-2. Flood Wall Cross Section (8,820 cfs)

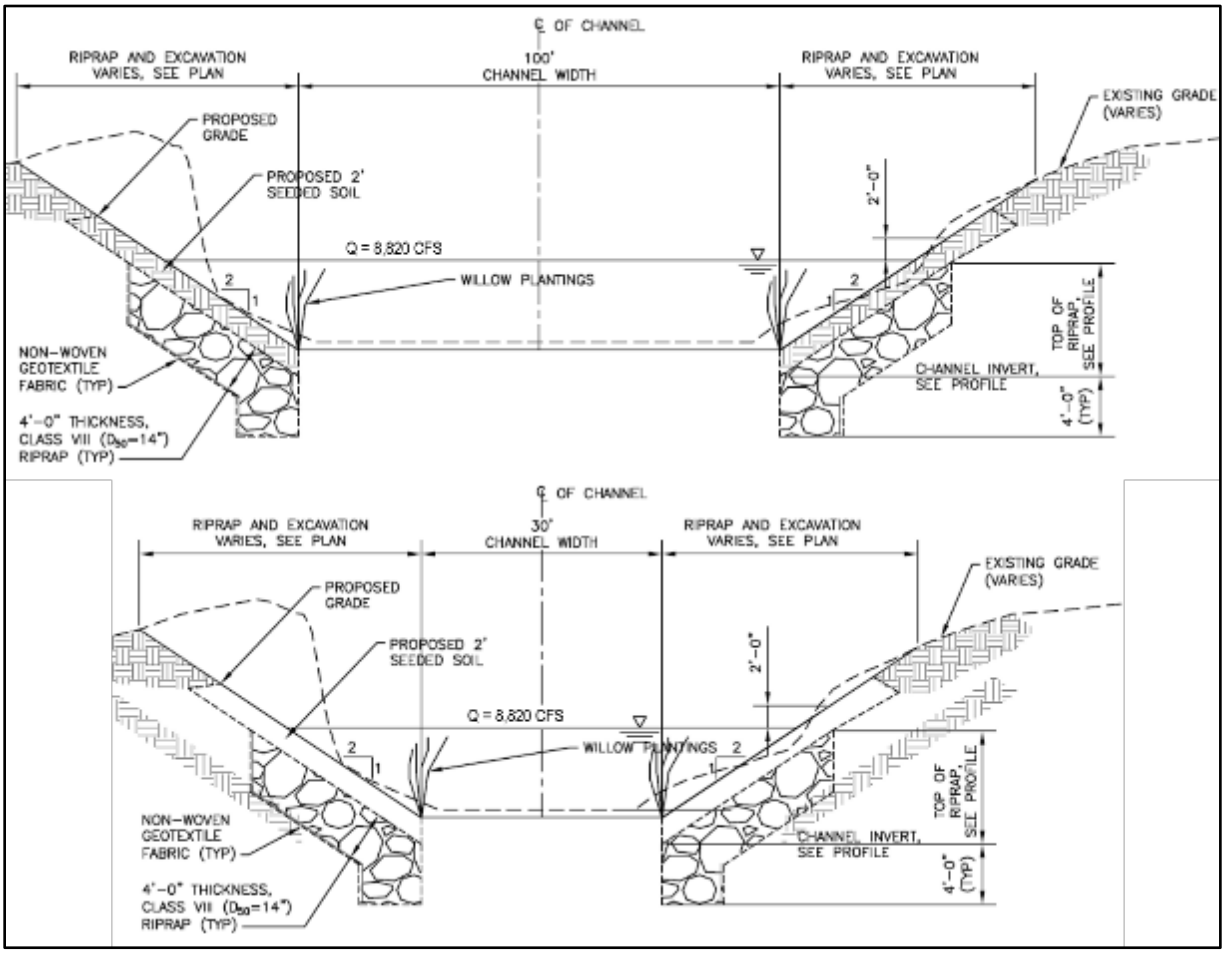

Figure 4-3. Riprap Channel Cross Sections (8,820 cfs) 30 ft and 100 ft Widths

An easement would be acquired on state, city, and private land to include the modified Gould Wash channel up to the top of the proposed bank and permanent access for O&M to maintain the channel. Demolition or relocation of buildings is not anticipated for alternative measures along the channel.

Seven road crossings along the channel through Hurricane City would need to be replaced and upsized to pass 8,820 cfs. A summary of bridge improvements is provided in Table 4-1.

Table 4-1. Culvert and Bridge Improvements 8,820 cfs

Location	Structure Type	Proposed Improvement
600 N	Culvert	Replace existing culvert with (4) 14-foot-wide by 14-foot-tall box culverts
1580 W	Culvert	Replace existing culvert with (4) 14-foot-wide by 14-foot-tall box culverts
State St	Culvert	Replace existing culvert with (4) 14-foot-wide by 14-foot-tall box culverts
1150 W	Culvert	Replace existing culvert with (4) 14-foot-wide by 14-foot-tall box culverts
700 W	Bridge	Replace bridge
400W	Bridge	Replace bridge
180 W	Bridge	Replace bridge

Nonstructural Flood Prevention Measures

Nonstructural flood prevention measures include purchasing easements for the modified channel corridor through Hurricane City to protect and maintain the channel for flood conveyance. The SLOs would continue to follow the FEMA floodplain guidance and restrictions for development within SFHAs.

Construction Staging and Access

Approximately seven staging areas adjoining the Gould Wash channel alignment through Hurricane City would be used during construction totaling 8.1 acres. Access to the channel would be from city streets adjacent to the channel except at the northern extent. Two new gravel construction access roads would be installed at the northern extent for replacement of the 600 N Street culverts and for access to the northern segment of the channel. New gravel access roads would be constructed parallel to and adjoining the channel for temporary construction access and left in place for O&M access after construction completion. Staging and access areas are depicted in Appendix B, Map 3.

Borrow Material and Disposal

All materials for channel armoring would be purchased from a permitted offsite facility or distributor and no borrow areas are proposed. Sediment excavated from channel widening activities would be stockpiled for use as native cover over the installed riprap armoring. Unused stockpiled materials would be disposed of at an offsite permitted disposal location.

Revegetation

The existing banks of Gould Wash through Hurricane City consist primarily of non-native and problematic grass and weeds with scattered shrubs. After construction completion, disturbed areas and the new soil covered riprapped channel banks would be seeded with an NRCS and USACE approved native seed mix appropriate for the anticipated hydraulic regime and climate. The open channel bottom would allow for natural re-establishment of riparian vegetation where hydraulic conditions allowed. Due to anticipated pressurized irrigation modifications proposed by the city as part of a different project, irrigation return flows would no longer be present in the channel at the anticipated time of construction completion for this alternative. The Gould Wash channel through Hurricane City does not have a natural hydraulic regime that supports riparian vegetation, but irrigation return flows have historically supported the growth of riparian vegetation along segments of the channel. The hydraulic conditions would be assessed after construction completion and restoration efforts monitored and coordinated with USACE.

Revegetated areas would be maintained on a regular basis to prevent the establishment of N&I plant species until areas are fully established. A Post Construction Rehabilitation Plan (PCRP) would be developed and would include mechanisms for addressing weed establishment and treatment.

Real Property Rights

Temporary and permanent easements would be obtained on state and private lands as needed for alternative access and construction. Permanent easements include the modified Gould Wash channel up to the top of the proposed bank and adjoining areas for O&M access. Demolition or relocation of buildings is not anticipated for alternative measures along the channel. Temporary

easements include construction staging areas and temporary construction access routes. Real property rights costs also include culvert and bridge work identified in Table 4-1.

Schedule

Alternative measures could be implemented over 12 to 18 months. There are no anticipated seasonal work restrictions, however, weather conditions in the watershed would be monitored closely during construction. If precipitation events or conditions are anticipated that could result in activation of flow in the ephemeral system, work would be stopped or avoided during those periods. Construction would be anticipated to start in 2027 and be completed in 2029.

Costs

Installation costs for these measures are estimated at $75,220,000 and include the items broken out in Table 4-2. Costs for O&M are estimated at $9,500 per year.

Table 4-2. Installation Cost

Item	Cost
Construction	$63,767,000
Engineering/Technical Assistance	$7,971,000
Permitting	$80,000
Real Property Rights	$1,808,000
Sponsor Administrative	$1,063,000
NRCS Administrative	$531,000
Total Installation	**$75,220,000**

4.2.2.2 New Detention Dam and 3,000 cfs Channel Modifications

This alternative includes structural and nonstructural measures. Nonstructural flood prevention measures include purchasing easements for areas exposed to flooding and implementing building restrictions in the remaining floodplain. Structural flood prevention measures consist of construction of a detention dam upstream of Hurricane City along Gould Wash to reduce the peak 100-year flood flow from 8,820 cfs down to 3,000 cfs. The detention dam would be a dry dam and not store water permanently, but only attenuate water temporarily to slow down flood flows during large flood events. Structural modifications along Gould Wash through Hurricane City would also be needed to provide for safe conveyance of the anticipated 3,000 cfs peak flow. However, the detention dam attenuated flow reduction would decrease the extent of modifications required along Gould Wash through Hurricane City.

A detailed description of the structural and nonstructural alternative measures is provided below. Structural alternative measures including temporary construction disturbance limits, borrow areas, access, and staging are depicted in Appendix B, Map B4.1 through B4.3. Easements for nonstructural measures are included in Appendix C, Figures C11.1 through C11.4.

Structural Flood Prevention Measures

A new earthen detention dam (approximately 3,880 feet long and 92 feet tall) would be constructed upstream of Hurricane City along Gould Wash on BLM-managed lands to decrease the maximum flood flow of 8,820 cfs entering Hurricane City during a 100-year flood, down to

approximately 3,000 cfs (Appendix B, Map B4.2 and B4.3). The dam would have enough volume to meet the required flood attenuation storage and provide 100 years of sediment accumulation. The dam would be equipped with a principal spillway system and plunge basin at the outfall. The principal spillway capacity would accommodate a pass-through flow for small flood events and attenuation of water behind the dam would begin to occur for larger storm events (approximately 10-year flood and greater floods) to reduce the peak flood flows in Gould Wash through Hurricane City. The dam would also be equipped with a concrete auxiliary spillway set at an elevation equal to the surface water elevation resulting from a 100-year flood (assuming the sediment pool is full). The dam and appurtenances would be designed to meet all Utah Dam Safety and NRCS design standards. The proposed detention dam improvements are provided in Figure 4-4. A cross section of the dam is provided in Figure 4-5.

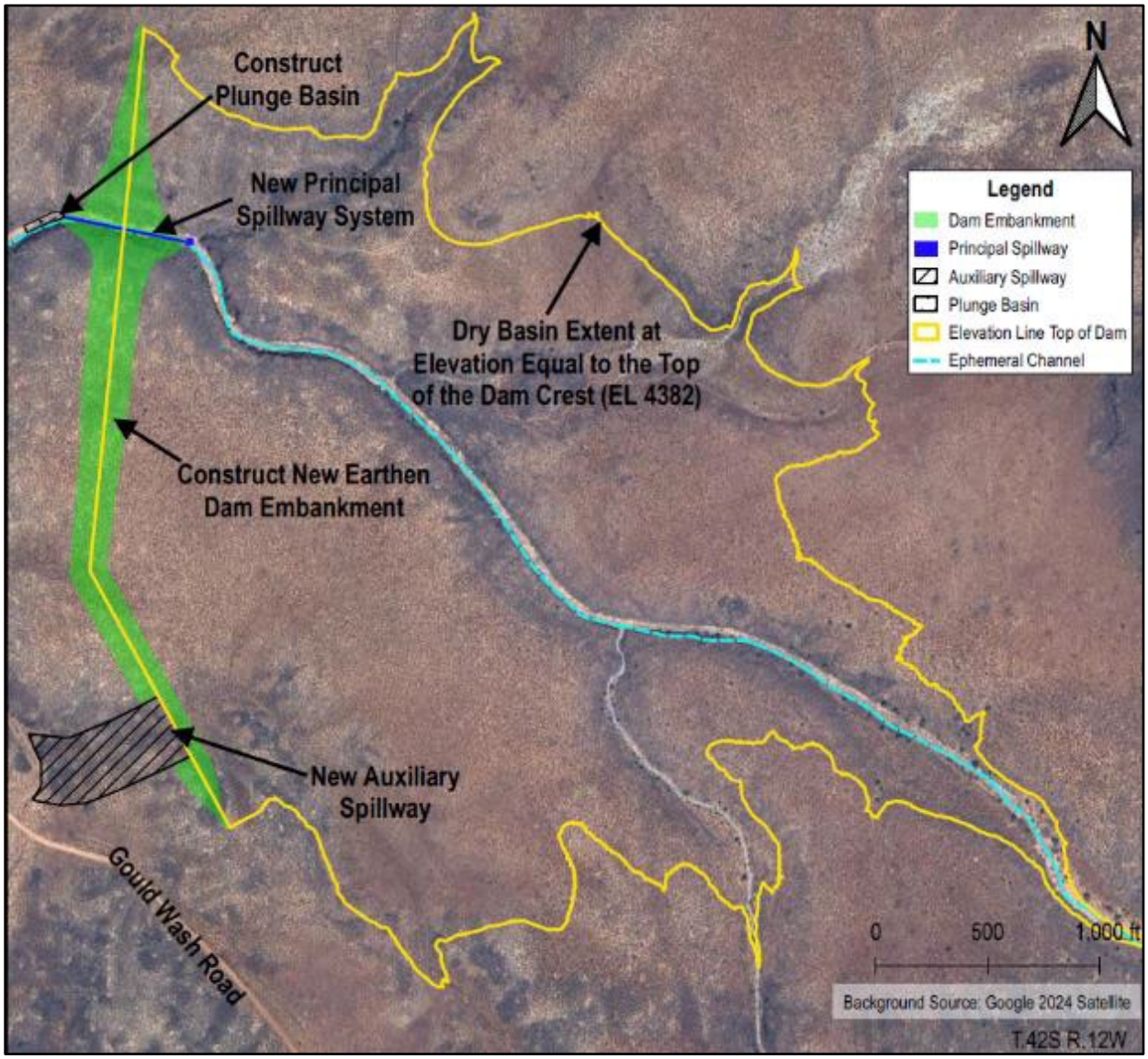

Figure 4-4. Detention Dam Improvements

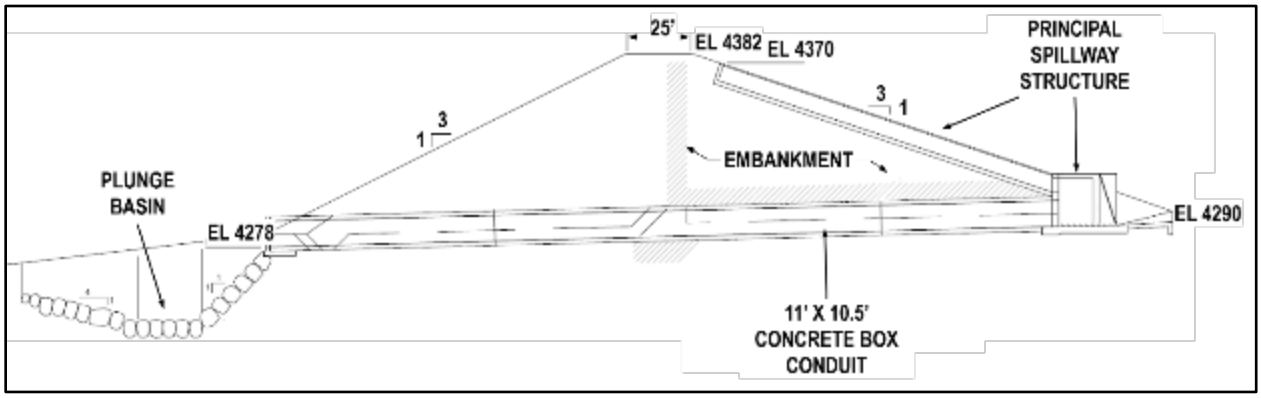

Figure 4-5. Dam Cross Section

Options for several sediment storage volumes were evaluated to determine and select the most feasible and economically beneficial options while decreasing impacts to resources. If no sediment storage volume was provided, the Sponsor would need to excavate and dispose of approximately 11.5 ac-ft (18,553 cubic yards) of sediment annually at a cost of $278,300 or $27,830,000 over a 100-year Project life. Refer to Appendix D for alternative sedimentation rate calculations. The cost to construct the entire dam that also includes 100-years of sediment storage is less than the cost to excavate and dispose of 100-years of sediment. Therefore, it was determined that annual excavation of sediment is cost prohibitive when compared to sizing the dam to accommodate for sediment accumulation. The option to excavate sediment would also disturb the floodplain upstream of the dam, the substrate of waters of the U.S., and the associated established vegetation on an annual basis increasing adverse environmental impacts to resources (waters of the U.S., vegetation, erosion, surface water quality, floodplains, N&I weeds, visual resources). Based on the analysis, it was determined that sizing the dam to provide 100 years of sediment storage provided the best option to optimize economic benefits and reduce environmental impacts.

Modifications along approximately 12,540 linear feet of Gould Wash channel through Hurricane City would be required which includes constructing an engineered flood wall (9 feet tall) along approximately 3,200 linear feet and placing riprap on channel banks along approximately 9,340 linear feet. Recontouring along Gould Wash through Hurricane City would be performed as needed along the riprap bank sections to maintain a 30-foot-wide bottom width and 2:1 side slopes. The riprap would be covered with sediment excavated from the channel banks during construction, to match the look (color/texture) and characteristics of the existing Gould Wash channel banks. Channel improvements are depicted in Figure 4-6. Cross sections of the engineered flood wall and riprap channel are provided in Figure 4-7 and Figure 4-8.

To maintain the same ephemeral stream function for water infiltration, the channel bottom would be left open along the entire modified length, but would require grouted rock boulder grade control structures to prevent head cutting. The spacing of grade control structures would be the same as described for the 8,820 cfs alternative in Section 4.2.2.1.

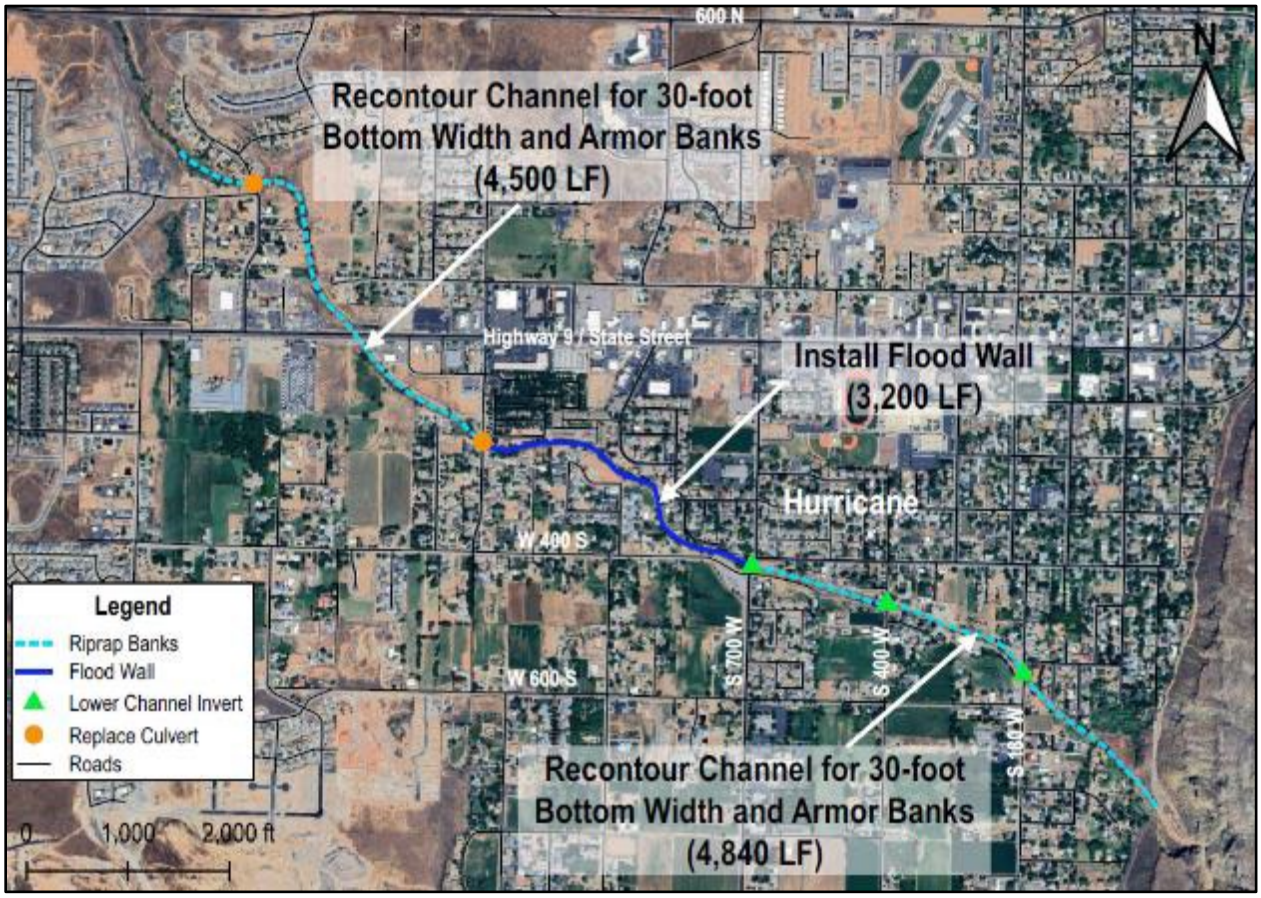

Figure 4-6. Gould Wash Channel Improvements for 3,000 cfs

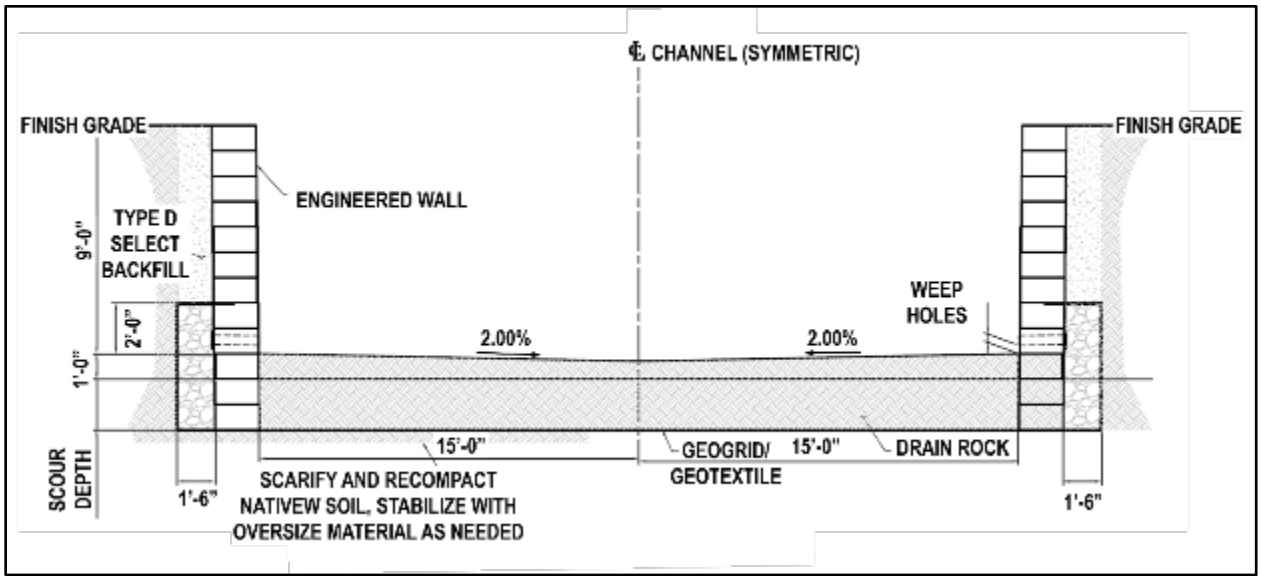

Figure 4-7. Flood Wall Cross Section (3,000 cfs)

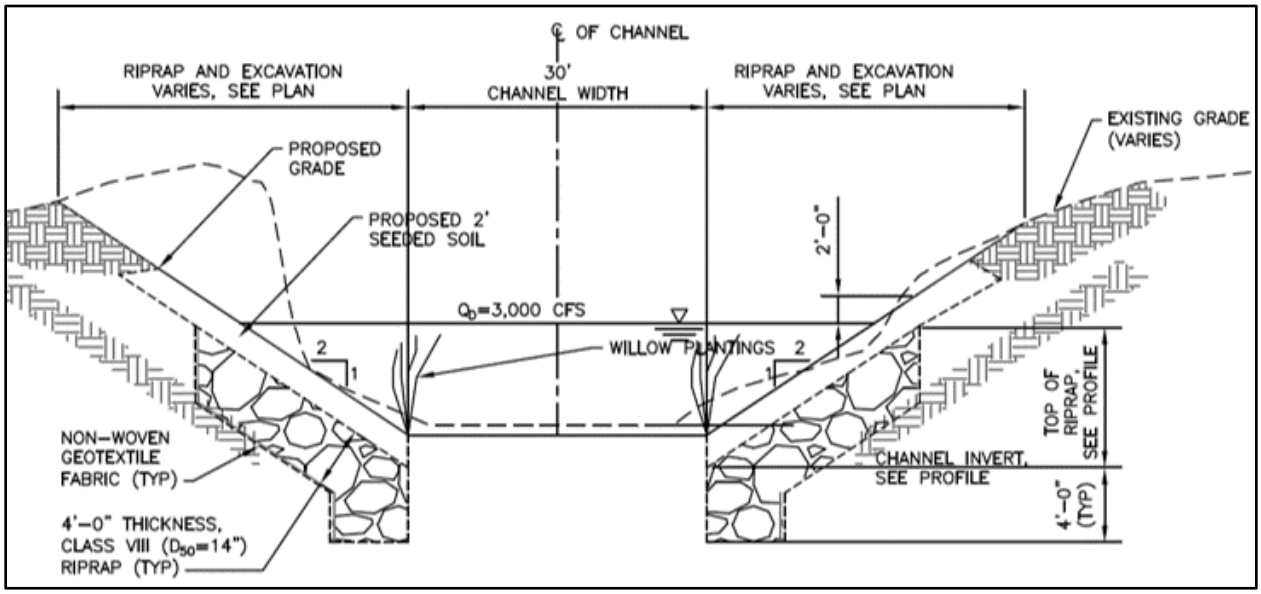

Figure 4-8. Riprap Channel Cross Section (3,000 cfs)

Five road crossings along the channel through Hurricane City would need to be modified to pass 3,000 cfs. A summary of the culvert and bridge improvements is provided in Table 4-3.

Table 4-3. Culvert and Bridge Improvements 3,000 cfs

Location	Structure Type	Proposed Improvement
1580 W	Culvert	Replace existing culvert with (2) 14-foot-wide by 10-foot-tall box culverts
1150 W	Culvert	Replace existing culvert with (2) 14-foot-wide by 10-foot-tall box culverts
700 W	Bridge	Lower the bottom of the channel to increase capacity under the bridge
400W	Bridge	Lower the bottom of the channel to increase capacity under the bridge
180 W	Bridge	Lower the bottom of the channel to increase capacity under the bridge

Nonstructural Flood Prevention Measures

Nonstructural flood prevention measures include purchasing easements for areas exposed to flooding and implementing building restrictions in the remaining floodplain. An easement would be acquired along the modified channel corridor through Hurricane City to protect and maintain the channel for flood conveyance (see Appendix C, Figures C11.1 through C11.3). A long-term right-of-way on BLM-managed lands would be secured for the duration of the Project life at the detention dam and for its upstream basin area (see Appendix C, Figure C11.4). The SLOs would require future development within the floodplain to construct structures above the base 100-year flood elevation. The SLOs would continue to follow the FEMA floodplain guidance and restrictions for development within SFHAs.

Construction Staging and Access

Approximately seven staging areas (Staging Area 1 through Staging Area 7) that adjoin Gould Wash through Hurricane City would be used during construction totaling 8.1 acres (Appendix B, Map B4.1). Access to the channel would be from city streets adjacent to the channel.

Access for construction of the dam would use existing paved and dirt access roads as depicted in Appendix B, Map B4.2. Improvements may be required along unpaved access road segments to accommodate heavy construction equipment. A new access road would be constructed from Gould Wash Road to the proposed dam, along both sides of the dam, and along the dam crest for construction access and left in place for permanent access to accommodate O&M requirements. Staging at the proposed dam location consists of Staging Area 8 covering approximately 11.1 acres and Staging Area 9 covering approximately 2.9 acres adjoining the proposed dam. Staging and access areas for construction of the detention dam are depicted in Appendix B, Maps B4.2 and B4.3.

Borrow Material and Disposal

All materials for channel armoring would be purchased from a permitted offsite facility or distributor. Three borrow source areas are proposed for construction of the dam embankment. These include Borrow/Disposal Area 1 covering 16.3 acres, Borrow/Disposal Area 2 covering 13.8 acres, and Borrow/Disposal Area 3 covering 128.1 acres (Appendix B, Map B4.2). However, only 40 acres of Borrow/Disposal Area 3 would be potentially mined for borrow material, but those areas would be determined during final design. Disturbance within the borrow/disposal areas would avoid sensitive features (waters of the U.S., sensitive habitat areas, cultural sites, etc.). Any excess sediment or rock that is not used for channel modification or dam construction would be disposed of within the borrow excavations to replace materials removed, or disposed of at an offsite permitted disposal location, if deemed necessary.

Revegetation

The existing banks of Gould Wash through Hurricane City consist primarily of non-native and problematic grass and weeds with scattered shrubs. After construction completion, disturbed areas along the channel and the new soil covered riprapped channel banks would be revegetated the same as described for the Alternative in Section 4.2.2.1.

Disturbed areas for construction of the dam and borrow/disposal areas would be seeded with an NRCS and BLM approved drought resistant herbaceous seed mix after construction completion.

Revegetated areas would be maintained on a regular basis to prevent the establishment of N&I plant species until areas are fully established. A PCRP would be developed and would include mechanisms for addressing weed establishment and treatment.

Real Property Rights

Temporary and permanent easements would be obtained on state, federal, and private lands as needed for alternative access and construction. Permanent easements include the modified Gould Wash channel up to the top of the proposed bank and adjoining areas for O&M access. Demolition or relocation of buildings is not anticipated for alternative measures along the channel. A long-term right-of-way would also be obtained on BLM lands for the dam and upstream dry detention basin including areas needed for O&M access. Temporary ROWs would include those for construction staging areas, temporary construction access routes, and borrow/disposal areas. Real property rights costs also include culvert replacement work identified in Table 4-3.

Schedule

These measures would be implemented over approximately 2 ½ years. Construction of the detention dam would occur first and take 18 to 24 months to complete. The channel modifications

through Hurricane City would be initiated after most of the detention dam has been constructed beginning approximately 1 ½ years into the construction schedule. Installation of the channel measures would take approximately one year to complete. There are no anticipated seasonal work restrictions, however, weather conditions in the watershed would be monitored closely during construction. If precipitation events or conditions are anticipated that could result in activation of flow in the ephemeral system, work would be stopped or avoided during those periods. Construction would be anticipated to start in spring 2027 and be completed by fall of 2029.

Costs

Installation costs for these measures are estimated at $62,677,000 and include the items broken out in Table 4-2. Costs for O&M of the dam and channel are estimated at $18,700 per year.

Table 4-4. Installation Cost

Item	Cost
Construction	$52,252,000
Engineering/Technical Assistance	$6,531,000
Permitting	$100,000
Real Property Rights	$2,488,000
Sponsor Administrative	$871,000
NRCS Administrative	$435,000
Total Installation	**$62,677,000**

4.3 Alternatives Considered but Eliminated from Detailed Study

In accordance with NEPA (40 CFR 1502.14), some initial alternatives were eliminated from further study due to exorbitant costs, logistics, environmental reasons, or other critical factors. A description of the alternatives eliminated during the screening process and the elimination justification is provided in the subsections below.

4.3.1 New Dam with Sediment Storage and 3,000 cfs Flow into Hurricane (Dam Placement Options)

This alternative consists of constructing a new dam upstream of Hurricane City along Gould Wash to decrease the maximum flood flow over Hurricane Cliffs and into Hurricane City from 8,820 cfs (100-year flood) down to approximately 3,000 cfs and provide volume for 100 years of sediment accumulation. Three dam locations were considered, but only one of these locations provides topographic conditions feasible for construction of a dam that would meet the required floodwater and 100-year sediment storage volumes. The feasible location is included in detailed analysis (see Section 4.2.2.2). The other two locations for dam placement were eliminated from further analysis because they cannot reasonably meet the required storage volumes. Additionally, sediment excavation to meet the required volumes was found to be cost prohibitive when compared to raising a dam to provide extra storage volume.

4.3.2 New Dam without Sediment Storage and 3,000 cfs Flow into Hurricane

This alternative consists of constructing a new dam upstream of Hurricane City along Gould Wash to decrease the maximum flood flow over Hurricane Cliffs and into Hurricane City from 8,820 cfs (100-year flood) down to approximately 3,000 cfs. Three possible locations for construction of a dam were analyzed and an approximate 83- to 113-foot dam height was required depending on the site for construction of the dam. Modifications to the channel through Hurricane City would also be required for this alternative to pass 3,000 cfs as described for the New Detention Dam and 3,000 cfs Channel Modifications Alternative included in detailed study.

Even though this alternative provides flood storage, it does not provide sediment storage. NRCS policy requires consideration of dam sediment provisions for the longest reasonable period practical for the evaluated life of 100-years maximum, but no less than 50-years. This would require the sponsor to excavate approximately 13 to 14.6 acre-feet (ac-ft) of sediment annually (range depends on site location for dam) from the basin upstream of the dam. Annual sediment excavation costs were estimated between $314,000 to $353,000. This would be approximately $21,400,000 to $35,300,000 over a 100-year life. The Sponsor would not be able to fund the estimated sediment excavation costs required for this alternative and the additional O&M costs would result in negative economic benefits. Additionally, sediment excavation costs were determined cost prohibitive compared to increasing the dam capacity to accommodate sediment storage. Therefore, an alternative for construction of a dam with no sediment storage was eliminated from further study.

4.3.3 New Multiple Dams in Series

This alternative consists of constructing two new dams in series upstream of Hurricane City along Gould Wash to decrease the maximum flood flow over Hurricane Cliffs and into Hurricane City from 8,820 cfs (100-year flood) down to approximately 3,000 cfs. The dams would provide storage to accommodate 100 years of sediment accumulation. The same modifications to Gould Wash through Hurricane City would be required as those described for the New Detention Dam and 3,000 cfs Channel Modifications Alternative included in detailed study. The engineering analysis concluded that one approximately 65.5-foot-tall dam and one approximately 110.4-foot-tall dam in series would be required. Overall reduction of decrease in dam height was insignificant at less than two vertical feet of reduction of dam height compared to construction one dam at either dam in series location. The cost and disturbance associated with construction of two dams would be doubled for this alternative with no added benefit when compared to the other alternatives considered in detail. This would result in a negative economic benefit and increased environmental impacts compared to other alternatives. Therefore, this alternative was eliminated from further study.

4.3.4 Land Acquisition/Easement for Existing 100-Year Floodplain (Nonstructural Alternative)

This alternative would establish a flood easement for the 100-year floodplain and require acquisition of private lands in Hurricane City. Approximately 651 acres of private lands containing 650 residents, 99 commercial businesses/offices, and 7 other community structures (churches, post office, restroom) are located within the 100-year flood inundation area that would need to be purchased. All structures would need to be demolished, utilities relocated, roads removed, etc.

and the land returned to a natural state. Costs were estimated and averaged per structure type and the total cost for purchase of structures/properties were calculated at approximately $243,480,000. Costs do not include demolition of structures, relocation of roads/utilities, restoration of the land, etc. Based on the exorbitant costs, negative economic benefit, and significant environmental impacts to families/businesses occupying the structures, this alternative was eliminated from further study.

4.3.5 New Dam and Land Acquisition/Easement for Remaining 100-Year Floodplain (Structural and Nonstructural Combo)

A new earthen dam would be constructed upstream of Hurricane City along Gould Wash as described for the New Detention Dam and 3,000 cfs Channel Modifications Alternative included in detailed study. Due to unique site conditions and highly erosive soils (see Sections 2.1.3 and 3.2.1), channel bank armoring would still be required along the Gould Wash channel through Hurricane City to safely pass the 3,000 cfs design flow. Nonstructural measures to ensure bank stability are not feasible based on these unique site conditions. Therefore, this alternative was eliminated from further study.

4.3.6 Natural Channel Alternative for 8,820 cfs Flow Through Hurricane

A more natural flow channel would be constructed through Hurricane City to safely convey the 100-year flood flow of 8,820 cfs by widening the channel along approximately 13,100 linear feet (approximately 2.5 miles). The channel would be widened to approximately 400 feet wide along the 13,100 linear foot section. The new flood corridor would consist of a low flow channel and floodplain bench. Creating the new channel and floodplain would require substantial excavation of material. Due to the presence of highly erodible soil, armoring along channel banks would still be required to be safely engineered. A flood easement for the 100-year new floodplain and channel requires acquisition of private lands at an estimated cost of $142,300,000 that would be borne by the Sponsor. All structures along the new corridor would be demolished and utilities relocated. Seven new bridges would also be constructed across the new channel to maintain existing public access. Installation costs were approximated at $192,300,000. This alternative was eliminated from detailed study due to exorbitant costs, negative economic benefit, lack of meeting a “natural channel” design due to required armoring, and significant environmental impacts to families/businesses occupying the properties containing structures within the new flood corridor.

4.3.7 New Dam and Natural Channel Alternative 5,500 cfs Through Hurricane

A dam would be constructed upstream of Hurricane City to decrease the maximum flood flow over Hurricane Cliffs and into Hurricane City from 8,820 cfs (100-year flood) down to approximately 5,500 cfs. A more natural flow channel would be constructed through Hurricane City to safely convey the 100-year flood flow of 5,500 cfs by widening the channel along approximately 13,100 linear feet (approximately 2.5 miles). The channel would be widened to approximately 300 feet wide along the 13,100 linear foot section. The new flood corridor would consist of a low flow channel and floodplain bench. Creating the new channel and floodplain would require substantial excavation of material. Due to the presence of highly erodible soil, armoring along channel banks would still be required to be safely engineered. A flood easement for the 100-year new floodplain and channel requires acquisition of private lands at an estimated cost of $112,350,000 that would

be borne by the Sponsor. All structures along the new corridor would be demolished and utilities relocated. Five new bridges would also be constructed across the new channel to maintain existing public access. Installation costs were approximated at $158,350,000. This alternative was eliminated from detailed study due to exorbitant costs, negative economic benefit, lack of meeting a “natural channel” design due to required armoring, and significant environmental impacts to families/businesses occupying the properties containing structures within the new flood corridor.

4.3.8 New Dam and Natural Channel Alternative 3,000 cfs

A new earthen dam would be constructed upstream of Hurricane City along Gould Wash as described for the New Detention Dam and 3,000 cfs Channel Modifications Alternative included in detailed study. A natural flow channel would be constructed through Hurricane City to safely convey the 100-year flood flow of 3,000 cfs by widening the channel (200 feet wide) along approximately 13,100 linear feet. The new flood corridor would consist of a low flow channel and floodplain bench. To accomplish this, significant amounts of fill would be placed in the existing channel and a new meandering low flow path constructed. The new channel configuration would reduce velocities at a 100-year flood down to 3.5 to 6.5 ft/s. Soils along Gould Wash through Hurricane City are noncolloidal sand/loam/silt/silty loam, which water velocities above 1.5 to 2.25 ft/s would cause bank erosion issues. Due to high erosivity potential of the soils along the channel alignment, armoring would still be required along segments to be safely engineered. Therefore, natural unarmored channel banks are not a feasible option for this alternative.

An easement would be acquired on state, city, and private land to include the modified Gould Wash channel up to the top of the proposed bank and permanent access for O&M. All structures along the corridor would be demolished and utilities relocated. Five new bridges would also be reconstructed across the new channel to maintain existing public access.

Installation costs were approximated at $127,973,000 ($57,452,000 construction], $7,182,000 [engineering], $100,000 [permitting], $2,437,000 [Administrative], and $60,802,000 [real property rights]).

The cost to install this alternative was determined to be exorbitant and would exceed the benefits resulting in a negative economic benefit. The alternative was unsuccessful at accomplishing a natural channel design, as armoring would still be required. It would have adverse impacts to the community from displacement of families/businesses and from extensive modification of city infrastructure/utilities, which is anticipated to cause political unrest. The alternative would substantially modify the existing ephemeral system by widening the channel 6 to 7 times its current width which would substantially change how the current system operates. Additionally, the existing channel would be filled to create the new channel configuration that would substantially modify existing waters of the U.S. For these reasons, this alternative was eliminated from detailed study.

4.3.9 New Dam and Increase Channel Capacity 5,500 cfs

A dam would be constructed upstream of Hurricane City to decrease the maximum flood flow over Hurricane Cliffs and into Hurricane City from 8,820 cfs (100-year flood) down to approximately 5,500 cfs. Modifications along approximately 13,100 linear feet of Gould Wash through Hurricane City would be required to increase the channel capacity to 5,500 cfs. This includes widening and armoring the channel along 13,100 linear feet with concrete and riprap, upsizing/replacing culverts

and bridges at 5 road crossings, and acquiring lands within the new channel extents. This alternative was eliminated from detailed study due to negative economic benefit and increased environmental impacts while providing no additional benefits when compared to alternatives included in detailed study.

4.3.10 New Dam and Increase Channel Capacity 3,000 cfs (Full Channel Armoring)

A dam would be constructed upstream of Hurricane City to decrease the maximum flood flow over Hurricane Cliffs and into Hurricane City from 8,820 cfs (100-year flood) down to approximately 3,000 cfs. Modifications along approximately 12,540 linear feet of Gould Wash through Hurricane City would be required to increase the channel capacity to 3,000 cfs. This includes widening and armoring the channel along 13,100 linear feet with concrete and riprap, upsizing/replacing culverts and bridges at 5 road crossings, and acquiring lands within the new channel extents. Riprap armoring would cover the channel banks and the channel bottom as well as the concrete section to avoid channel headcutting. This alternative modifies water seepage conditions along the channel bottom and would require mitigation measures for impacts to waters of the U.S. This alternative was eliminated from detailed study due to increased adverse environmental impacts to waters of the U.S. while providing no additional benefits when compared to alternatives included in detailed study.

4.3.11 New Dam and Increase Channel Capacity 8,820 cfs (Full Channel Armoring)

Modifications along approximately 13,100 linear feet of Gould Wash through Hurricane City would be required to increase the channel capacity to 8,820 cfs. This includes widening and armoring the channel along 13,100 linear feet with concrete and riprap, upsizing/replacing culverts and bridges at 7 road crossings, and acquiring lands within the new channel extents. Riprap armoring would cover the channel banks and the channel bottom as well as the concrete section to avoid channel headcutting. This alternative modifies water seepage conditions along the channel bottom and would require mitigation measures for impacts to waters of the U.S. This alternative was eliminated from detailed study due to increased adverse environmental impacts to waters of the U.S. while providing no additional benefits when compared to alternatives included in detailed study.

4.3.12 Improve Existing Ponds/Detention Basins Upstream

This alternative would look at improving existing ponds and detention basins within the upstream drainage area to reduce flows produced during a 100-year flood. The alternative was suggested during the Project scoping meeting and existing pond/detention basin locations were identified on aerial imagery by public attendees of the meeting. A total of 12 ponds were identified with a combined volume calculated at approximately 78 ac-ft. Modeling was performed using HEC-HMS for the 100-year flood and resulted in a peak flow reduction of approximately 80 cfs, or 0.9 percent of the total 100-year peak flow. Based on the engineering analysis, the existing ponds would not be capable of any significant reduction of peak flood flows into Hurricane City during a 100-year flood. Therefore, the alternative is not capable of meeting the purpose and need and was eliminated from further study.

4.3.13 Reduce Gould Wash Flows Through Hurricane Below 3,000 cfs

Decreasing peak flows through Hurricane City to less than 3,000 cfs during a 100-year flood were evaluated in attempt to reduce impacts to Gould Wash from concrete and riprap measures, and to determine if flows could be reduced enough to allow feasible options for construction of a more natural channel configuration. Various methods were looked at including construction of a dam, construction of multiple dams, terracing, using/improving existing ponds/detention basins, and a combination of these items. During the engineering analysis it was determined that 3,000 cfs is the lowest reasonable reduction in flow that could be achieved through Hurricane City. This is due primarily to flows from the uncontrolled drainage area downstream of feasible proposed dam locations, combined with stormwater runoff from Hurricane City producing a peak flow of approximately 3,000 cfs. This alternative was determined to be infeasible and was eliminated from further study.

4.3.14 Land Terracing Alternative

This alternative includes terracing areas of the upper watershed to spread out flows and decrease the peak flood flow entering Hurricane City at a 100-year flood down to 3,000 cfs. To accomplish this, approximately 3,584 acres (5.6 square miles) of land would have to be graded with terraces at a spacing of 100 feet. The upstream drainage area is owned by a mixture of landowners including federal, state, and private. Obtaining approvals or acquiring lands to install land terracing on 3,584 acres of land is infeasible. Additionally, disturbance to 3,584 acres of land would have significant adverse impacts to soil, vegetation, animals, and water resources. Therefore, this alternative was eliminated from further study.

4.3.15 Terrace and Construct Dam Alternative

This alternative consists of construction of a dam in combination with terracing downstream of the dam to reduce peak flows during a 100-year flood down to 3,000 cfs over the Hurricane Cliffs. To accomplish this, approximately 553 acres (0.86 square miles) of land would have to be graded with terraces. Modification to the channel through Hurricane City would be made to accommodate a flow of 3,000 cfs. Disturbance of an additional 553 acres above what is already being disturbed for construction of the dam and channel would have significant adverse impacts to soil, vegetation, animals, and water resources. Additionally, it is not feasible that approval or acquisition of land to install the measures could be obtained. Therefore, this alternative was eliminated from further study.

4.3.16 Seeding Alternative (Nonstructural)

Seeding in the upstream drainage area was looked at to reduce the amount of stormwater runoff and sediment erosion into Gould Wash. The drainage area of Gould Wash covers approximately 64.5 square miles and is within the northeastern-most region of the Mojave Desert with unpredictable and infrequent precipitation. Additionally, most of the watershed is undeveloped (approximately 99 percent) with very limited irrigation water availability or accessibility. Establishment of herbaceous vegetation is not anticipated to be successful in this arid region. This alternative was determined to be infeasible and was eliminated from further study.

4.4 Final Array of Alternatives

Eighteen Action Alternatives were explored during the scoping process including nonstructural alternatives. In accordance with NEPA (40 CFR 1502.14), some initial alternatives were eliminated from further analysis due to exorbitant costs, logistics, environmental reasons, or other critical factors (see Section 4.3).

Alternatives were screened at two levels to determine feasibility of implementing alternative measures. The first level of alternative screening consisted of a practicability test screened against: 1) ability to meet the purpose and need of the Project; 2) ability to meet a positive economic benefit and/or provide sufficient positive environmental or social effects required for NRCS flood prevention project approval; 3) land acquisition feasibility; 4) logistics; 5) existing technology; and 6) exorbitant costs. Refer to the PR&G Analysis Report included in Appendix E for further information.

Alternatives determined to be practicable from the first level of screening were next compared with their impacts to waters of the U.S. In accordance with the Guidelines at 40 CFR 230.10(a), a 404 permit cannot be issued if a practicable alternative exists that would have less adverse impact on the aquatic ecosystem (known as the LEDPA). Therefore, alternatives that met the initial feasibility screening criteria but were easily determined to have more adverse impacts to waters of the U.S., were determined infeasible and were eliminated from further study, since they could not be permitted under Section 404 of the CWA. The PR&G Analysis provided in Appendix E includes the initial screening process, screening tables, and conclusions.

The feasible alternatives determined from the screening process were carried forward in detailed study. These include the Increase Channel Capacity through Hurricane for 8,820 cfs Alternative and the New Dam and 3,000 cfs Channel Modifications Alternatives (see Section 4.2.2). The No Action alternative is also required to be evaluated in the Plan-EIS to provide a baseline comparison. An Ecosystem Services Tradeoff Analysis was completed for the alternative carried forward in detailed study (Appendix E). The analysis included identification of the locally preferred, nonstructural, environmentally preferred, maximum net monetized benefits plan, socially preferred, and NRCS preferred alternatives included in detail study for the Project. It also included comparing guiding principles, ecosystem service benefits, and economic analysis to determine the alternative that provides the greatest economic, environmental, and social effects to support selection of the NRCS preferred alternative.

4.4.1 Design Considerations to Reduce Resource Impacts

Action Alternatives were modified as needed to avoid impacts to resources where reasonable and minimize impacts to resources when they could not be avoided. By incorporating the avoidance and minimization measures, the Action Alternatives do not require mitigation for resource impacts. The specific alternative modifications to reduce impacts to the environment are described for each Action Alternative below.

4.4.1.1 Increase Channel Capacity through Hurricane for 8,820 cfs Alternative

Since the Gould Wash Channel through Hurricane City does not have capacity to convey the 100-year design flow of 8,820 cfs, this alternative requires more extensive modifications to the channel. Modifications along approximately 5,510 linear feet would include channel widening while maintaining consistently sloped banks, ensuring a proper channel gradient is maintained,

and armoring the banks. Modifications along 7,590 linear feet would consist of widening and installing a floodwall.

The design was adjusted to maintain a natural open channel bottom through modified segments of Gould Wash through Hurricane City in coordination with USACE and EPA, to allow Gould Wash to maintain its natural stream function. Along the 5,510 linear foot segments, placement of native material over riprap channel banks was incorporated to maintain the existing look, feel, and function of the channel banks, along with revegetation. A trapezoidal channel design was used for riprap bank armored segments to best mimic a natural channel configuration. A low flow channel was not incorporated into the design based on past project experience for ephemeral systems in Washington County, which have shown better results by allowing the low flow channel to form naturally. Willow plantings would be placed at the base of the channel banks and an herbaceous riparian seed mix placed on the channel bottom where hydrologic conditions are present that could support such vegetation for maintaining existing channel functions.

A floodwall was incorporated in the alternative design in place of a concrete channel per recommendations from the EPA on providing a more aesthetically pleasing look and maintaining an open channel bottom. Where floodwall placement is required along approximately 7,590 linear feet of channel banks through Hurricane City, vegetation was incorporated into the floodwall design as recommended by the USACE to maintain vegetative cover. An herbaceous riparian seed mix can be placed on the channel bottom where hydrologic conditions are present that could support such vegetation for maintaining existing channel functions.

The measures incorporate BMPs during construction to: prevent and control soil erosion; prevent the spread of N&I plant species; minimize fugitive dust, MSAT, and GHG emissions; protect water quality; avoid impacts to migratory birds, bald/golden eagles, BLM sensitive species, and SGCN through preconstruction surveys; and to reduce construction noise. Disturbance extents were not able to avoid impacting desert tortoise designated critical habitat, so minimization measures to reduce impacts to desert tortoise and critical habitat were implemented. The alternative avoids disturbance to cultural sites eligible for listing in the NRHP and recreation trails. Disturbed areas would be restored and stabilized after construction completion as well as be monitored/controlled for N&I plants. A detailed description of the BMPs and restoration measures for each resource are described in detail in Section 5.0.

4.4.1.2 New Dam and 3,000 cfs Channel Modifications Alternative

The dam was designed to maintain the natural Gould Wash flow condition to the greatest extent possible by allowing a straight pass-through flow for all floodwater produced from storm events up to about a 10-year storm. The dam traps sediment to help replace the lost sediment trapping function in the developed alluvial flat in Hurricane City that would no longer be flooded after installation of alternative measures. The dam reduces peak flood flows into Hurricane City, substantially reducing the amount of channel modifications needed along Gould Wash through the city to convey flood flows. Construction of the dam relocates the floodplain from a developed area that adversely impacts ecological floodplain functions to a natural area upstream capable of providing beneficial ecological and hydrological floodplain functions for the ephemeral system.

Since most of the existing channel has the capacity to convey the proposed 3,000 cfs 100-year design flow, channel modifications are minimized. Modifications along approximately 9,340 linear feet of the channel would include maintaining consistently sloped banks for a trapezoidal channel,

ensuring a proper channel gradient is maintained, and armoring the banks. A floodwall would be installed along approximately 3,200 linear feet. The same design components for the riprap banks, floodwall, and vegetation plantings/seeding as described for the other Action Alternative would also be used for this alternative to maintain the natural channel functions.

The measures incorporate the same BMPs during construction as described for the other Action Alternative with additional modifications to the disturbance footprint to avoid impacting ESA plant and animal species. The alternative also avoids disturbance in desert tortoise critical habitat.

5.0 Environmental Consequences

The final array of alternatives was evaluated to compare the economic, environmental, and social effects that may result from each alternative. The final array of alternatives includes the No Action Alternative and the Action Alternatives (Increase Channel Capacity Through Hurricane for 8,820 cfs Alternative and New Detention Dam and 3,000 cfs Channel Modifications Alternative).

This section describes the potential effects of the alternatives within each resource category as defined in Section 3.0. Ecosystem service categories overlap with the resource concerns and therefore, are not discussed separately from the resource concerns. For reference, the ecosystem service categories relevant to this Project and the applicable resource concerns that discuss these categories are provided in Table 3-2 of Section 3.1. A summary and comparison of resource concerns for alternatives is provided at the end of this section in Table 5-18. Even though ecosystem services are incorporated as applicable into each relevant resource effect discussion, they are broken out separately at the end of this section in Table 5-19 to identify the ecosystem services tradeoffs between alternatives. Refer also to the Ecosystem Services Tradeoff Analysis Evaluation Table included in Appendix E that was performed for alternatives included in detailed study.

The following lists the specific terminology used to describe impacts associated with alternative measures:

Type

- Direct Effect: Impacts caused by a proposed action and occurring at the same time and place.
- Indirect Effect: Impacts caused by an action that are later in time or farther removed in distance but are still reasonably foreseeable.
- Cumulative Effect: The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person is undertaking such other action.

Duration

- Temporary and Permanent Impacts: Temporary impacts are impacts that are not lasting and the affected resource will return or be restored to its previous (pre-project) state. Permanent impacts are those in which the affected resource will not return to its previous state within one’s lifetime.
- Short- and Long-Term Impacts: Short-term impacts are those that last through the duration of construction and shortly after (duration of impact is approximately 3 to 4 years). Long-term impacts are those that last for an extended duration of time. For this evaluation, long-term impacts extend beyond year 4 up to the end of the 100-year Project life.

Intensity

- No Impact – Resource conditions would not change.
- Negligible – Resource condition changes would be so slight there would no measurable or perceptible consequence to the resource.
- Minor – A small measurable effect to the resource, but localized, small, and of little consequence to the resource. Mitigation measures, if needed to offset adverse effects, would be easily implemented and successful based on knowledge and experience.
- Moderate – A measurable effect to the resource from the alternative actions. Mitigation measures would likely be needed to offset adverse effects and could be extensive, moderately complicated to implement, and probably successful based on knowledge and experience.
- Substantial – A large, measurable effect to the resource from the alternative actions. Mitigation measures would be needed to offset adverse effects and could be extensive and complicated to implement.

5.1 Upland Erosion

Refer to Section 3.2.1 for existing upland erosion conditions within the area of potential impact.

5.1.1 No Action Alternative

Upland erosion conditions would not change from existing conditions and erosion would continue at the same rate it has historically occurred. No measurable impacts are anticipated from continuation of O&M activities.

5.1.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

Direct minor impacts during construction in disturbed areas are anticipated until ground cover becomes established or until the areas are stabilized. Areas disturbed during construction activities would have a short-term increased potential for erosion. This includes 52.7 acres of land along and adjoining Gould Wash in the western segment of the Project area. Proper BMPs would be installed during and after construction to offset impacts that would help prevent and control soil erosion, such as, but not limited to, silt fences, fiber wattles, and/or earthen berms. A Storm Water Pollution Prevention Plan (SWPPP) would be implemented that contains erosion and sediment control BMPs (refer to Section 5.4.2). After construction completion, disturbed areas susceptible to erosion would be restored through establishment of ground cover and/or stabilized as appropriate. Refer to Section 5.9.2 regarding vegetation restoration. With implementation of BMPs and restoration/stabilization measures, these direct short-term impacts would be minor. No measurable direct long-term impacts to upland erosion are anticipated from installation of alternative measures based on revegetation and stabilization measures.

Indirect adverse impacts of increased channel erosion potential are expected during future flood events. Water volumes would be substantially increased in the modified channel segment and downstream of the modified channel segment during passage of future large flood events (see Table 5-1 of Section 5.5.2). The increased volume of water would result in greater depths and velocities of flood flows downstream of the modified channel segment. This would have adverse indirect impacts of increased erosion potential to the downstream channel and receiving waters of the Virgin River at the Gould Wash confluence over the long term. However, the erosion of

Gould Wash at the Virgin River confluence is negligible in comparison to the erosion caused by flood flows from the Virgin River. Therefore, measurable adverse erosion impacts are only anticipated for Gould Wash downstream of the channel improvements. These impacts would be minor because the Gould Wash channel downstream of the channel improvements is cut through basalt bedrock that is not easily eroded.

Continued O&M activities would occur to maintain the modified Gould Wash channel. These activities are not anticipated to have measurable impacts to upland erosion because the alternative measures incorporate appropriate stabilized O&M access and channel stabilization features.

5.1.3 New Detention Dam and 3,000 cfs Channel Modifications

Direct minor impacts during construction in disturbed areas are anticipated until ground cover becomes established or until the areas are stabilized. Areas disturbed during construction activities would have a short-term increased potential for erosion. This includes approximately 44.2 acres of land disturbed in the western segment of the Project area and approximately 113.1 acres of land disturbed in the eastern segment. The same BMPs would be installed during and after construction to offset impacts as described for the alternative in Section 5.1.2 above. With implementation of BMPs and restoration/stabilization measures, these direct impacts would be minor. No measurable direct long-term impacts to upland erosion are anticipated from installation of alternative measures based on revegetation and stabilization measures.

Indirect beneficial impacts of decreased channel erosion are expected during future flood events. For most flood events, changes in flow volume through Gould Wash channel are negligible. For less frequent larger flood events, flow volume through Gould Wash is reduced through Hurricane City, which allows for safe conveyance of these flows through the channel. However, downstream of Hurricane City from 600 N to the Virgin River, changes in flood volumes range from negligible to a minor decrease (see Table 5-2 in Section 5.5.3). These changes are anticipated to have indirect beneficial impacts of decreased erosion potential to the downstream channel and receiving waters of the Virgin River. These impacts would be minor because the Gould Wash channel downstream of the channel improvements is cut through basalt bedrock that is not easily eroded

Continued O&M activities would occur to maintain the modified Gould Wash channel and new upstream detention dam. These activities are not anticipated to have measurable impacts to upland erosion because the alternative measures incorporate appropriate stabilized O&M access and channel stabilization features.

5.2 Sedimentation

Refer to Section 3.2.2 for existing sedimentation conditions within the area of potential impact and Appendix D for alternative sedimentation calculations.

5.2.1 No Action Alternative

Sedimentation conditions and sediment transport through Gould Wash to the Virgin River would not change from existing conditions and would continue at the same rate it has historically occurred, estimated at 14.9 ac-ft annually. Sediment would continue to deposit in the developed areas of Hurricane City at an estimated 9.4 ac-ft annually from storm events large enough to

overtop the Gould Wash channel through Hurricane City (refer to Section 3.1 of Appendix D). This sediment deposition would have moderate long-term indirect adverse impacts to the developed areas of Hurricane City that are located within the floodplain and exposed to future flooding.

Hurricane City would continue to conduct regular sediment removal O&M activities along approximately 12,540 linear feet to maintain the existing channel capacities of Gould Wash through Hurricane City over the long term.

5.2.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

Alternative measures would remove the 100-year Gould Wash floodplain in Hurricane City and reduce the 500-year floodplain by approximately 685.1 acres. This is anticipated to reduce the sediment deposition within the developed areas of Hurricane City by 9.4 ac-ft annually. However, this would increase the amount of sediment transported through Gould Wash to the Virgin River by 9.4 ac-ft annually. The developed areas of Hurricane City within the Gould Wash floodplain would have a long-term moderate indirect benefit of reduced sedimentation during future flooding. A long-term indirect adverse impact to the Virgin River would occur from an increase by 2% in sediment load at its confluence with Gould Wash (refer to Section 3.2.2 of Appendix D for sediment load calculations). The Virgin River experiences large fluctuations in sediment load depending on precipitation events in the Virgin River drainage area. The indirect impact to the Virgin River is anticipated to be negligible when considering the small change, the large and highly variable sediment loads in the Virgin River, and infrequent occurrence of flow in Gould Wash. The negligible impact decreases in the downstream direction as the Virgin River drainage area increases.

The O&M activities for the installed measures would remove sediment as necessary to maintain the channel capacity. With more sediment load in the channel, sediment removal activities in Gould Wash through Hurricane City may be performed more frequently than those conducted under the No Action Alternative.

5.2.3 New Detention Dam and 3,000 cfs Channel Modifications

This alternative would remove the Gould Wash 100-year floodplain in Hurricane City and reduce the 500-year floodplain by 685.1 acres. The developed areas of Hurricane City within the Gould Wash floodplain would have long-term moderate indirect benefits of reduced sedimentation during future flooding. The floodplain in Hurricane City would be transferred to the upstream dam detention basin, which would also transfer the sediment trapping benefit on the Hurricane City alluvial flat to the detention basin. The new upstream detention basin is estimated to trap 11.5 ac-ft of sediment annually. This is anticipated to reduce the sediment deposition within the developed areas of Hurricane City by 11.5 ac-ft annually. It could decrease the amount of sediment transported through Gould Wash to the Virgin River by up to 2.1 ac-ft annually. This change in sediment transport to the Gould Wash-Virgin River confluence is determined to be negligible at 0.6 percent and is within the level of error of calculations. Therefore, the transfer of sediment capture from the developed Hurricane City alluvial flat to the proposed detention basin is not expected to result in a measurable net change of sediment reaching the confluence (refer to Section 3.2.1 of Appendix D for sediment load calculations).

The O&M activities for the installed measures would be to manually remove sediment around the dam's principal spillway as needed to maintain operation of the spillway system. Less sediment

load in Gould Wash downstream of the dam would decrease the frequency of sediment removal activities needed through the channel in Hurricane City.

5.3 Prime and Unique Farmland

The Project contains prime farmland and farmland of statewide importance in the western segment of the Project area, but none is present in the eastern segment. Refer to Section 3.2.3 for a description of existing farmland of statewide importance within the area of potential impact.

5.3.1 No Action Alternative

There would be no change from existing conditions and no disturbance above what is currently experienced would occur on soil designated as “prime farmland” or “farmland of statewide importance.” The future risk of flooding to Hurricane City would remain that would have an indirect adverse impact to approximately 177.26 acres of soils classified as “prime farmland if irrigated” and 1.24 acres of soils classified as “farmland of statewide importance.”

5.3.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

Temporary disturbance would occur on 3.66 acres of soil classified as “prime farmland if irrigated” during construction in the western segment of the Project area (see Appendix C, Map C1.1). These consist of construction equipment driving or parking on the soils. The direct short-term impacts during construction would be minor and these areas would be restored after construction completion. No long-term direct impacts to these soils are anticipated.

The future risk of flooding to Hurricane City would be removed for all floods up to and including the 100-year flood and would be substantially reduced for the 500-year flood. This decreases flood damage to approximately 177.26 acres of soil classified as “prime farmland if irrigated” and 1.24 acres of soil classified as “farmland of statewide importance” in the benefited area (see Appendix C, Map C1.1). An indirect long-term moderate benefit to production on these prime and unique farmlands is anticipated.

No measurable impacts to prime farmland soils would occur from O&M activities for the installed measures because none are located within areas proposed for O&M.

5.3.3 New Detention Dam and 3,000 cfs Channel Modifications

Temporary impacts during construction to 3.66 acres of soils classified as “prime farmland if irrigated” would occur the same as described for the alternative in Section 5.3.2 above. The indirect benefits to 177.26 acres of soil classified as “prime farmland if irrigated” and 1.24 acres of soil classified as “farmland of statewide importance” would also be the same. No impacts to prime and unique farmlands are anticipated in the eastern segment of the Project area because none are present. No measurable impacts to prime farmland soils would occur from O&M activities for the installed measures because none are located within areas proposed for O&M.

5.4 Surface Water Quality

Refer to Section 3.2.4 for existing surface water quality conditions within the area of potential impact.

5.4.1 No Action Alternative

There would be no measurable change to surface water quality conditions from the continued O&M activities. Potential introduction of contaminants from future overland flooding of developed areas would pose an indirect adverse threat to the water quality of the Virgin River and Virgin River AU2 over the long term, including downstream water uses. However, estimating the intensity of the impact is not reasonable based on several unpredictable factors.

5.4.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

Disturbance to approximately 52.7 acres of land would occur in and near Gould Wash during construction, but these areas would be stabilized and restored after construction completion. The Project area currently contains an abundance of loose noncohesive soils that are easily eroded and transported downstream during storm events. The additional amount of loose soil from construction disturbance would represent a negligible portion (0.1%) of the soil surface area in the Gould Wash drainage that contribute to sediment transported downstream during storm events. No permanent surface waters are present and dewatering activities would not be required due to lack of shallow groundwater. The Gould Wash channel is dry under normal conditions and based on elimination of irrigation return flows proposed prior to the start of construction, surface water is only anticipated to be present following a large precipitation event and only for a short duration of time. Precipitation events would be monitored during construction and work within the channel would be halted during such an event. Based on the normally dry condition of the channel, implementation of the BMPs listed below, restoration of disturbed areas, minimal area contributing to sediment in Gould Wash of 0.1%, and avoiding work in the channel during precipitation events, construction activities are anticipated to have negligible direct impacts on surface water quality.

Project design elements, including required BMPs, would be implemented to reduce the quantity of sediment (1) entering drainages, and (2) flowing downstream and violating any federal or state water quality rules and regulations. This alternative would also meet Utah antidegradation requirements. Construction BMPs would include, but are not limited to, the following:

- A Storm Water Pollution Prevention Plan (SWPPP) would be required and implemented that contains erosion and sediment control and pollution prevention BMPs, such as, but not limited to, silt fences, fiber wattles, and/or earthen berms.
- Water bodies adjacent to construction and staging areas would be identified, and such measures as straw bales, silt fences, and other appropriate sediment control BMPs would be implemented to prevent the entry of sediment and other contaminants into waters.
- To ensure that accidental spills do not enter waters, the storage of petroleum-based fuels and the refueling of construction machinery would not occur outside of approved designated staging/batch plant areas. Furthermore, the alternative would comply with state and federal water quality standards and toxic effluent standards to minimize any potential adverse impacts from discharges to waters of the U.S.
- No construction materials would be stockpiled or deposited in or near any water bodies.

Alternative measures remove the floodplain in Hurricane City, reducing the potential for contamination in floodwater that could occur from future overland flooding of developed areas during large flood events. This would have an indirect benefit to the water quality of the Virgin River and downstream water uses over the long term. However, estimating the intensity of the impact is not reasonable based on several unpredictable factors.

Removal of the floodplain would result in more sediment being transported downstream. Based on a sedimentation analysis conducted (refer to Section 5.2.2), this alternative would increase the amount of sediment reaching the Virgin River by approximately 9.5 ac-ft per year. Additional sediment input into surface water has the potential to adversely impact water quality. However, the Virgin River carries large sediment loads and the 9.5 ac-ft change is negligible at 2% of the average river sediment loads (refer to Section 5.2.2). The negligible change combined with the infrequent occurrence of flow in Gould Wash and highly variable annual sediment loads in the Virgin River would result in no measurable change to annual sediment loads for the Virgin River.

Water interaction with demolished concrete or concrete rubble can impact water quality. If rain falls on improperly managed and newly crushed concrete rubble, the leachate can make receiving waters more basic and more turbid (cloudy) (Washington State Department of Ecology 2024). The project consists of constructing a concrete flood wall along approximately 7,590 linear feet of Gould Wash. The material would not be crushed and would not consist of rubble. Water interaction within the wall would be infrequent and only occur when a large storm event activates the channel. This could be a few hours to a few days annually. Based on the solid condition of the installed concrete wall and infrequent water interaction, leachate from the concrete material is not a concern and is not anticipated to have an impact on water quality of Gould Wash or the Virgin River.

5.4.3 New Detention Dam and 3,000 cfs Channel Modifications

Disturbance to approximately 155.5 acres of land would occur near and in Gould Wash and near tributaries of Goud Wash (44.2 acres in the western segment of the Project area and 111.3 acres in the eastern segment). The Project area currently contains an abundance of loose noncohesive soils that are easily eroded and transported downstream during storm events. The additional amount of loose soil from construction disturbance would represent a negligible portion (0.4%) of the soil surface area in the Gould Wash drainage that currently contribute to sediment transported downstream during storm events. Construction BMPs would be implemented as described in Section 5.4.2. Based on the normally dry condition of the channel, implementation of the BMPs listed Section 5.4.2, restoration of disturbed areas, minimal area contributing to sediment in Gould Wash of 0.4%, and avoiding work in the channel during precipitation events, construction activities are anticipated to have negligible direct impacts on surface water quality.

The alternative transfers the floodplain from the developed areas of Gould Wash to a natural undeveloped area upstream. This would reduce contamination input that would occur from future overland flooding of developed areas during a large storm event. No net change is expected for sediment delivered to the Virgin River (refer to Section 5.2.3). Therefore, an indirect benefit to water quality of the Virgin River and downstream water uses is expected over the long term from the reduction in overland flooding and associated risk of contamination to surface water. However, estimating the intensity of the impact is not reasonable based on several unpredictable factors.

The project consists of constructing a concrete flood wall along approximately 3,200 linear feet of Gould Wash. Based on the solid condition of the installed concrete wall and infrequent water interaction (a few hours to a few days per year), leachate from the concrete material is not a concern and is not anticipated to have an impact on water quality of Gould Wash or the Virgin River.

5.5 Surface Water Quantity and Flow

Refer to Section 3.2.5 for information on water quality and flow within the area of potential impact.

5.5.1 No Action Alternative

There would be no change to surface water quantities and flow for this alternative. The adverse flood flow quantities and limited Gould Wash channel conveyance capacities would remain over the long term. The Gould Wash channel through Hurricane City and associated culverts/bridges would remain at their current limited capacities. The projected increased frequency and intensity of floods would remain.

5.5.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

This alternative would increase the Gould Wash channel capacity through Hurricane City, including bridge and culvert structures, to safely pass the 100-year flood flow of 8,820 cfs. All storm events and flows less than or equal to the 100-year flood would be contained in the banks of the channel. There would be no change to water quantities, but the developed Hurricane City floodplain would be removed and flood flows contained in the channel, changing the timing for passage of flood flows through Gould Wash. This would have an indirect moderate benefit to future flood flow conditions providing better management for conveyance of flood flows through Gould Wash over the long term. The measures would also increase resilience to the projected rise in flood frequency and intensity.

Water volumes would be substantially increased in the modified channel segment and downstream of the modified channel segment during passage of future large flood events as shown in Table 5-1. The increased volume of water would result in greater depth and velocities of flood flows downstream of the modified channel segment. While the channel is capable of containing these flows, the increased water depths and velocities during future flood events could increase channel erosion as described in Section 5.1.2.

Table 5-1. Peak Flood Flow Through Hurricane City

24-Hour Storm Event	Peak Flows into Hurricane City (cfs)[1]	Peak Flows at 600 N Culvert Mouth (cfs)	
		Existing Conditions	Alternative Conditions
2-Year	852	852	852
5-Year	1,912	1,622	1,912
10-Year	3,047	2,365	3,047
25-Year	5,036	2,914	5,036
50-Year	6,896	3,591	6,896
100-Year	8,820	4,630	8,820
500-Year	15,400	4,900	8,820

Source: Calculated from NRCS HEC-RAS Model
1 – Peak flows into Hurricane City are the same between the existing condition and alternative condition.

5.5.3 New Detention Dam and 3,000 cfs Channel Modifications

This alternative would transfer the floodplain in Hurricane City upstream through construction of a new detention dam. The detention dam would be designed to have pass-through flows for an

approximate 10-year event to maintain natural flow conditions to the greatest extent reasonable. There would be no change to water quantities, but the developed Hurricane City floodplain would be transferred to the new upstream detention dam, changing the timing for passage of flood flows through Gould Wash. This would have an indirect moderate benefit to future flood flow conditions providing better management for conveyance of flood flows through Gould Wash over the long term. The measures would also increase resilience to the projected rise in flood frequency and intensity.

For most flood events, changes in flow volume through Gould Wash channel are negligible. For less frequent larger flood events, flow volume through Gould Wash is reduced through Hurricane City, which allows for safe conveyance of these flows through the channel. However, downstream of Hurricane City from 600 N to the Virgin River, changes in flood volumes range from negligible to a minor decrease. Refer to Table 5-2 for peak flood flow conditions through Hurricane City. The decreased water depths and velocities during future flood events could reduce channel erosion as described in Section 5.1.3.

Table 5-2. Peak Flood Flow Through Hurricane City

24-Hour Storm Event	Peak Flow into Hurricane City (cfs)		Peak Flow at 600 N Culvert Mouth (cfs)	
	Existing Conditions	Alternative Conditions	Existing Conditions	Alternative Conditions
2-Year	852	852	852	852
5-Year	1,912	1,912	1,622	1,912
10-Year	3,047	2,760	2,365	2,760
25-Year	5,036	2,862	2,914	2,862
50-Year	6,896	2,885	3,591	2,885
100-Year	8,820	3,000	4,630	3,000
500-Year	15,400	9,585	4,900	4,725

Source: Calculated from NRCS HEC-RAS Model

5.6 Waters of the U.S.

Refer to Section 3.2.6 for a list of all waters of the U.S. within the area of potential impact.

5.6.1 No Action Alternative

This alternative would continue to temporarily disturb waters of the U.S. for sediment and vegetation clearing along the Gould Wash channel to maintain the existing channel capacity. Minor indirect adverse impacts from future sediment removal O&M activities along approximately 12,540 linear feet of Gould Wash through Hurricane City would continue over the long term.

5.6.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

This alternative would require modifications along approximately 13,500 linear feet of Gould Wash (see Appendix C, Map C3.1) which includes excavation, grading, and bridge/culvert replacement to increase the channel capacity to 8,820 cfs. Riprap armoring would be placed on the banks of the widened channel along 5,510 linear feet and a flood wall placed along 7,590 linear feet. With a proposed open channel bottom width ranging between 30 feet and 100 feet, the bank armoring

is anticipated to be outside of the delineated OHWM, which averages approximately 25 feet wide. The channel bottom would be left open to provide the same channel function, but grade control structures would be required to maintain channel stability. To preserve the existing channel bank functions, soil would be placed over the riprap then vegetated. Vegetation would also be incorporated into the flood wall.

Short-term direct adverse impacts to waters of the U.S. would occur from construction disturbance in Gould Wash channel. These impacts would be minor because construction disturbance is not anticipated to have measurable long-term impacts based on the avoidance, minimization, and restoration measures proposed that would maintain the existing stream channel functions. In coordination with the USACE the channel modifications would provide the same channel functions and no mitigation would be required (see the 404(b)(1) Analysis included in Appendix E).

An indirect minor adverse impact would occur in Gould Wash over the long term. This alternative would continue to disturb waters of the U.S. for sediment and vegetation clearing along the Gould Wash channel to maintain the existing channel capacity over the long term, but these activities may be more frequent than the No Action Alternative due to the anticipated increase in sediment load (see Section 5.2.2).

5.6.3 New Detention Dam and 3,000 cfs Channel Modifications

This alternative would require grading and culvert/bridge modifications along 12,540 linear feet of Gould Wash though Hurricane City (see Appendix C, Map C3.1) as needed to maintain a consistent channel capacity for safe conveyance 3,000 cfs. Riprap armoring would be placed on the banks of the channel along 9,340 linear feet and a flood wall placed along 3,200 linear feet. The channel bottom would be left open to provide the same channel function, but grade control structures would be required to maintain channel stability. With a proposed open channel bottom width of 30 feet, the bank armoring is anticipated to be outside of the delineated OHWM, which averages approximately 25 feet wide. To preserve the existing channel bank functions, soil would be placed over the riprap then revegetated and vegetation would be incorporated into the flood wall.

This alternative also constructs a detention dam along Gould Wash that would place approximately 550 linear feet of the channel in a concrete conduit through the dam (see Appendix C, Map C3.3). Modifications downstream of the conduit along approximately 160 linear feet may be needed as appropriate to protect from channel scour at the outfall. Based on a 404(b)(1) Analysis attached in Appendix E, the existing Gould Wash channel at the proposed dam location is carved into basalt bedrock, consists of steep basalt cliffs on either bank with a dry channel bottom, and no riparian vegetation is present. Stream flow is confined between the basalt cliffs through this corridor with no floodplain. The channel experiences infrequent flow and typically only for a short duration (a few hours) with a negligible infiltration component. The function provided by this segment of the ephemeral channel is water conveyance which would not be changed from the proposed modifications. Therefore, piping this segment of Gould Wash through the dam is not anticipated to have a measurable change to the existing stream function. Disturbance in proposed borrow/disposal areas would avoid modifications in waters of the U.S.

Short-term direct adverse impacts to waters of the U.S. would occur from construction disturbance in Gould Wash channel along approximately 12,540 linear feet in Hurricane City and in 710 linear feet at the proposed detention dam. These impacts would be minor because construction

disturbance is not anticipated to have measurable direct long-term impacts based on the avoidance, minimization, and restoration measures proposed that would maintain the existing stream channel functions. In coordination with the USACE the channel modifications would provide the same channel functions, and no mitigation would be required (see the 404(b)(1) Analysis included in Appendix E). This alternative was also determined to be the LEDPA in the 404(b)(1) Analysis.

An indirect minor benefit to Gould Wash through Hurricane City would occur over the long term. This alternative would continue to disturb waters of the U.S. for sediment and vegetation clearing along the Gould Wash channel to maintain the existing channel capacity, but these activities would be less frequent than the No Action Alternative due to the anticipated decrease in sediment load (see Section 5.2.3).

5.7 Floodplain Management

Refer to Section 3.2.7 for the existing flooding conditions of Gould Wash and floodplain management.

5.7.1 No Action Alternative

This alternative would have an indirect adverse impact from continued exposure to damaging floods within Hurricane City over the long term. Developed areas of Hurricane City would remain in the regulated FEMA floodplain. The community within the flooded areas would continue to be at risk of injury or death during flood events, and buildings, lands, roads, infrastructure, and utilities would be damaged if a large flood were to occur. The projected increase in flood frequency and intensity would remain and threaten the community over the long term. This indirect future risk of flooding poses a moderate threat to Hurricane City.

Buildings within the regulated floodplain may require additional flood insurance coverage through the NFIP directly impacting building owners.

5.7.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

This alternative would have an indirect moderate beneficial impact that would safely convey all future flood flows through Hurricane City for up to and including a 100-year flood and substantially reduce flooding at a 500-year flood. The community within the benefited area would no longer be at risk of injury or death during these floods, and buildings, lands, roads, infrastructure, and utilities would be protected if a 100-year flood or lesser flood were to occur. At a 500-year flood the extent of flooding would be reduced from 748 acres to 62.9 acres. Additionally, flooding would be avoided to 146 mobile homes, 584 homes, 129 businesses/offices, 3 schools, 6 churches, and a post office at a 500-year flood. Refer to the flood tables in Section 5.18 that identify structures flooded under the No Action Alternative versus the Action Alternative. Flood maps for the 100-year and 500-year floods are provided in Appendix C, Maps C8.1, C8.2, and C,8.3 for existing and proposed conditions. The measures would also increase resilience to the projected rise in flood frequency and intensity.

Hurricane City and Washington County would consult with the local floodplain zoning authority and appropriate FEMA region staff for updates to the FIRMs. Flood insurance requirements may not be needed in areas, which would directly benefit owners previously required to obtain flood insurance coverage through the NFIP.

5.7.3 New Detention Dam and 3,000 cfs Channel Modifications

The alternative would have the same beneficial impacts as those described for the alternative in Section 5.7.2 above because it provides the same level of flood protection.

5.8 Air Quality and Climate

Refer to Section 3.2.8 for existing air quality conditions within the area of potential impact.

5.8.1 No Action Alternative

This alternative would not result in a change to the air quality conditions. The Sponsor performs routine O&M along the Gould Wash channel through Hurricane City as needed. However, construction equipment typically consists of one backhoe and/or one dump truck operating less than 1 week with activities occurring every two to five years. Based on the limited equipment, duration of activities, and frequency of performing work, the O&M activities are not anticipated to have a measurable impact on air quality or GHG emissions.

5.8.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

Construction activities would temporarily emit several air pollutants. PM10 emissions are associated with the dust created from demolition, land clearing, ground excavation, cut-and-fill operations, and road construction. All other pollutants (PM2.5, CO, sulfur oxides [SOx], nitrous oxides [NOx], mobile source air toxics [MSATs], and greenhouse gases [GHGs]) are generated from heavy-duty diesel engines used by the construction equipment. Construction emissions are greatest during the earthwork phases because of the dust associated with this activity. Fugitive dust can also be produced by winds blowing through the construction site and by trucks carrying uncovered loads. Additionally, mud tracked onto paved roads leading to and from the construction site creates a source of fugitive dust (i.e., road dust) after it dries.

Fugitive dust, MSAT, and GHG emissions increases associated with construction would be minimized by implementing applicable BMPs. These include the following:

- Spraying the soil on-site with water or other similar approved dust suppressant/soil binder.
- Wetting materials hauled in trucks, providing adequate freeboard (space from the top of the material to the top of the truck), or covering loads to reduce emissions during material transportation/handling.
- Providing a stabilized construction entrance (track-out pad), wheel washers, and/or other similar BMPs at construction site access areas to reduce track-out of site materials onto the adjacent roadway network.
- Removing tracked-out materials deposited onto adjacent roadways.
- Wetting material stockpiles to prevent wind-blown emissions.
- Establishing vegetative cover on bare ground as soon as possible after grading to reduce wind-blown dust.
- Requiring appropriate emission-control devices on all construction equipment.
- Requiring the use of cleaner burning fuels.
- Using only properly operating, well-maintained construction equipment.

Annual emissions for the alternative construction measures were calculated and compared to the total emissions in Washington County (Table 5-3). They were also compared to the EPA de minimis threshold rates for general conformity (Table 5-4). General conformity ensures that the action taken by federal agencies do not interfere with a State or tribe's ability to attain and maintain the NAAQS for air quality, as required by the Clean Air Act (EPA 2024c). The General conformity regulations play an important role in helping to protect air quality with those areas that do not meet the NAAQS (nonattainment areas) and areas of vulnerable air quality (maintenance areas). The Project area is not located in or near a nonattainment area or maintenance area and the General Conformity regulations do not apply. However, the comparison of alternative emissions to the EPA de minimis threshold rates help to identify if alternative construction emissions would have a measurable influence on air quality. For conservative estimates, the alternative emissions calculations consider a range based on a construction schedule spanning 1.5 to 2 years.

The results of the comparison show that the alternative construction emissions do not exceed the EPA de minimis criteria (see Table 5-4). They also have a negligible contribution to the county's emissions (see Table 5-3). Refer to Appendix D for additional information regarding emission calculations.

Table 5-3. Annual Emissions for Washington County and 8,820 cfs Alternative

Pollutant	County Emissions (tons/yr)[1]	Alternative tons/year (2-year)	% of County Emissions	Alternative tons/year (1.5-year)	% of County Emissions
NOx	3,370.4	1.47	0.043%	1.95	0.058%
CO	23,008.6	12.84	0.056%	17.12	0.074%
PM10	5,682.7	0.07	0.001%	0.10	0.002%
PM2.5	1,354.6	0.07	0.005%	0.10	0.007%
SO2	123.4	0.03	0.022%	0.04	0.029%
VOC	14,466.1	0.70	0.005%	0.93	0.006%

1 – Source: UDEQ 2023b

Table 5-4. EPA De Minimis Thresholds and 8,820 cfs Alternative Emissions

Pollutant	EPA De Minimis Value for NAAs and MAs (tons/year)[1]	Alternative tons/year (2-year)	Alternative tons/year (1.5-year)
NOx	100	1.47	1.95
CO	100	12.84	17.12
PM10	100	0.07	0.10
PM2.5	100	0.07	0.10
SO2	100	0.03	0.04
VOC	50-100	0.70	0.93

1 – Source: EPA 2024c

Utah air quality permitting requirements were also considered. The UDAQ does not require a permit for construction activities outside of nonattainment or maintenance areas that only use non-road construction equipment. However, a permit for sources that emit five tons or more of criteria pollutants per year, or more than 500 pounds of an individual Hazardous Air Pollutant

(HAP) or 2,000 pounds of all HAPs combined per year require a New Source Review Approval Order (AO). The HAP emissions calculated for the alternative are 121 pounds per year, assuming a 2-year construction schedule and 161 pounds per year assuming a 1.5-year schedule. The total for all HAPs during construction is 242 pounds. These values are well under the AO thresholds and do not require a permit.

Total GHG emissions from construction, including production of concrete, is calculated at 5,534 metric tons of CO_2 (see Appendix D for additional information on calculations). This amount is well below the EPA threshold for reporting GHG emissions of 25,000 metric tons annually. The EPA GHG equivalencies calculator (EPA 2024d) was used to convert the emissions into a concrete equivalent amount that can be better understood. The 5,534 metric tons is equivalent to the energy use for 1-year of 722 homes. This amount was divided by a construction schedule of 1.5 to 2 years to arrive at an approximate number of homes per year at 481 for a 1.5-year schedule and 361 for a 2-year schedule. The number of homes in Washington County for 2023 was estimated at 85,717 (USCB). The alternative was determined to have a negligible contribution to the GHG produced by homes at 0.6% for a 1.5-year schedule and 0.4% for a 2-year schedule. The O&M measures after construction are also negligible at an estimated 1.85 metric tons per year or 185 metric tons over the 100-year project life.

The alternative incorporates measures to reduce GHG emissions. This includes using concrete sourced from a nearby distributor located within 5 miles of Hurricane City to reduce vehicle GHG emissions. Cement would incorporate reusable wastes including a fly ash binder, granulated slag, and post-consumer glass as reasonable or available to reduce the carbon footprint. Concrete mixture optimization would be facilitated through performance-based specifications. Engineering fill and armoring materials will be sourced from the nearest possible location to reduce vehicle GHG emissions.

There would be no short-term adverse effects to air quality or GHGs from the alternative based on negligible emissions, values under the EPA general conformity de minimis thresholds, no requirements for air quality permits, GHG emissions below the EPA reportable limits, the location of the Project outside of nonattainment or maintenance areas, implementation of BMPs, and the short-term of construction. Measurable long-term impacts to air quality are not expected from continuation of O&M activities.

5.8.3 New Detention Dam and 3,000 cfs Channel Modifications

Construction activities would temporarily emit several air pollutants. PM10 emissions are associated with the dust created from demolition, land clearing, ground excavation, cut-and-fill operations, and road construction. All other pollutants (PM2.5, CO, SOx, NOx, MSATs, and GHG]) are generated from heavy-duty diesel engines used by the construction equipment. Construction emissions are greatest during the earthwork phases because of the dust associated with this activity. Fugitive dust can also be produced by winds blowing through the construction site and by trucks carrying uncovered loads. Additionally, mud tracked onto paved roads leading to and from the construction site creates a source of fugitive dust (i.e., road dust) after it dries.

Fugitive dust, MSAT, and GHG emissions increases associated with construction would be minimized by implementing the applicable BMPs listed in Section 5.8.2.

Similar to the other alternative in Section 5.8.2, annual emissions for this alternative's construction measures were calculated (refer to Appendix D for calculations) and compared to the total

emissions in Washington County and the EPA de minimis threshold rates for general conformity in Table 5-5 and Table 5-6, respectively. For conservative estimates, the alternative emissions calculations consider a range based on a construction schedule spanning 1.5 to 2 years.

The results of the comparison show that the alternative construction emissions do not exceed the EPA de minimis criteria (see Table 5-6). They also have a negligible contribution to the county's emissions (see Table 5-5).

Table 5-5. Annual Emissions for Washington County and Alternative

Pollutant	County Emissions (tons/yr)[1]	Alternative tons/year (2-year)	% of County Emissions	Alternative tons/year (1.5-year)	% of County Emissions
NOx	3,370.4	1.56	0.046%	2.08	0.062%
CO	23,008.6	13.64	0.059%	18.19	0.079%
PM10	5,682.7	0.08	0.001%	0.10	0.002%
PM2.5	1,354.6	0.08	0.006%	0.10	0.008%
SO2	123.4	0.03	0.023%	0.04	0.031%
VOC	14,466.1	0.74	0.005%	0.99	0.007%

1 – Source: UDEQ 2023b

Table 5-6. EPA De Minimis Thresholds and Alternative Emissions

Pollutant	EPA De Minimis Value for NAAs and MAs (tons/year)[1]	Alternative tons/year (2-year)	Alternative tons/year (1.5-year)
Nox	100	1.56	2.08
CO	100	13.64	18.19
PM10	100	0.08	0.10
PM2.5	100	0.08	0.10
SO2	100	0.03	0.04
VOC	50-100	0.74	0.99

1 – Source: EPA 2024c

Similar to the other alternative in Section 5.8.2, Utah air quality permitting requirements were also considered for the AO HAP. The HAP emissions calculated for the alternative are 129 pounds per year assuming a 2-year construction schedule and 171 pounds per year assuming a 1.5-year schedule. The total for all HAPs during construction is 258 pounds. These values are well under the AO thresholds and do not require a permit.

Total GHG emissions from construction, including production of concrete, was calculated at 4,303 metric tons of CO_2 (see Appendix D for additional information on calculations). This amount is well below the EPA threshold for reporting GHG emissions of 25,000 metric tons annually. The EPA GHG equivalencies calculator (EPA 2024d) was used to convert the emissions into a concrete equivalent amount that can be better understood. The 4,303 metric tons is equivalent to the energy use for 1-year of 561 homes. This amount was divided by a construction schedule of 1.5 to 2 years to arrive at an approximate number of homes per year at 374 for a 1.5-year schedule and 281 for a 2-year schedule. The number of homes in Washington County for 2023 was estimated at 85,717 (USCB). The alternative was determined to have a negligible contribution to

the GHG produced by homes at 0.4% for a 1.5-year schedule and 0.3% for a 2-year schedule. The O&M measures after construction are also negligible at an estimated 3.17 metric tons per year or 317 metric tons over the 100-year project life. Measures to reduce GHG emissions to the greatest extent possible would be the same as those described in 5.8.2.

There would be no short-term adverse effects to air quality or GHGs from the alternative based on negligible emissions, values under the EPA general conformity de minimis thresholds, no requirements for air quality permits, GHG emissions below the EPA reportable limits, the location of the Project outside of nonattainment or maintenance areas, and the short-term of construction. Measurable long-term impacts to air quality are not expected from continuation of O&M activities.

5.9 Vegetation Communities

Refer to Section 3.2.9 for existing information on vegetation communities within the area of potential impact.

5.9.1 No Action Alternative

There would be no change to existing plant communities for this alternative. Indirect adverse impacts to vegetation would occur from continued future sediment/debris removal O&M activities along approximately 12,540 linear feet of Gould Wash channel through Hurricane City over the long term. These impacts would be minor based on the lack of sensitive plant communities present (sensitive plant species, protected natural areas, conservation areas, or ecologically critical areas).

5.9.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

Direct short-term impacts would occur from temporary construction disturbance to approximately 7.4 acres of vegetated lands within the western segment of the Project area (Table 5-7) and 45.3 acres of developed land (See Appendix C, Map C5.1). Areas identified as developed were not included in the vegetation impact analysis. No disturbance would occur in the eastern segment of the Project area. Temporarily disturbed areas would be restored upon construction completion with a native weed free NRCS approved seed mix. Types of vegetation for restoration would be selected in consideration of soil, hydrology, and climate conditions. The USACE would be included in approval and decision-making for vegetation restoration measures within their jurisdictional areas. There are no sensitive plant communities (sensitive plant species, protected natural areas, conservation areas, or ecologically critical areas) in the western segment of the Project area. Short-term impacts would be minor based on the lack of presence of sensitive plant communities, vegetation restoration measures, and N&I[1] management measures (see Section 5.11.3 for N&I BMPs).

Table 5-7. Vegetation Communities Impacts

Vegetation Type	Area Disturbed (acres)
Shrub/Scrub	4.2
Pasture/Hay	0.4
Riparian	2.8
Total	**7.4**

A minor indirect adverse impact is expected for vegetation in Gould Wash through Hurricane City. The future O&M activities along Gould Wash through Hurricane City to remove sediment and maintain channel capacity would continue. However, the anticipated increase in sediment load in the channel (refer to Section 5.2.2) may require more frequent sediment removal than the No Action Alternative, which would increase disturbance to vegetation communities along the channel over the long term.

5.9.3 New Detention Dam and 3,000 cfs Channel Modifications

Direct short-term impacts would occur from temporary disturbance to approximately 111.3 acres of vegetated lands (see Appendix C, Map C5.1 and C 5.2) with 3.4 acres in the western segment of the Project area and 107.9 acres within the eastern segment (Table 5-8). Areas identified as developed were not included in the vegetation impact analysis. There are no sensitive plant communities (sensitive plant species, protected natural areas, conservation areas, or ecologically critical areas) in the Project area. Temporarily disturbed areas would be restored upon construction completion with a native weed free seed mix to match the existing surrounding plant communities approved by NRCS, BLM or USACE, as applicable. Types of vegetation for restoration would be selected in consideration of soil, hydrology, and climate conditions. The BLM and USACE would be included in approval and decision-making for vegetation restoration measures within their jurisdictional areas. Short-term impacts would be minor based on the lack of presence of sensitive plant communities, vegetation restoration measures, and N&I[1] management measures (see Section 5.11.3 for N&I BMPs).

Table 5-8. Vegetation Communities Impacts

Vegetation Type	Area Disturbed (acres)
Western Segment	
Shrub/Scrub	0.5
Pasture/Hay	0.4
Riparian	2.5
Subtotal	*3.4*
Eastern Segment	
Shrub/Scrub	101.1
Herbaceous	6.8
Subtotal	*107.9*
Total	**111.3**

In the eastern segment of the Project area approximately 4.5 acres of land would be permanently removed from construction of a concrete auxiliary spillway. At a fraction of a percent of the total vegetated lands within the Project area and no sensitive plant communities present, this impact would be negligible. Approximately 15.3 acres of shrub/scrub lands would be converted to grassland to comply with dam safety regulations for no woody vegetation on a dam embankment. This change is also considered negligible due to lack of sensitive plant communities and the small change equivalent to a fraction of a percent of the vegetated lands within the Gould Wash drainage area.

A minor indirect benefit is expected for vegetation in Gould Wash through Hurricane City. The O&M activities along Gould Wash through Hurricane City to remove sediment and maintain channel capacity would continue. However, the anticipated decrease in sediment load in the channel (refer to Section 5.2.3) would reduce the frequency of future sediment O&M removal activities needed through the channel. This would result in less disturbance to vegetation communities along the channel over the long term compared to the No Action Alternative.

5.10 Special Status Plant Species

Based on special status plant species surveys and reports (included in Appendix E), no ESA or BLM-listed plant species are present in the Project area. Refer to Section 3.2.10 for additional information. A BA was prepared and submitted to USFWS on February 11, 2025, to comply with Section 7 of the ESA (Appendix A).

5.10.1 No Action Alternative

There would be no impacts to special status plant species or suitable habitat for this alternative because none are present within the areas proposed for O&M activities.

5.10.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

There would be no impacts to special status plant species or suitable habitat for this alternative because none are present within the areas proposed for installation of alternative measures or for O&M activities.

5.10.3 New Detention Dam and 3,000 cfs Channel Modifications

There would be no impacts to special status plant species or suitable habitat for this alternative because none are present within the areas proposed for installation of alternative measures or for O&M activities.

5.11 Noxious Weeds and Invasive Plants

Refer to Section 3.2.11 for existing information on N&I weeds and non-native plants within the area of potential impact.

5.11.1 No Action Alternative

The O&M activities for routine sediment removal in the Gould Wash channel through Hurricane City would continue to increase disturbance and risk for future invasion of N&I weeds along the channel over the long term. This results in an indirect adverse impact from continued O&M. Based on the current plant species along the channel that are dominated by N&I weeds and non-native species, future O&M would likely have a negligible to minor adverse increase in future invasions.

5.11.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

This alternative would have direct short-term impacts that would put the Project area at risk for future invasion of N&I weeds from disturbance to 7.4 acres of vegetated lands within the western segment of the Project area. BMPs would be implemented during construction to prevent the spread of N&I plant species and comply with Executive Order 13112. During construction and until restoration areas are fully established, they would be maintained on a regular basis to prevent the establishment of N&I plant species. Non-desirable plant species would be controlled by

cleaning equipment prior to delivery to the Project site and eradicating these species before the start and during construction as discovered. In addition, a Post Construction Rehabilitation Plan (PCRP) would be developed and would include mechanisms for addressing weed establishment and treatment. Disturbed areas would be restored to preconstructions conditions or better after construction completion. Short-term impacts would be minor based on vegetation restoration after construction, development of a PCRP, and implementation of BMPs during construction.

No direct long-term adverse impacts are anticipated from installation measures based on implementation of BMPs and development and implementation of a PCRP. Minor direct long-term benefits would be achieved from native vegetation restoration measures described in Section 5.9.2 and implementation of a PCRP that would reduce N&I and other weeds along the Gould Wash channel through Hurricane City over the long term.

The increase in sediment load in the channel would require more frequent sediment removal O&M activities than the No Action Alternative (refer to Section 5.2.2). This would result in an indirect adverse impact with minor increases in future disturbance and risk for invasion of N&I weeds along the channel over the long term.

5.11.3 New Detention Dam and 3,000 cfs Channel Modifications

This alternative would have direct short-term impacts that would put the Project area at risk for future invasion of N&I weeds from disturbance to 111.3 acres of vegetated lands within the western and eastern segments of the Project area. Disturbed areas would be monitored, maintained, and controlled for N&I species as described in Section 5.11.2. A PCRP would be developed and would include mechanisms for addressing weed establishment and treatment. Disturbed areas would be restored to preconstructions conditions or better after construction completion. These impacts would be minor based on vegetation restoration after construction, development of a PCRP, and implementation of BMPs during construction.

No direct long-term adverse impacts are anticipated from alternative actions based on implementation of BMPs and development and implementation of a PCRP. Minor direct long-term benefits would be achieved from native (weed free) vegetation restoration measures described in Section 5.9.3 and implementation of a PCRP that would reduce N&I and other weeds in restored/revegetated areas over the long term.

The anticipated decrease in sediment load in the channel would reduce the frequency of O&M sediment removal activities needed through the channel in Hurricane City (refer to Section 5.2.3). This would result in an indirect benefit with minor decreases in disturbance and reduced future risk for invasion of N&I weeds along the channel over the long term.

5.12 Riparian Areas

Artificially supported riparian areas consisting primarily of herbaceous species with patches of shrub species are present along Gould Wash through Hurricane City within the Project area. Refer to Section 3.2.12 for additional information on riparian areas within the area of potential impact.

5.12.1 No Action Alternative

The O&M activities of routine sediment removal would continue to disturb artificially supported poor quality riparian vegetation along the Gould Wash channel bed over the long term.

5.12.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

Direct short-term impacts would occur from disturbance to approximately 2.8 acres of artificially-supported poor quality riparian area (see Appendix C, Map C5.1). These areas occur along the existing Gould Wash channel bed through Hurricane City. Approximately 2.7 acres of this riparian vegetation is dominated primarily by herbaceous species with patches of shrub species. The remaining 0.1 acres is dominated by cottonwood trees (*Populus fremontii*) along the channel bed. The channel modifications would maintain a natural open channel bottom to allow for re-establishment of riparian vegetation. Disturbed areas that may support riparian vegetation would be seeded or hydroseeded with a NRCS and USACE approved native riparian seed mix. Types of vegetation for restoration of riparian areas would be selected in consideration of soil, hydrology, and climate conditions at the time of construction completion and determined in coordination with the USACE. Herbaceous riparian vegetation would begin to reestablish within one month of seeding and willow species would begin to reestablish within the first season. Short-term impacts would be minor based on temporary disturbance, reestablishment of riparian vegetation after construction is completed, poor quality of the existing riparian corridor, and minimal amount of area disturbed.

Direct long-term impacts are expected for the 0.1 acres of disturbance to areas dominated by cottonwood trees. These areas would take longer to reestablish to preconstruction conditions at approximately 10 years. Long-term impacts would be minor based on reestablishment of riparian vegetation after construction is completed and the minimal amount of riparian vegetation disturbed.

A minor indirect impact is expected for riparian vegetation in Gould Wash through Hurricane City. The O&M activities along Gould Wash through Hurricane City to remove sediment and maintain channel capacity would continue. However, the anticipated increase in sediment load in the channel (refer to Section 5.2.2) may require more frequent sediment removal than the No Action Alternative, which would increase disturbance to riparian vegetation communities along the channel over the long term.

5.12.3 New Detention Dam and 3,000 cfs Channel Modifications

This alternative would have similar short-term direct impacts as those described for the alternative in Section 5.12.2 above with less temporary disturbance (2.5 acres) to riparian vegetation and measures would avoid disturbance within areas dominated by cottonwood trees. The riparian vegetation in the areas proposed for disturbance is located along the channel bottom and is dominated primarily by herbaceous species and/or narrowleaf willow. Riparian vegetation restoration measures would be the same as described in Section 5.12.2. Short-term direct impacts would be minor based on temporary disturbance, reestablishment of riparian vegetation after construction is completed, poor quality of the existing riparian corridor, and minimal amount of area disturbed. Long-term direct impacts to riparian vegetation from installation of alternative measures are not anticipated.

A minor indirect benefit is expected for riparian vegetation in Gould Wash through Hurricane City. The O&M activities along Gould Wash through Hurricane City to remove sediment and maintain channel capacity would continue. However, the anticipated decrease in sediment load in the channel (refer to Section 5.2.3) would reduce the frequency of future sediment O&M removal

activities needed through the channel. This would result in less disturbance to vegetation communities along the channel over the long term compared to the No Action Alternative.

5.13 Fish and Wildlife

Refer to Section 3.2.13 for information regarding the presence of wildlife and wildlife habitat within the area of potential impact. Wildlife game species state crucial habitat for Gambel's quail (*Callipepla gambelii*), and substantial habitat for mule deer (*Odocoileus hemionus*), ringneck pheasant (*Phasianus colchicus*), and white winged dove (*Zenaida asiatica*) are located in the Project area (see Appendix C, Maps C6.1 and C6.2). However, these species are not SGCN and the state does not regulate work in these habitats nor do they have work restrictions for them. Additionally, no threat is present for the species continued existence by the state or by federally agencies.

5.13.1 No Action Alternative

No short- or long-term direct impacts to fish or wildlife would occur because the alternative would not install new measures. Indirect impacts to habitat along the Gould Wash channel through Hurricane City would continue where habitat would be regularly disturbed from future O&M activities consisting of sediment and debris removal to maintain channel capacities over the long term. These areas offer low-quality habitat and are within the developed areas of Hurricane City. No sensitive habitats would be disturbed. Wildlife species, if present, may be disturbed and displaced to adjacent habitats during O&M activities, but could return to the area after completed. These indirect impacts would be minor based on the proximity in developed areas, low-quality habitat, no sensitive habitats present, and temporary disturbance.

The threat of floodwater contamination to the Virgin River would remain with indirect adverse impacts to terrestrial/wildlife species and habitat in the Virgin River. However, estimating the intensity of the impact is not reasonable based on several unpredictable factors associated with flood events.

5.13.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

Direct short-term impacts to wildlife and wildlife habitat would occur from construction disturbance on approximately 7.4 acres of vegetated areas in the western segment of the Project area (see Section 5.9.2 and Appendix C, Map C5.1). These areas offer low-quality habitat and are within the developed areas of Hurricane City. No sensitive habitats would be disturbed, except for desert tortoise critical habitat (refer to Section 5.14.2 for ESA species/habitat impacts). Avoidance and minimization measures would be in place for bird species and special status species as described in Sections 5.14.2 and 5.15.2. Wildlife species, if present, may be disturbed and displaced to adjacent habitats during construction. Once construction is completed, they could return to the area. Temporarily disturbed areas would be restored upon construction completion. Refer to Section 5.9.2 for vegetation restoration measures. Short-term impacts would be minor based on the lack of sensitive habitats, low-quality habitat, short duration of construction, implementation of avoidance/ minimization measures, and restoration of disturbed areas.

Alternative measures remove the floodplain in Hurricane City, reducing the potential for contamination in floodwater that could occur from future overland flooding of developed areas during large flood events. This would have an indirect benefit to the water quality of the Virgin

River benefiting aquatic/terrestrial wildlife and habitat in the river over the long term. However, estimating the intensity of the impact is not reasonable based on several unpredictable factors.

Indirect adverse impacts on fish and wildlife would occur due to changed streamflow conditions during future flood events over the long term. Alternative measures would remove the floodplain in Gould Wash and increase the sediment load and channel conveyance capacity of the wash. The depth and velocity of water downstream of the channel improvements would increase during large storm events (10-year floods and greater). This would occur from approximately 600 N Road downstream 1-mile to the Virgin River and at the Virgin River confluence. While the fish species of the Virgin River have adapted to arduous conditions such as extensive floods and large sediment loads, as reported in an EPA report on ephemeral streams (EPA 2008), the changed flood depth, velocity, and sediment load could adversely impact terrestrial/riparian habitat along Gould Wash and terrestrial/riparian or aquatic habitat at its confluence with the Virgin River. Damage to terrestrial/aquatic habitat (removal of vegetation and stream bedload disturbance) increases with higher water volumes.

The severity and extent of the adverse impact to habitat and species from increased flow is difficult to estimate based on the highly variable and unpredictable hydrologic conditions of the ephemeral system and unknown timing for when such an event may occur. However, based on the changed flow conditions presented in Section 5.5.2, minor increases in water volumes conveyed downstream of 600 N Road to the Virgin River would begin to occur at a 10-year flood, which has a 10 percent chance of occurrence in any given year. This percent increases as storm events get larger and substantial increases in flow are expected at a 100-year flood, which has a 1 percent chance of occurrence in any given year. The flow increases by 682 cfs or 29% more than the baseline at a 10-year flood and 4,190 cfs or 90% more than the baseline at a 100-year flood. Impacts to aquatic wildlife species and habitat would increase as the flood events get larger.

A minor indirect adverse impact is expected for habitat in Gould Wash through Hurricane City. The O&M activities would continue to disturb habitat and wildlife along Gould Wash through Hurricane City over the long term, similar to the baseline No Action Alternative. However, greater sediment loads in the channel would result in more frequent future sediment removal O&M disturbance increasing disturbance to low quality habitat over the long term.

5.13.3 New Detention Dam and 3,000 cfs Channel Modifications

Direct short-term impacts to wildlife and wildlife habitat would occur from construction disturbance on approximately 111.3 acres of vegetated lands, with 3.4 acres in the western segment of the Project area and 107.9 in the eastern segment (refer to Section 5.9.3 and Appendix C, Maps C5.1 and D C5.2). No sensitive habitats would be disturbed. Conservation measures would be in place for bird species and special status species as described in Sections 5.14.3 and 5.15.2. Wildlife species, if present, may be disturbed from construction equipment and noise, and displaced to adjacent habitats during construction. Once construction is completed, they can return to the area. Temporarily disturbed habitats would be restored and revegetated to match the surrounding plant communities after construction completion. Refer to Section 5.9.3 for vegetation restoration measures. Short-term impacts would be minor based on the lack of sensitive habitats, short duration of construction, implementation of avoidance/minimization measures, and restoration of disturbed areas.

Replacement of habitat with concrete on approximately 4.5 acres would occur to construct the detention dam's auxiliary spillway. This permanent loss is negligible at 0.7 percent of the available habitat in the Project area or 0.009 percent of the Gould Wash drainage area. No sensitive habitats (protected natural areas, conservation areas, ecologically critical areas, or ESA critical habitat) would be disturbed Therefore, this permanent loss is not anticipated to have measurable long-term impacts to wildlife or their habitat in the area.

Alternative measures remove the floodplain in Hurricane City, reducing the potential for contamination in floodwater that could occur from future overland flooding of developed areas during large flood events. This would have an indirect benefit to the water quality of the Virgin River benefiting aquatic/terrestrial wildlife and habitat in the river over the long term. However, estimating the intensity of the impact is not reasonable based on several unpredictable factors.

Alternative measures would transfer the floodplain of Gould Wash from the developed area of Hurricane City to an undeveloped natural upstream area, maintaining a similar channel capacity through the City. Downstream of the channel improvements, indirect beneficial impacts on fish and wildlife would occur due to changed streamflow conditions during future flood events over the long term. The severity and extent of the benefits to habitat and species from increased flow is difficult to estimate based on the highly variable and unpredictable hydrologic conditions of the ephemeral system and unknown timing for when such an event may occur. However, the change in flow conditions downstream of the modified channel segment to the Virgin River are negligible to minor, as presented in Section 5.5.3. The increase in flow along the 1-mile stretch from 600 N Road to the Virgin River increases by 395 cfs or 18% more than the baseline at a 10-year flood, then gradually decreases for the 25-year though 100-year floods. The decrease in flow along this segment would be 52 cfs or 2% less than the baseline at a 25-year flood and 1,630 cfs or 35% less than the baseline at a 100-year flood. Because the larger flood events result in the most damage, the impacts to species and habitat is anticipated to decrease from the baseline condition along the 1-mile segment as flood events get larger.

A minor indirect benefit is expected for habitat in Gould Wash through Hurricane City. The future O&M activities would continue to disturb habitat along Gould Wash through Hurricane City over the long term, similar to the baseline No Action Alternative. However, decreased sediment loads in the channel would reduce the frequency of future O&M disturbance to remove sediment and reduce the associated disturbance to wildlife and low-quality habitat.

5.14 Special Status Animal Species

One ESA-listed species (desert tortoise [*Gopherus agassizii*]) was found to have suitable habitat and designated critical habitat in the Project area. However, desert tortoises are not expected to be present in the Project area due to surveyed lack of presence or signs of presence. One BLM sensitive species/Utah SGCN (Arizona toad [*Bufo microscaphus*]) has the potential to be present in the western segment of the Project area, and one BLM sensitive species/Utah SGCN (burrowing owl [*Athene cunicularia*]), has the potential to be present within the eastern segment of the Project area. Refer to Section 3.2.14 for additional information regarding special status species and habitat within the area of potential impact.

5.14.1 No Action Alternative

Habitat along Gould Wash channel through Hurricane City in the western segment of the Project area would continue to be regularly disturbed from O&M activities consisting of sediment and

debris removal to maintain channel capacities over the long term. However, desert tortoise are not expected to be present due to lack of presence or signs of presence and O&M activities would not be performed in designated critical habitat. Therefore, the O&M activities are not anticipated to have measurable impacts on ESA-listed desert tortoise or designated critical habitat. No measurable impacts are anticipated for BLM sensitive species/Utah SGCN Arizona toad based on lack of breeding habitat, lack of permanent surface water, and performing O&M activities when water is not present along the channel. No other special status animal species would be impacted from alternative measures.

5.14.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

Alternative modifications would temporarily disturb 7.4 acres of designated critical habitat for ESA-listed desert tortoise near the Project area intersection with 600 N Street (see Appendix C, Map C7). Disturbed areas would be restored upon construction completion and compensatory mitigation is not anticipated. Based on the desert tortoise survey conducted, Project measures within designated critical habitat would be focused on flood conveyance in Gould Wash and are not anticipated to affect the Primary Constituent Elements associated with desert tortoise critical habitat ((Hamilton 2024 – Attached to the BA in Appendix E). Therefore, adverse impacts to desert tortoise critical habitat from alternative measures including future O&M activities are not expected.

Based on lack of presence or signs of presence and implementation of conservation measures, this alternative including future O&M activities is not anticipated to have adverse effects to desert tortoises. Presence/absence surveys for desert tortoise would be completed during the active season prior to construction and in coordination with USFWS and BLM. If desert tortoises or their signs are discovered during surveys (indicating presence), Section 7 Consultation will be reinitiated. If no desert tortoise or their signs are discovered during pre-construction presence/absence surveys, the conservation measures for USFWS Utah 2018 Desert Tortoise Section 7 Guidelines for Unoccupied, Medium or Low Quality Habitat will be adhered to.

Suitable habitat for BLM sensitive species/Utah SGCN Arizona toad would be disturbed during construction activities. Conservation measures would be implemented to avoid and minimize impacts to the species. Preconstruction surveys would be performed for Arizona toad, as applicable and determined in coordination with UDWR, prior to the commencement of work activities in areas of suitable habitat for the species. If the species were found during surveys, conservation measures would be implemented in coordination with UDWR. Short-term adverse impacts to SGCN are not expected with implementation of conservation measures and restoration of disturbed areas. No measurable long-term impacts to Arizona toad are anticipated from O&M activities because these activities would be performed when water is not present in the channel.

As discussed in Section 5.13.2, increases in water volumes to the Virgin River would begin to occur at a 10-year flood for this alternative, which may adversely impact habitat in Gould Wash downstream of 600 N Road to its confluence with the Virgin River. The Virgin River at this location provides habitat for many state SGCN and ESA-listed species, in addition to designated critical habitat. Any adverse habitat modification from these increased flows could have implications to sensitive habitats and associated special status species. However, the severity and extent of the impacts downstream is difficult to estimate considering the highly variable flow conditions in the Virgin River, variable and unpredictable hydrologic conditions of the Gould Wash ephemeral system, and unknown timing for when a damaging flood event may occur.

5.14.3 New Detention Dam and 3,000 cfs Channel Modifications

Construction activities would not disturb designated critical habitat for ESA-listed desert tortoise. Based on lack of presence or signs of presence and implementation of conservation measures, this alternative including future O&M activities is not anticipated to have adverse effects to desert tortoises. Presence/absence surveys for desert tortoise would be completed during the active season prior to construction and in coordination with USFWS and BLM. If desert tortoises or their signs are discovered during surveys (indicating presence), Section 7 Consultation will be reinitiated. If no desert tortoise or their signs are discovered during pre-construction presence/absence surveys, the conservation measures for USFWS Utah 2018 Desert Tortoise Section 7 Guidelines for Unoccupied, Medium or Low Quality Habitat will be adhered to. These conservation measures are detailed in the BA attached in Appendix E.

A BA was completed for the alternative and is included in Appendix E. The BA was submitted for informal consultation to the USFWS on February 11, 2025, with a **May Effect, Not Likely to Adversely Affect** determination for desert tortoise and **No Effect** determination for all other ESA species/designated critical habitat to comply with Section 7 of the ESA (Appendix A). The USFWS concurred with the determination on February 26, 2025 (Appendix A).

Suitable habitat for BLM sensitive species/Utah SGCN Arizona toad and burrowing owl would be disturbed during construction activities, but would be restored after construction completion. Conservation measures would be implemented to avoid and minimize impacts to the species. Preconstruction surveys would be performed for Arizona toad and burrowing owl, as applicable and determined in coordination with UDWR (within non-BLM lands) and BLM (within BLM-managed lands), prior to the commencement of work activities in areas of suitable habitat for either species. If the species were found during surveys, conservation measures would be implemented in coordination with UDWR or BLM, as applicable. Please see Section 5.15.2 below for additional surveys, avoidance, and minimization measures applicable for burrowing owl that would be implemented for migratory birds. Short-term impacts to BLM sensitive species/Utah SGCN are not expected with implementation of conservation measures and restoration of disturbed areas. No measurable long-term impacts to burrowing owl or Arizona toad are anticipated from future O&M activities because the activities would be performed outside of the nesting season for burrowing owl and when water is not present in the channel.

As discussed in Section 5.13.3, decreases in water volumes to the Virgin River would occur for larger flood events, which may benefit habitat in Gould Wash downstream of 600 N Road to its confluence with the Virgin River. The Virgin River at this location provides habitat for many state SGCN and ESA-listed species, in addition to designated critical habitat. Any benefit to habitat from these decreased flows could benefit sensitive habitats and associated special status species. However, the severity and extent of the impacts downstream is difficult to estimate considering the highly variable flow conditions in the Virgin River, variable and unpredictable hydrologic conditions of the Gould Wash ephemeral system, and unknown timing for when a damaging flood event may occur.

5.15 Migratory Birds and Bald/Golden Eagles

Refer to Section 3.2.15 for a description of migratory birds/golden eagles and occurrence within the area of potential impact.

5.15.1 No Action Alternative

Activities for O&M along the existing Gould Wash channel are typically timed outside of the breeding season for birds and are not anticipated to have measurable impacts to migratory birds.

5.15.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

Construction activities would disturb suitable breeding/nesting habitat for migratory birds, and suitable foraging habitat for migratory birds and bald/golden eagles. Direct short-term impacts would occur from disturbance on approximately 7.4 acres of vegetated areas in the western segment of the Project area (see Section 5.9.2 and Appendix C, Map C5.1). If construction activities occur during migratory bird breeding/nesting periods, conservation measures would be in place to avoid/minimize impacts to ensure compliance with the MBTA. With implementation of the conservation measures below, measurable direct impacts to migratory birds and bald/golden eagles would consist of human activity/noise nuisances that would discourage birds from foraging and nesting in the construction disturbance areas. Once construction is complete, the disturbed areas would be restored/revegetated, and no direct long-term impacts are expected. Short-term impacts would be minor based on short duration of construction, implementation of conservation measures, and restoration of disturbed areas.

Tree vegetation clearing would be performed outside of the bird breeding season. For construction activities that occur during migratory bird breeding/nesting periods, the Project area (and surrounding habitats) would be surveyed by a qualified biologist for active nests no more than five days prior to the commencement of work. If active nests were found during surveys, spatial buffers would be established around such in coordination with USFWS and NRCS. Construction activities within the buffer areas would be prohibited until a qualified biologist confirmed that all nests are no longer active. Disturbed areas would be restored after construction completion. Measurable direct long-term impacts to migratory birds or bald/golden eagles are not anticipated for alternative measures based on restoration of disturbed areas.

Indirect adverse impacts on birds and associated habitat would occur from changed streamflow conditions during future flood events over the long term the same as described in Section 5.13.2. Activities for O&M along the existing Gould Wash channel are typically timed outside of the bird breeding season and are not anticipated to have measurable impacts to migratory birds.

5.15.3 New Detention Dam and 3,000 cfs Channel Modifications

Approximately 111.3 acres of vegetated lands, with 3.4 acres in the western segment of the Project area and 107.9 in the eastern segment would be disturbed (refer to Section 5.9.3 and Appendix C, Maps C5.1 and D C5.2). The same conservation measures would be in place as described in Section 5.15.2. With implementation of the conservation measures measurable direct impacts to migratory birds and bald/golden eagles would consist of human activity/noise nuisances that would discourage birds from foraging and nesting in the construction disturbance areas. Once construction is complete, the disturbed areas would be restored/revegetated and no direct long-term impacts are expected. Short-term impacts would be minor based on short duration of construction, implementation of conservation measures, and restoration of disturbed areas. Measurable direct long-term impacts to migratory birds or bald/golden eagles are not anticipated for alternative measures based on restoration of disturbed areas.

Indirect benefits for birds and associated habitat would occur from changed streamflow conditions during future flood events over the long term the same as described in Section 5.13.3. Activities for O&M along the existing Gould Wash channel are typically timed outside of the bird breeding season and future activities are not anticipated to have measurable indirect impacts to migratory birds.

5.16 Social Issues and Local Economy

Refer to Section 3.2.16 for existing socioeconomic conditions within the area of potential impact.

5.16.1 No Action Alternative

There would be no change to socioeconomic conditions for this alternative. The risk of flooding along Gould Wash would continue to have a moderate adverse indirect impact that threatens the social wellbeing and prosperity of the community over the long term. Flooding would cause property damage, environmental degradation, and interruption in business operations. Flood insurance may continue to be required for structures located within the floodplain that have federally backed mortgages. The annual cost of flood damage was estimated at $2,462,600 (see Section 18 of Appendix D).

There would be continued risk of flood-related mental health issues (depression, post-traumatic stress disorder, substance abuse, etc.) with associated costs for those impacted by flooding over the long term. These costs were not calculated as part of the flood damage due to uncertainties in calculation methods, but these indirect adverse impacts are important to note as they influence impacted individuals financially.

Community unrest and political turmoil surrounding FEMA floodplain mapping regulations would continue. These social issues are expected to have long-term moderate direct adverse impacts based on the number of structures located in SFHAs that are now regulated, and additional insurance coverage costs that owners may be subject to pay.

5.16.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

This alternative has an indirect moderate benefit to the socioeconomic conditions of Hurricane City over the long term. Alternative measures would reduce future flooding to Hurricane City for up to and including a 100-year flood and substantially reduce flooding at a 500-year flood. The reduction in flooding would benefit the social wellbeing and prosperity of the community. It would reduce property damage, environmental degradation, and interruption in business operations. Flood insurance may no longer be required for structures in Hurricane City because none would be located within a FEMA regulated 100-year floodplain. The flood damage reduction from implementation of this alternative were estimated at $2,444,300 annually as documented in the PR&G Report included in Appendix E.

The risk of flood-related mental health issues (depression, post-traumatic stress disorder, substance abuse, etc.) would be reduced over the long term. These costs were not calculated as part of the flood damage reduction due to uncertainties in calculation methods, but these indirect benefits are important to note as they influence impacted individuals financially.

Community unrest and political turmoil surrounding FEMA floodplain mapping regulations would be eliminated with implementation of the flood protection measures that remove Hurricane City from the 100-year regulated floodplain. However, with a large increase in channel size (wider

channel) and 1.4 miles (7,590 feet) for the constructed floodwall, some minor discontent could arise from residents who own land that adjoin the modified segments of Gould Wash. Therefore, a long-term moderate direct benefit of reduced community unrest/political turmoil surrounding FEMA floodplain mapping would occur, but minor direct long-term adverse impacts from some property owners adjoining the larger modified channel may also occur.

5.16.3 New Detention Dam and 3,000 cfs Channel Modifications

The long-term indirect beneficial impacts from protection against future flooding and direct long-term benefits of reduced community unrest/political turmoil of this alternative would be the same as those described for the other Action Alternative in Section 5.16.2 because it provides the same level of flood protection.

Direct long-term adverse impacts from some property owners adjoining the modified channel segments may occur. However, most of the modified Gould Wash channel through Hurricane City would be similar in size and/or appearance to the existing channel. The constructed floodwall segment would be 10 feet narrower than the other Action Alternative and only extend 3,200 feet. Therefore, this alternative is anticipated to be more accepted by adjoining landowners with less discontent than the other Action Alternative. These adverse impacts are expected to be negligible based on the similarity in channel size and/or appearance and flood protection tradeoff it would provide for the adjoining landowners.

5.17 Historic / Cultural Resources / Native American Religious Concerns

Refer to Sections 3.2.17 for historic properties within the APE. Section 106 of the NHPA of 1966, as amended (54 U.S.C. 300101), requires federal agencies to consider the effects of their undertakings on historic properties. Per 36 CFR 800.5, an undertaking would have adverse effects to historic properties when it may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the NRHP. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

5.17.1 No Action Alternative

The O&M along the Gould Wash channel would continue, but no disturbance would occur to resources that are eligible for listing or listed in the NRHP from these activities. The risk of flooding would remain with moderate indirect adverse impacts to historic properties within the benefited area. This includes 1 historic district, 2 structures, and 98 buildings.

5.17.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

Alternative measures would not disturb the historic canals, ditches, or laterals within the western segment of the Project area that are eligible for the NRHP. Therefore, no direct or indirect adverse effects to historic properties would occur. A moderate indirect benefit to historic properties within the benefited area would be achieved over the long term due to reduced risk of flooding and

associated reduced damage to 101 historic properties, consisting of 1 historic district, 2 structures, and 98 buildings.

5.17.3 New Detention Dam and 3,000 cfs Channel Modifications

As described for the other Action Alternative, no disturbance would occur to historic canals, ditches, or laterals within the western segment of the Project area. The historic properties identified in the eastern segment of the Project area would be avoided during construction with exclusionary fencing installed where appropriate, except for historic roads (sites 42W4397 and 42WS6188). These sites are existing active roads that would be used for construction access. A summary of effects to historic properties within the APE is provided below. The NRCS determined that this alternative would have no adverse effects to historic properties.

- 42WS4931 (Hurricane Canal and lateral ditches) – No Historic Properties Affected; the site would be entirely avoided.
- 42WS4397 (historic road to Virgin City) – No Adverse Effect; the road would be used to access the project construction areas with no improvement over the existing conditions and no historical features would be altered.
- 42WS4400 (prehistoric camp) – No Adverse Effect; the site straddles the paved modern day Gould Wash Road, and the paved road would be used for access. No artifacts or features were observed in the paved roadway and the usage of the existing modern road through the site without modification is not an adverse effect.
- 42WS5323 (Gould's shearing corral and prehistoric camp) – No Historic Properties Affected; the site will be avoided, and exclusionary fencing may be implemented to ensure avoidance.
- 42WS5328 (prehistoric camp and historical trash scatter) – No Historic Properties Affected; the site adjoins the paved Gould Wash Road, and the paved road would be used for access. No artifacts or features were observed in the paved road and the site would be avoided.
- 42WS6188 (historical Toquerville to Arizona Road) – No Adverse Effect; this road would be used to access the project construction areas with no improvement over existing conditions except for possible light grading to smooth the road. The road would not be widened or deepened appreciably.
- 42WS6990 (prehistoric camp) – No Historic Properties Affected; this site will be avoided and exclusionary fencing will be implemented to ensure avoidance.
- 42WS6991 (prehistoric camp and possible rock art): No Historic Properties Affected; this site adjoins the modern-day Gould Wash Road. The road will be used as is without improvement and the site avoided.

A moderate indirect benefit to historic properties within the benefited area would be achieved over the long term due to reduced risk of flooding to 101 historic properties, consisting of 1 historic district, 2 structures, and 98 buildings.

Section 106 consultation was completed for this alternative for a determination of **No Adverse Effect to Historic Properties** as described in Section 7.1. The NRCS as the lead federal agency

consulted with the SHPO, cooperating agencies (USACE, BLM, and EPA), and tribes on the determination of effects. NRCS consulted with 15 tribes to comply with EO 13007, 13175, the AIRFA, and the NHPA as described in Section 7.1.3. A consultation letter was sent to SHPO on November 6, 2024, to tribes on November 12, 2024, and USACE on November 13, 2024 (Appendix A). No consultation response has been received from the USACE. The BLM reviewed all cultural resource materials and provided their approval for the documented information (Appendix A). The SHPO concurred with the finding of effect in a letter dated December 24, 2024 (Appendix A). The Paiute Indian Tribe of Utah responded via email on January 22, 2025, concurring with no adverse effect to historic properties and recommended installing exclusionary fencing at site 42WS6990 beforehand. Refer to the referenced sections for consultation details and dates, and refer to Appendix A for documentation of consultation.

5.18 Public Health and Safety

Refer to Sections 3.2.18 for existing information on public health and safety within the area of potential impact.

5.18.1 No Action Alternative

The residents of Hurricane City would continue to have moderate adverse indirect impacts to their health and safety from the risk of future flooding over the long term. The community would suffer from degraded physical and mental health if a damaging flood were to occur. The risk of serious injury and loss of life would remain for all flood events greater than a 25-year flood. Table 5-9 provides the number of structures at risk of inundation for the 24-hour flood events.

Table 5-9. No Action Alternative Structures Flooded

Flood Event	Homes	Commercial/ Office	Schools	Churches	Post Office
2-Year	6	0	0	0	0
5-Year	70	0	0	0	0
10-Year	109	0	0	0	0
25-Year	393	30	2	3	1
50-Year	529	59	2	3	1
100-Year	650	99	2	4	1
500-Year	826	130	3	4	1

5.18.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

The residents of Hurricane City would experience moderate indirect benefits to their health and safety from the reduced risk of future flooding over the long term. The community would no longer be at risk of injury and loss of life for all future flood events up to and including a 100-year flood. The physical and mental health of the community would be improved following a large storm event due to avoided flooding and safe flood routing through the city. Table 5-10 provides the number of structures remaining at risk of inundation for the 24-hour flood events.

Table 5-10. Action Alternative Structures Flooded

Flood Event	Homes	Commercial/ Office	Schools	Churches	Post Office
2-Year through 100-Year	0	0	0	0	0
500-Year	96	1	0	0	0

5.18.3 New Detention Dam and 3,000 cfs Channel Modifications

The indirect long-term health and safety benefits from reduced future flooding would be the same as those described for the alternative in Section 5.18.2 because it provides the same level of flood protection.

This alternative also constructs an NRCS high hazard class detention dam upstream of Hurricane City with a risk of loss of life if the dam were to fail (refer to Section 2.4.3.2 of Appendix D). However, the dam would be constructed to meet all Utah and NRCS dam safety requirements for safe operation and passage of all required design storm events to protect the dam from a breach. An Emergency Action Plan (EAP) would be completed for the detention dam as described in Section 6.11. Additionally, the detention dam would be dry and would only hold water temporarily to attenuate flood flows during passage of large flood events (approximate 10-year flood and greater). Based on the dam meeting safety requirements and the normal dry dam conditions, a breach is not anticipated over the life of the structure and the structure is not anticipated to adversely impact the health and safety of the downstream community.

5.19 Recreation

Refer to Section 3.2.19 for existing recreation within the area of potential impact.

5.19.1 No Action Alternative

There would be no change to recreation for this alternative.

5.19.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

Alternative modifications along Gould Wash through Hurricane City would occur near the Three Falls Trailhead. The trail would remain open to recreationists during construction and no short-term impacts to recreation are anticipated. The O&M activities for the installed measures would not impact recreation access or recreation trails and no long-term impacts to recreation would occur from alternative measures or from O&M activities.

5.19.3 New Detention Dam and 3,000 cfs Channel Modifications

Alternative modifications along Gould Wash through Hurricane City would occur near the Three Falls Trailhead. The trail would remain open to recreationists during construction and no impacts to recreation along the trail are anticipated. Areas proposed for modifications in the eastern segment of the Project area are on BLM-managed lands that are open for public recreation; however, no impacts to recreation trails or trail access are anticipated. Recreationists would see increased construction traffic along existing vehicle roads, but it is not anticipated to deter recreationists from using the area. Therefore, the alternative is not anticipated to have a measurable short-term impact on recreation.

The O&M activities for the installed measures would not impact recreation access or recreation trails and no long-term impacts to recreation would occur from alternative measures or from O&M activities.

5.20 Land Use

Refer to Section 3.2.20 for existing land use within the area of potential impact.

5.20.1 No Action Alternative

There would be no change to land use for this alternative.

5.20.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

This alternative would require Hurricane City to purchase an easement for the modified channel segment and associated O&M access along the Gould Wash existing alignment (Appendix C, Map C10.1). Although the use of Gould Wash through Hurricane City would remain the same, the easement will secure real property rights for Hurricane City to protect and maintain the channel for flood conveyance. No short- or long-term adverse effects on land use are expected with the proper establishment and purchase of easement to construct and maintain the installed measures.

5.20.3 New Detention Dam and 3,000 cfs Channel Modifications

This alternative would require Hurricane City to purchase a permanent easement for the modified Gould Wash channel and associated O&M access along the Gould Wash existing alignment (Appendix C, Map C10.1). Although the use of Gould Wash through Hurricane City would remain the same, the easement would secure real property rights for Hurricane City to protect and maintain the channel for flood conveyance.

In the eastern segment of the Project area, temporary land use authorizations would be secured for the borrow/disposal areas consisting of up to 70.1 acres as depicted in Appendix C, Map C11.4. Approximately 40 acres of the temporary authorization could either be entirely on BLM-managed lands or divided between private and BLM-managed land, depending on the final placement of the 40-acre borrow/disposal area. In addition, a long-term ROW on approximately 265.8 acres of BLM land would be obtained for the detention dam, flood storage basin behind the dam, and access in and around the dam to perform O&M activities. The area would still remain open to the public after installation with the same land use, but would also serve an additional use as a flood detention area over the long term. No short- or long-term adverse effects on land use are expected with the proper establishment and purchase of easement to construct and maintain the installed measures

Grazing occurs on BLM-managed lands in the eastern segment of the Project area. Areas within the active work zones (approximately 90 acres) would be blocked from grazing access within the Hurricane Fault grazing allotment (Allotment No. 14028). The temporary grazing area closures would not block stock watering access and no stock watering occurs within the areas proposed for closure. Refer to Appendix C, Map C10.2 for temporary grazing restriction areas. Additionally, the area closed only accounts for less than 1 percent of the available grazing area of the pastures. Therefore, no measurable short-term impacts to grazing from construction activities are anticipated. After construction completion the areas would be restored and reopened for grazing access with no long-term impacts to grazing operations.

5.21 Visual Resources

Refer to Section 3.2.21 for existing visual resources within the area of potential impact.

5.21.1 No Action Alternative

There would be no change to visual resources and scenic beauty for this alternative. The existing O&M activities of sediment removal would continue. Temporary indirect impacts to visual quality would occur in areas disturbed from O&M activities until the disturbed areas are stabilized and vegetation reestablishes.

5.21.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

Minor short-term impacts are anticipated that would directly affect visual quality, due to disturbed lands and construction equipment parked or operating on those lands. Areas disturbed during construction activities would be restored after construction completion by grading to match natural contours and revegetated as described in Section 5.9.2. A section of Gould Wash channel through Hurricane City would include installation of a flood wall, but the flood wall would be designed to provide aesthetic qualities and incorporate vegetation. These measures are anticipated to provide visual character and quality for the floodwall segment. Therefore, long-term impacts to visual quality from installation of alternative measures are not anticipated.

The O&M disturbance activities would continue along Gould Wash through Hurricane City over the long term, similar to the baseline No Action Alternative. However, greater sediment loads in the channel may result in more frequent sediment removal O&M disturbance. This would increase the O&M direct impacts to visual quality from the No Action Alternative baseline with a minor indirect adverse impact.

5.21.3 New Detention Dam and 3,000 cfs Channel Modifications

The minor short-term impacts to visual quality for modifications of Gould Wash through Hurricane City during construction would be the same as those described for the alternative in Section 5.21.2. The O&M disturbance activities along the modified channel segment would continue over the long term, similar to the baseline No Action Alternative. However, decreased sediment loads in the channel may result in less frequent sediment removal O&M disturbance. This would decrease the O&M indirect impacts to visual quality from the No Action Alternative baseline.

Ground disturbing activities and construction of a detention dam would also occur in the eastern segment of the Project area. Short-term impacts to visual quality would occur during construction in the areas disturbed for borrow, staging, and dam construction. These areas do not offer scenic views, lack unique visual qualities, and/or are on previously disturbed lands. Construction disturbance would not block scenic views of the surrounding landscape. The disturbed areas would be restored and vegetation reestablished after the measures are installed. Therefore, the short-term visual impacts are anticipated to be minor.

Construction of the earthen embankment dam would alter the landscape at its location, but re-establishment of grass and herbaceous vegetative cover would blend the embankment to match surrounding plant communities. The dam is located on a desert valley floor that does not provide unique or scenic views and would not obstruct the scenic views of the surrounding mesa slopes or cliffs. Due to lack of recreation trails or recreation access, the area is not frequently used for recreation and not readily visible. Alterations for construction of the dam would be in compliance

with the BLM designated Visual Resource Management Class III of the area. The earthen dam embankment is not anticipated to have a measurable impact to the visual quality of the area based on the location, limited viewpoints/recreationists, lack of unique or scenic views, restoration and revegetation measures, and compliance with the BLM Visual Resource Management Class III requirements.

5.22 Transportation Infrastructure and Traffic

Refer to Section 3.2.22 for a description of existing transportation infrastructure within the area of potential impact.

5.22.1 No Action Alternative

There would continue to be an indirect adverse impact on transportation infrastructure over the long term from flooding along Gould Wash. Refer to Appendix C, Maps C8.1 and 8.2 for existing flood inundation extents during the 100-year and 500-year floods. Flood damage to roads was estimated at $95,000 annually (refer to Section 18.0 of Appendix D).

5.22.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

Alternative measures would modify water crossings along the Gould Wash channel alignment through Hurricane City to safely pass the anticipated 100-year flood flow of 8,820 cfs. This would include replacing four culverts and three bridges as described in Section 4.2.2.1. Short-term direct impacts to roadway sections at the water crossings would occur, including road closures or partial road closures with traffic detours. This may slow traffic movement through the area and place temporary increases in traffic flow on surface roads for detours. A summary of the road closures for bridge/culvert replacement is provided in Table 5-11. Closures would occur along minor/major collector roads and on a major arterial. Based on the number of closures, duration of closure, and closure impacts to major collectors and an arterial, the work would have a moderate nuisance and delay impact to local traffic and commuters. Work on culverts/bridges would be sequenced to avoid multiple culvert/bridge closures at the same time in the same area. The roads would reopen for normal traffic flow after construction completion.

Table 5-11. 8,820 cfs Channel - Road Closure for Culvert/Bridge Replacements

Location	Structure Type Replaced	Road Type	Estimated Closure or Partial Closure Time
600 N	Culvert	Minor arterial	1 month
1580 W	Culvert	Minor collector	1 month
State Route 9 (State Street)	Culvert	Minor arterial	6 months
1150 W	Culvert	Minor collector	1 month
700 W (Airport Road)	Bridge	Major collector	3 months
400W	Bridge	Minor collector	3 months
180 W	Bridge	Minor collector	3 months

Alternative improvements would reduce future Gould Wash flooding to Hurricane City and associated roadways providing indirect minor benefits to roadway corridors over the long term.

No flooding would occur to roadways for up to and including a 100-year flood event and a substantial decrease in flooding to roadways would occur during a 500-year flood. This would reduce flood damage to transportation infrastructure by an estimated $94,200 annually (refer to Section 18.0 of Appendix D).

5.22.3 New Detention Dam and 3,000 cfs Channel Modifications

This alternative would have the same long-term indirect benefits of reduced flooding as described for the other Action Alternative in Section 5.22.2. Short-term direct impacts during construction would be less than those described for the other Action Alternative, with less water crossings being modified. Only two culverts would be replaced as presented in Table 5-12 and described in Section 4.2.2.2. Impacts include road closures or partial road closures with traffic detours. Grading and sediment excavation would occur under 3 bridges, but activities would not be performed on the road, and road closures are not anticipated to complete this work. Based on the short duration of road closures and type of roads as minor collectors, the work would have a minor nuisance and delay impact for local traffic.

Table 5-12. 3,000 cfs Channel - Road Closure for Culvert/Bridge Replacements

Location	Structure Type Replaced	Road Type	Estimated Closure or Partial Closure Time
1580 W	Culvert	Minor collector	1 month
1150 W	Culvert	Minor collector	1 month

5.23 Noise and Vibration

Please refer to Section 3.2.23 for existing noise and vibration conditions within the area of potential impact.

5.23.1 No Action Alternative

There would be no change to noise or vibration conditions for this alternative. The existing O&M activities of sediment removal along Gould Wash through Hurricane City would continue. Temporary indirect noise impacts to nearby residences/businesses would occur during O&M activities.

5.23.2 Increase Channel Capacity Through Hurricane for 8,820 cfs

Applicable Hurricane City, Washington County, and BLM noise laws do not provide specific criteria for permissible noise or vibration levels during construction activities. However, the Federal Transit Administration (FTA) has developed noise and vibration criteria that could be considered reasonable criteria for consideration.

Noise criteria vary based on the existing noise environment and adjacent land use. The FTA criteria note a 90 A-weighted decibel (dBA) day limit for residential areas, and 100 dBA day limit for commercial and industrial areas for a general assessment on construction noise (FTA 2018). The FTA construction vibration damage criteria are included in Table 5-13 (FTA 2018). The criteria include peak particle velocity (PPV) for various structure categories to prevent damage. The criteria for human interference is included in Table 5-14 which are expressed in U.S reference

velocity units of one micro-inch per second, abbreviated as VdB. Most buildings near the Project area are residential and would likely be considered category III buildings from Table 5-13. Land uses of the surrounding properties would fall under Category 2 and Category 3 from Table 5-14.

Table 5-13. Construction Vibration Damage Criteria

Building/Structural Category	PPV (in/sec)
I. Reinforced-concrete, steel or timber (no plaster)	0.5
II. Engineered concrete and masonry (no plaster)	0.3
III. Non-engineered timber and masonry buildings	0.2
IV. Buildings extremely susceptible to vibration damage	0.12

** Root mean square velocity in decibels, VdB re 1 micro-inch per second*

Table 5-14. Impact Criteria for Indoor Ground-Borne Vibration

Land Use Category	Frequent Events (VdB)	Occasional Events (VdB)	Infrequent Events (VdB)
Category 1: Buildings where vibration would interfere with interior operations.	65	95	65
Category 2: Residences and buildings where people normally sleep.	72	75	80
Category 3: Institutional land uses with primarily daytime use.	75	78	83

During construction activities, noise and vibration could be generated that would constitute a moderate nuisance to nearby rural residences and commercial/office buildings. Construction in the western portion of the Project area would occur near sensitive receptors (primarily residences). The community would experience increases in noise and vibration during construction activities. Table 5-15 depicts the noise sources during construction and associated noise emission levels at 50 feet from the noise source. Table 5-16 depicts the peak particle velocity (PPV) from the vibratory activities for this alternative anticipated at 25 feet from the source.

Table 5-15. dBA for Construction Equipment

Construction Equipment	dBA @ 50 feet
Backhoe	78
Compactor (ground)	83
Concrete Mixer Truck	79
Concrete Pump Truck	81
Crane	81
Dozer	82
Dump Truck	76
Excavator	81
Flatbed Truck	74
Front End Loader	79
Grader	85
Paver	77

Construction Equipment	dBA @ 50 feet
Pickup Truck	75
Scraper	84
Vacuum Street Sweeper	82
Warning Horn	83

Source: Federal Highway Administration 2018

Table 5-16. PPV for Construction Equipment

Construction Equipment	PPV @ 25 feet
Pile Driver (sonic/vibratory)	0.170-0.734
Vibratory Roller	0.210
Loaded Trucks	0.076
Large Bulldozer	0.089
Small Bulldozer	0.003

Source: FTA 2018

The noise levels for construction equipment are below the FTA criteria of a 90 dBA day limit for residential areas. Vibration levels would be under the 0.2 PPV criteria for damage to category III buildings (non-engineered timber and masonry buildings), except for pile driving. Vibratory roller activities would be greater than 25 feet from buildings and are not anticipated to exceed the 0.2 PPV criteria. If vibration activities for pile driving were found to exceed the damage threshold during construction, measures would be implemented to minimize vibration damage using feasible means.

The noise and vibration levels would not be continuous throughout the entire workday and would move with construction equipment as activities progressed along the channel alignment. Noise control programs (42 U.S.C. 4913) and any appliable noise/vibration regulations within BLM, Washington County, or Hurricane City jurisdiction (as applicable and identified in Section 3.2.23) would be followed. Noise minimization efforts may include avoiding operation of mechanical equipment between the hours of 10:00 p.m. and 6:00 a.m. per Hurricane City and Washington County Code, and outfitting construction equipment with noise dampening measures (if needed). The following measures would also be implemented in the western portion of the Project area to inform sensitive receptors of work activities and address noise complaints.

- Property owners within 500 feet of the work boundary would be notified by the Hurricane City of the anticipated noise/vibration disturbances at least two weeks prior to construction.
- A vibration monitoring specification will be developed during the design phase that will be implemented by the contractor during construction.
- A contact number to register noise/vibration complaints would be provided in the owner notification.
- Noise complaints and resolution would be documented and handled by Hurricane City.

Noise and vibration are anticipated to have a direct moderate impact to occupants of nearby residences/businesses during construction, but noise regulation/criteria would be adhered and minimization measures implemented as described above. Impacts would be short-term and noise levels would return to normal after construction completion.

The O&M activities would continue along Gould Wash through Hurricane City over the long term, similar to the baseline No Action Alternative. However, greater sediment loads in the channel may result in more frequent sediment removal O&M activities. This would increase the noise O&M indirect impacts from the No Action Alternative baseline.

5.23.3 New Detention Dam and 3,000 cfs Channel Modifications

The alternative impacts in the western segment of the Project area would be similar as those described for the alternative in Section 5.23.2, except the minimal bridge modifications are not anticipated to require pile driving. Therefore, noise levels for construction equipment would be below the FTA criteria of a 90 A-weighted decibel (dBA) day limit for residential areas, and vibration levels would be under the 0.2 PPV criteria for damage to category III buildings. Noise and vibration are anticipated to have a direct moderate impact to occupants of nearby residences/businesses during construction, but the same measures would be implemented as described for the alternative in Section 5.23.2, to inform sensitive receptors of work activities and address noise complaints.

The eastern segment of the project area does not contain populations that would be sensitive to noise or vibration, except for one location (Three Points Center) that is located near the Gould Wash Road construction access route. The Three Point Center is located over ¾ miles from areas where construction work activities would occur, therefore, nuisance noise would be from increased vehicle/equipment traffic along Gould Wash Road. There would be a minor short-term increase in noise during construction. After construction completion noise levels would return to existing conditions.

The O&M activities in the western segment of the Project area would continue along Gould Wash through Hurricane City over the long term, similar to the baseline No Action Alternative. However, decreased sediment loads in the channel may result in less frequent sediment removal O&M activities. This would decrease the noise O&M indirect impacts from the No Action Alternative baseline. The O&M activities in the western segment of the Project area are anticipated to be similar to existing conditions with no increase in noise generated. In the eastern segment of the Project area, new routine O&M activities would occur at the detention dam, but noise and vehicle traffic changes would be unnoticeable from existing conditions. Additionally, the location of the dam is over 1-mile from the nearest occupied building. Therefore, no long-term noise or vibration impacts to people are anticipated in the eastern segment of the Project area from O&M activities.

5.24 Cumulative Effects

A list of known past, present, or reasonably foreseeable future actions in the vicinity of the Project area is provided below. The area over which the cumulative effects are evaluated varies by resource, as the nature and range of potential effects vary by resource. A potential for cumulative impact was identified if a relationship exists such that the impacts from the Project might affect or be affected by impacts from another action.

- Hurricane City Pressurized Irrigation: This consists of installing irrigation piping and a pump station in Hurricane City to convert 715 acres of agricultural land from flood irrigation to sprinkler irrigation. The action would improve water supply, conservation and irrigation delivery. Water savings after construction is completed are estimated at 800 to 1,200 ac-ft per year, or 1,050 to 1,600 ac-ft per year in a wet year. Water would be returned or left in the Virgin River for improved water quality and quantity in the river. These actions would

also support species and habitat along the Virgin River corridor that relies on Virgin River water flows. The action is currently under construction and estimated for completion in December of 2025.

- Frog Hollow Dam Rehabilitation: The existing dry detention dam along Frog Hollow upstream of Hurricane City, is proposed for modification to bring the structure up to current safety standards and extend the life of the structure. The measures would improve the safety of the detention dam and extend the benefits of sediment and flood retention the dam provides for the next 100 years. The Frog Hollow channel drains to a low-lying area and does not have connectivity to the Virgin River, Gould Wash, or downstream jurisdictional waters. The dam rehabilitation is currently in construction and is anticipated for completion in December 2024.
- Gould Wash Trail System: The Hurricane City Trails Master Plan (Hurricane City 2021b) identifies a future unpaved trail along Gould Wash through the city. The trail extends from the existing Hurricane Cliffs Trailhead northwest along the wash to the southern edge of the canyon at the Virgin River. It is anticipated that after the Gould Wash Flood Protection Project has been implemented and constructed, the City of Hurricane would extend a new unpaved trail in the upland adjoining the wash. With an anticipated completion for the Gould Wash Flood Protection Project in 2030, construction of the trail is estimated to take place in or after 2031.
- Pedestrian Crossing at 180 W Road and Gould Wash: The existing bridge crossing at Gould Wash and 180 W Road does not have a pedestrian or bike crossing. Hurricane City will be adding a sidewalk to the bridge which will connect to the existing sidewalks that currently end at the bridge. This will improve public safety for elementary school students that have to cross the bridge daily to get to school and for the public that uses the bridge. Construction to install the sidewalks is estimated to take place in the summer of 2025 and take one month to install.
- Road Improvements at 700 W Road and Gould Wash: Hurricane City will be replacing the 700 W bridge crossing and improving the roads around the bridge. The bridge crossing has two T-intersections on either side and three pedestrian crosswalks through the area. The improvements will improve public safety and provide better traffic flow. Construction is anticipated to start in winter of 2025 and take four months to complete.

The location of the other actions to the Project area is provided in Appendix C, Map C12. Most adverse impacts from Project alternatives are short-term during construction and the alternatives are proposed to provide long-term benefits. Similarly, the other actions have short-term adverse impacts during construction and are intended to provide long-term benefits to various resources including water, public health and safety, floodplain management, recreation, socioeconomics, and Virgin River fish/wildlife/habitat. The short-term construction impacts from all actions do not occur at the same time and/or place nor do they overlap and therefore, do not combine to create cumulative adverse impacts. Cumulative impacts determined for each resource for the Project alternatives and other actions are included in Table 5-17.

Table 5-17. Cumulative Impacts

Alternative	Cumulative Impact
Upland Erosion	
No Action Alternative	No measurable direct or indirect upland erosion impacts would occur. Therefore, the alternative would not contribute to cumulative impacts when combined with the other actions.
Action Alternatives	Direct short-term erosion impacts are anticipated for the Action Alternatives along with minor indirect long-term impacts. The construction timeframes for the other actions do not overlap with the proposed Action Alternatives, and the other actions would not result in long-term impacts to upland erosion. Therefore, the combined actions would not contribute to cumulative impacts for upland erosion.
Sedimentation	
No Action Alternative	No direct sedimentation impacts would occur for this alternative. The indirect adverse impact of sediment deposition would continue to occur in developed areas of Hurricane City that are flooded. However, none of the other actions result in adverse sedimentation conditions that would cumulatively contribute to this adverse impact.
Increase Channel Capacity Through Hurricane for 8,820 cfs Alternative	No direct sedimentation impacts would occur for the alternatives. Indirect impacts to sedimentation changes in the Virgin River were determined to be negligible. The Frog Hollow Dam Rehabilitation and Gould Wash Trail System have no influence on sediment transport through Gould Wash or to the Virgin River. The Hurricane City Pressurized Irrigation Project would eliminate flood irrigation return flows into Gould Wash. However, these flows are minimal and typically infiltrate before reaching the Virgin River. The irrigation return flows do not have a measurable influence on sediment transport in the wash based on the small volumes and low water velocities. The 180 W Road and 700 W Road modifications are also not anticipated to change sediment transport conditions in the wash. Therefore, the Project combined with the other actions would not have a measurable contribution to cumulative sedimentation impacts to the Virgin River. This alternative and the Frog Hollow Dam Rehabilitation both protect Hurricane City from flooding and reduce adverse sediment deposition in developed areas. These combined actions would cumulatively provide a moderate long-term benefit of reduced sedimentation to the developed community.
New Detention Dam and 3,000 cfs Channel Modifications	No direct sedimentation impacts would occur for the alternatives. The alternative actions were determined to have negligible indirect impacts with no measurable net change to sedimentation in the Virgin River. As described for the other Action Alternative, the Frog Hollow Dam Rehabilitation, Gould Wash Trail System, Hurricane City Pressurized Irrigation and road improvement projects have no influence on sediment transport through Gould Wash or to the Virgin River. Therefore, the Project combined with the other actions would not have a measurable contribution to cumulative sedimentation impacts to the Virgin River. This alternative and the Frog Hollow Dam Rehabilitation both protect Hurricane City from flooding and reduce adverse sediment deposition in developed areas. These combined actions would cumulatively provide a moderate long-term benefit of reduced sedimentation to the developed community.

Alternative	Cumulative Impact
Prime and Unique Farmlands	
No Action Alternative	No direct impacts to prime and unique farmlands would occur for this alternative. The indirect adverse impact of flooding to prime and unique farmlands in Hurricane City would continue to occur. However, none of the other actions result in impacts that would cumulatively contribute to this adverse flooding impact.
Action Alternatives	Impacts to prime and unique farmlands are direct and short-term, only occurring during Project construction disturbance with no impacts after construction. The construction timeframes for the other actions do not overlap with the Project. Therefore, the Project does not contribute to a cumulative adverse impact on prime and unique farmlands. The proposed Action Alternatives and the Frog Hollow Dam Rehabilitation both protect Hurricane City from flooding and reduce adverse flooding impacts to prime and unique farmlands. These combined actions would provide a moderate long-term cumulative benefit of reduced flood damage to prime and unique farmlands in and around Hurricane City.
Surface Water Quality	
No Action Alternative	The risk to water quality from future overland flooding of developed areas would continue to pose an indirect adverse threat to water quality of the Virgin River. However, the other actions do not result in adverse water quality conditions that would cumulatively contribute to this impact.
Action Alternatives	Cumulative adverse impacts to surface water quality are not anticipated for either Action Alternative because the alternative actions were determined to have negligible impacts and none of the other actions occur at the same time and/or same place as the Action Alternatives to have a cumulative contribution. The pressurized irrigation project would reduce contaminants in surface water as flood irrigation practices are converted to sprinkler irrigation, decreasing the amount of agricultural contaminated water entering Gould Wash. It would also reduce water diversions from the Virgin River directly benefiting water quality. The indirect benefits of reduced potential for floodwater contamination from the Action Alternatives combined with the pressurized irrigation project would provide a minor cumulative benefit of improved surface water quality for Gould Wash and the Virgin River.
Surface Water Quantity and Flow	
No Action and Action Alternatives	The other actions do not change surface water quantity and flow, and/or do not result in adverse flow conditions. Therefore, the other actions do not contribute to the No Action Alternative adverse Gould Wash channel capacity flood flow constraints nor the projected increased frequency and intensity of floods.
Increase Channel Capacity Through Hurricane for 8,820 cfs Alternative	This alternative increases water depths and velocities in the Gould Wash channel downstream of the channel improvements, with minor adverse impacts of increased erosion. The other actions do not change surface water quantity and flow, and/or do not result in adverse flow conditions. Therefore, the other actions do not contribute to the alternative's adverse impact. Both the alternative and the From Hollow Dam Rehabilitation help to manage and convey flood flows. The combined actions provide cumulative benefits of increased resilience to the projected rise in flood frequency and intensity.

Alternative	Cumulative Impact
New Detention Dam and 3,000 cfs Channel Modifications	This alternative decreases water depths and velocities in the Gould Wash channel downstream of the channel improvements, with minor benefits of decreased erosion. The other actions do not change surface water quantity and flow except for the Frog Hollow Dam improvements. Frog Hollow Dam after rehabilitation would be maintained as it has been since the construction of the detention dam in 1955, but the service life of the dam would be extended 100 years. The Frog Hollow dam decreases water depths and velocities in the downstream channel which reduces channel erosion potential. The combined actions would have a minor cumulative benefit of decreased water velocities and associated channel erosion for areas around Hurricane City. Both the alternative and the Frog Hollow Dam Rehabilitation help to manage and convey flood flows. The combined actions provide cumulative benefits of increased resilience to the projected rise in flood frequency and intensity.
Waters of the U.S. and Wetlands	
No Action and Action Alternatives	The non-Project actions do not alter waters of the U.S. or wetlands. Therefore, they would not contribute to cumulative impacts when combined with the Project alternatives.
Floodplain Management	
No Action Alternative	The indirect adverse impact from the risk of flooding to Hurricane City would remain. However, the other actions do not result in adverse flooding conditions that would cumulatively contribute to this impact.
Action Alternatives	No floodplain management changes would occur from the other actions, except for the Frog Hollow Dam Rehabilitation. The dam rehabilitation actions extend the life of the Frog Hollow Dam for 100 years providing long-term benefits of flood prevention for Hurricane City. The Project alternatives and Frog Hollow Dam rehabilitation provide a moderate long-term cumulative flood prevention benefit for Hurricane City.
Air Quality	
No Action	No measurable impacts to air quality would occur for this alternative. Therefore, the alternative would not have a measurable contribution to cumulative impacts.
Action Alternatives	The emissions from both alternatives were determined to be negligible. The combined construction activities of all actions would contribute to emissions. However, the construction timeframes for the other actions do not overlap with the Project. Additionally, the other actions are much smaller in scale than the Action Alternatives with less emissions and the area is not located in a nonattainment or maintenance area. Therefore, the cumulative emissions are expected to be de minimis with negligible impacts.
Special Status Plant Species	
No Action and Action Alternatives	There are no impacts to special status plant species for the Project alternatives and the alternatives would not contribute to cumulative impacts.
N&I Weeds	
No Action and Action Alternatives	Direct Project impacts would be offset through control of N&I species during and after construction disturbance and non-Project actions do not occur during the same time and/or place as the Project actions. Therefore, no cumulative impacts are anticipated.

Alternative	Cumulative Impact
Riparian Areas	
No Action and Action Alternatives	The Project alternative actions directly impact riparian areas along the Gould Wash channel bottom, but these impacts are temporary and the riparian areas would reestablish after construction completion. Due to lack of presence of riparian areas at Frog Hollow Dam or along the Gould Wash trail, no impacts would occur to riparian areas from these actions. The pressurized irrigation actions would not directly remove riparian areas but it would remove flood irrigation return flows that may indirectly impact artificially-supported riparian areas along the Gould Wash channel bottom. However, the conserved irrigation water would be used to increase flow in the Virgin River that would support natural riparian vegetation. The reduction in artificially supported riparian areas along Gould Wash for the improved support of natural riparian vegetation of the Virgin River would benefit the natural riparian corridor. Therefore, the combined actions are not expected to have adverse net cumulative impacts to riparian areas.
Fish and Wildlife (Including Migratory Birds, Bald Eagles, and Golden Eagles)	
No Action Alternative	The temporary disturbance to low-quality habitat along Gould Wash through Hurricane City for O&M would continue for this alternative. However, O&M actions would not occur at the same time and/or place as the other actions and are not anticipated to contribute to cumulative impacts.
Increase Channel Capacity Through Hurricane for 8,820 cfs Alternative	The direct temporary impacts to wildlife of this alternative do not occur at the same time and/or place as the other actions and are not anticipated to contribute to cumulative impacts. Increased flood depth, velocity, and sediment load to the Virgin River may have indirect adverse impacts to fish, wildlife, and associated habitat of the Virgin River. However, the other actions do not result in adverse impacts to fish, wildlife, or habitat of the Virgin River that would contribute to a cumulative adverse impact.
New Detention Dam and 3,000 cfs Channel Modifications	The direct temporary impacts to wildlife of this alternative do not occur at the same time and/or place as the other actions and are not anticipated to contribute to cumulative impacts. No measurable long-term adverse impacts to fish, wildlife, or habitat are anticipated for this alternative. Therefore, no cumulative adverse impacts are anticipated.
Special Status Animal Species	
No Action Alternative	There are no impacts to special status animal species for this alternative and the alternative does not contribute to cumulative impacts.
Increase Channel Capacity Through Hurricane for 8,820 cfs Alternative	This alternative was found to have indirect long-term adverse impacts in desert tortoise critical habitat and to sensitive species in the Virgin River. However, none of the other actions occur in desert tortoise habitat nor have adverse impacts to sensitive species in the Virgin River. Therefore, no cumulative adverse impacts are anticipated.
New Detention Dam and 3,000 cfs Channel Modifications	Short-term impacts to sensitive species were determined to be negligible with no long-term impacts. The other actions do not occur at the same time and/or place and would not have a cumulative contribution to the short-term negligible impacts. Therefore, no cumulative impacts to special status animal species would occur.

Alternative	Cumulative Impact
Social Issues and Local Economy	
No Action Alternative	The risk of flooding to Hurricane City and adverse indirect impact to wellbeing, prosperity, health, and safety would remain as well as the flood damage. The other actions would alleviate social public safety issues and improve the economy of Hurricane City and do not result in adverse impacts. Therefore, the other actions do not contribute to cumulative adverse impacts.
Action Alternatives	The Project alternatives would provide an indirect benefit to the wellbeing, prosperity, health, and safety of the community as well as reduce flood damage. The other action would also provide benefits to the public safety and economy of Hurricane City. The combined actions are anticipated to provide a moderate benefit to the socioeconomic conditions of Hurricane City.
Historic/Cultural	
No Action Alternative	The indirect adverse impacts from risk of flooding to historic properties would remain. However, the other actions would not result in adverse impacts to historic or cultural resources. Therefore, they would not contribute to cumulative impacts when combined with this alternative.
Action Alternatives	The Project alternatives were determined to have no adverse effects to historic properties or historic properties and no Native American religious concerns were identified. The other actions would not result in adverse impacts to these resources. Therefore, no cumulative adverse impacts would occur.
Health and Safety	
No Action	The risk of flooding to Hurricane City and adverse indirect impact to public health and safety would remain. However, the other actions would not result in adverse impacts to public health or safety. Therefore, they would not contribute to cumulative adverse impacts when combined with this alternative.
Action Alternatives	The Project alternatives provide an indirect benefit to public health and safety in Hurricane City from the flood protection measures. The Frog Hollow Dam rehabilitation measures and road improvements also benefit public health and safety for Hurricane City. The combined actions are anticipated to provide a moderate benefit to public health and safety for the community in Hurricane City.
Recreation	
No Action and Action Alternatives	There are no impacts to recreation for the Project alternatives and they would not contribute to cumulative impacts.
Land Use	
No Action Alternative	There are no changes to land use for this alternative and it would not contribute to cumulative impacts.
Increase Channel Capacity Through Hurricane for 8,820 cfs Alternative	Land use along the Gould Wash channel for flood conveyance would remain the same and no adverse impacts to land use would occur to contribute to cumulative adverse impacts.

Alternative	Cumulative Impact
New Detention Dam and 3,000 cfs Channel Modifications	Land use along the Gould Wash channel for flood conveyance would remain the same and no adverse impacts to land use would occur to contribute to cumulative adverse impacts. Temporary restrictions on public access and grazing access would occur during construction on BLM-managed lands for this alternative, but would return to normal after construction completion. None of the other actions occur at the same time or place to contribute a cumulative impact on these temporary restrictions.
Visual Resources	
No Action and Action Alternatives	Direct adverse visual impacts to visual quality would be short-term for alternative actions, only occurring during construction or for O&M. Direct adverse visual impacts would also occur during construction for the other actions. However, the alternative actions do not occur at the same time and/or place as the other actions and are not anticipated to have cumulative adverse impacts to the visual quality in Hurricane City. No long-term impacts to visual quality from the alternative actions or the other actions are anticipated as disturbed areas would be restored after construction. Therefore, no cumulative impacts to visual resources are anticipated.
Transportation Infrastructure and Traffic	
No Action Alternative	The alternative would continue to have an indirect adverse impact on transportation infrastructure from risk of flooding along Goud Wash. However, the other actions would not result in adverse impacts that compromise transportation infrastructure. Therefore, they would not contribute to cumulative adverse impacts when combined with this alternative.
Action Alternatives	Direct impacts to transportation infrastructure and traffic would be short-term, only occurring during Project construction. The alternative actions do not occur at the same time and/or place as the other actions and are not anticipated to have cumulative adverse impact on traffic. Indirect benefits would be achieved for the Project Action Alternatives that would protect transportation infrastructure from flooding, which is also accomplished by the Frog Hollow Dam rehabilitation. The two projects combined would have a moderate cumulative benefit that would protect transportation infrastructure in Hurricane City from flood damage.
Noise and Vibration	
No Action Alternative	Temporary direct noise impacts to occupants of residences and businesses would continue to occur during O&M activities. However, the O&M activities are not anticipated to occur at the same time and/or place as the other actions and are not anticipated to have cumulative adverse impacts.
Action Alternatives	Temporary direct noise impacts to occupants of residences and businesses would occur during construction. However, the activities are not anticipated to occur at the same time and/or place as the other actions and are not expected to have cumulative adverse impacts. Similar to the No Action Alternative, O&M activities would produce noise, but those activities would also not occur at the same time and/or place to contribute to cumulative noise impacts.

5.25 Summary and Comparison of Alternative Plans

The alternatives proposed for consideration and analyzed in detail in this Plan-EIS have been compared against each other to discern the merits and disadvantages of each alternative. This includes a side-by-side comparison of environmental, social, and economic effects.

Alternatives were compared to select one alternative that "best" maximized public benefits (environmental, economic, and social goals) with appropriate consideration of costs, guiding principles, the federal objective, PL 83-566 general purposes, and ecosystem services. This alternative is known as the NRCS preferred alternative. The NRCS preferred alternative for the Project was determined to be the New Detention Dam and 3,000 cfs Channel Modifications Alternative based on the alternative analysis performed. A PR&G Analysis was completed in support of decision-making for the preferred alternative and an Ecosystem Services Tradeoff Analysis Evaluation Table is included in Appendix E. The preferred alternative was also determined to be the USACE LEDPA based on the results of the 404(b)(1) analysis. A copy of the 404(b)(1) Analysis is included in Appendix E.

5.25.1 Summary of Effects on Resource Concerns

A summary of effects for the resource concerns for the final array of alternatives is provided in Table 5-18. Effects are grouped together between the alternatives in the table if they are the same and are separated if the impacts are different. Impacts that were determined to be negligible, not measurable, or would not occur, are not included in the table below. Please refer to the detailed analysis in Sections 5.1 through 5.23 for more detailed information on effects to resources.

Table 5-18. Summary and Comparison of Alternatives – Effects on Resource Concerns

Resource Concern/Item	No Action Alternative	Increase Channel Capacity Through Hurricane for 8,820 cfs	New Detention Dam and 3,000 cfs Channel Modifications
Soils			
Upland Erosion	Upland erosion conditions would not change and no measurable impacts would occur.	Direct short-term impacts on 52.7 acres of land would occur from construction disturbance. Impacts would be minor with implementation of BMPs and restoration/stabilization after construction is completed with no long-term impacts. Minor indirect adverse impacts of increased channel erosion potential from future flood events would occur over the long term.	Direct short-term impacts on 157.3 acres of land would occur from construction disturbance. Impacts would be minor with implementation of BMPs and restoration /stabilization after construction is completed with no direct long-term impacts. Minor indirect benefits of reduced channel erosion potential during future flood events would occur over the long term.
Sedimentation	Indirect long-term adverse impacts would occur from sediment deposition in developed areas of Hurricane City that are located within the floodplain and exposed to future flood risks.	Indirect long-term benefits would occur from reduced sediment deposition in developed areas of Hurricane City for future flood events. Indirect adverse impacts of increased sediment deposition in Gould Wash are expected with increased frequency for O&M.	This alternative has the same long-term benefit as described for the other Action Alternative with an added indirect benefit of reduced sediment deposition in Gould Wash that would decrease the frequency of future O&M.

Resource Concern/Item	No Action Alternative	Increase Channel Capacity Through Hurricane for 8,820 cfs	New Detention Dam and 3,000 cfs Channel Modifications
Prime and Unique Farmlands	Indirect long-term adverse impacts would occur to 177.26 acres of prime farmland and 1.24 acres of farmland of statewide importance from continued risk of flooding.	Minor direct impacts would occur from temporary disturbance on 3.66 acres of prime farmland, but the areas would be restored and no direct long-term impacts would occur to these soils. Indirect long-term moderate benefits to farmland production would occur on 177.26 acres of prime farmland and 1.24 acres of farmland of statewide importance from the removed risk of flooding to these areas for up to and including a 500-year flood.	
Water			
Surface Water Quality	Introduction of contaminants from future overland flooding of developed areas could have indirect adverse impacts of degradation to water quality of the Virgin River and downstream water uses over the long term.	An indirect long-term benefit to Virgin River water quality would occur from avoided future overland flooding and associated risk of degradation to Virgin River water quality and downstream water uses over the long term.	
Surface Water Quantity and Flow	The adverse flood flow quantities and limited Gould Wash channel conveyance capacities would remain over the long term. The projected increase in flood frequency and intensity would remain.	There would be an indirect moderate benefit for better management of flood flow conveyance through Hurricane City and increased resilience to the project rise in flood frequency and intensity over the long term. Indirect adverse impacts may occur from higher future flood volumes downstream of the channel improvements.	This has the same indirect benefit as the other Action Alternative with an added indirect benefit of decreased future flood volumes downstream of the channel improvements.
Waters of the U.S.	Minor indirect adverse impacts from sediment/debris removal O&M activities along approximately 12,540 linear feet of Gould Wash through Hurricane City would continue over the long term.	Short-term direct minor impacts would occur from temporary disturbance along 13,500 linear feet of Gould Wash. No direct long-term impacts to stream function would occur based on implementation of avoidance, minimization, and restoration measures. A minor indirect adverse impact to Gould Wash would occur from more frequent O&M disturbance.	Short-term direct minor impacts would occur from temporary disturbance along 13,250 linear feet of Gould Wash (12,540 linear feet in Hurricane City and 710 linear feet at the proposed detention dam). No direct long-term impacts to stream function would occur based on implementation of avoidance, minimization, and restoration measures. A minor indirect benefit to Gould Wash would occur from less frequent O&M disturbance.

Resource Concern/Item	No Action Alternative	Increase Channel Capacity Through Hurricane for 8,820 cfs	New Detention Dam and 3,000 cfs Channel Modifications
Floodplain Management	A moderate indirect adverse impact from future risk of flood damage within Hurricane City would remain with risk of injury or death. The projected increased frequency and intensity of floods would continue to threaten the community over the long term.	Hurricane City would see a moderate indirect long-term benefit from flood protection for a 100-year flood and substantially reduced flooding for a 500-year flood. The community within the benefited area would no longer be at risk of injury or death and buildings, lands, roads, infrastructure, and utilities would be protected during a 100-year flood. The measures would increase resilience to the project rise in flood frequency and intensity.	
Air Quality			
Air Quality	There would be no change to air quality conditions.	No short-term adverse effects to air quality or GHGs would occur for construction of the preferred alternative based on negligible construction emissions, emission values under the EPA general conformity de minimis thresholds, no requirements for air quality permits, GHG emissions below the EPA reportable limits, the location of the Project outside of nonattainment or maintenance areas, implementation of BMPs, and the short-term of construction. Measurable long-term impacts to air quality are not expected from continuation of O&M activities.	
Plants			
Vegetation Communities	Minor indirect adverse impacts to vegetation from sediment/debris removal O&M activities along approximately 12,540 linear feet of Gould Wash through Hurricane City would continue over the long term.	Minor direct short-term impacts would occur from temporary disturbance on 7.4 acres of vegetated lands that would be restored after construction completion. A minor indirect adverse impact to vegetation along Gould Wash would occur from more frequent O&M disturbance.	Minor direct short-term impacts would occur from temporary disturbance on 111.3 acres of vegetated lands that would be restored after construction completion. A minor indirect benefit to vegetation along Gould Wash would occur from less frequent O&M disturbance.
Special Status Plant Species	There would be no impacts to special status plant species or suitable habitat for this alternative because none are present within the areas proposed for installation of alternative measures or for O&M activities.		

Resource Concern/Item	No Action Alternative	Increase Channel Capacity Through Hurricane for 8,820 cfs	New Detention Dam and 3,000 cfs Channel Modifications
Noxious Weeds and Invasive Plants	The indirect negligible to minor impacts for N&I future invasion risks would continue over the long term from O&M disturbance.	Minor short-term direct impacts for risk of invasion of N&I weeds on 7.4 acres from construction disturbance. Minor direct long-term benefits are expected from native (weed free) vegetation restoration, development of a PCRP, and implementation of BMPs. N&I future invasion risks would increase over the long term from more frequent O&M disturbance.	Minor short-term direct impacts for risk of invasion of N&I weeds on 111.3 acres from construction disturbance. Minor direct long-term benefits are expected from native (weed free) vegetation restoration, development of a PCRP, and implementation of BMPs. Minor indirect benefits would occur from N&I future invasion risks would decrease over the long term from less frequent O&M disturbance.
Riparian Areas	Minor indirect adverse impacts to riparian vegetation from sediment/debris removal O&M activities along approximately 12,540 linear feet of Gould Wash through Hurricane City would continue over the long term.	Construction activities would directly impact riparian vegetation, but these areas would be restored with minor direct short-term impacts to approximately 2.7 acres and direct minor long-term impacts to approximately 0.1 acres. A minor indirect adverse impact to riparian areas along Gould Wash would occur from more frequent O&M disturbance.	Construction activities would directly impact riparian vegetation, but these areas would be restored with minor short-term impacts to approximately 2.5 acres of riparian vegetation. A minor indirect benefit to riparian areas along Gould Wash would occur from less frequent O&M disturbance.

Resource Concern/Item	No Action Alternative	Increase Channel Capacity Through Hurricane for 8,820 cfs	New Detention Dam and 3,000 cfs Channel Modifications
Animals			
Fish and Wildlife	Minor indirect impacts from future O&M disturbance to low-quality habitat along the Gould Wash channel through Hurricane City would continue over the long term. The threat of floodwater contamination to the Virgin River would remain with indirect adverse impacts to aquatic/terrestrial wildlife species and habitat in the Virgin River over the long term.	Minor direct short-term impacts from construction disturbance on 7.4 acres of land. Disturbed areas would be restored after construction with no direct long-term impacts. A minor indirect adverse impact to wildlife and habitat areas along Gould Wash would occur from more frequent O&M disturbance. Indirect long-term term adverse impacts to species in Gould Wash and at the Virgin River confluence downstream of the channel improvements may also occur from increases in future damaging flood flows at larger flood events. However, indirect benefits to aquatic/terrestrial wildlife species and habitat in the Virgin River are also expected over the long term from the reduced threat of floodwater contamination to the river.	Minor direct short-term impacts from construction disturbance on 111.3 acres of land. Disturbed areas would be restored after construction with negligible direct long-term impacts. A minor indirect benefit to wildlife and habitat along Gould Wash would occur from less frequent O&M disturbance. Indirect long-term benefits to species in Gould Wash and at the Virgin River confluence downstream of the channel improvements may also occur from reduction in future damaging flood flows at larger flood events. Indirect benefits to aquatic/terrestrial wildlife species and habitat in the Virgin River are also expected over the long term from the reduced threat of floodwater contamination to the river.

Resource Concern/Item	No Action Alternative	Increase Channel Capacity Through Hurricane for 8,820 cfs	New Detention Dam and 3,000 cfs Channel Modifications
Special Status Animal Species (ESA)	Impacts to ESA-listed species are not expected from continued O&M activities.	Direct adverse impacts to ESA-listed species are not expected. Approximately 7.4 acres desert tortoise critical habitat would be disturbed. Direct impacts to critical habitat would be negligible based on no impacts to Primary Constituent Elements. Indirect long-term adverse impacts to ESA-species (if present) may occur downstream of the channel improvements in Gould Wash and at the Virgin River confluence from increases in future damaging flood flows at larger flood events.	There would be no adverse direct or indirect impacts to ESA-listed species or designated critical habitat. Indirect long-term benefits to ESA species in Gould Wash downstream of the channel improvements and at the Virgin River confluence may occur from reduction in future damaging flood flows at larger flood events. A BA was submitted to the USFWS on February 11, 2025 to comply with Section 7 of the ESA (Appendix A) with a **May Effect, Not Likely to Adversely Affect** determination for desert tortoise and **No Effect** determination for all other ESA[1] species/ designated critical habitat (Appendix A).
Special Status Animal Species (SGCN)	Impacts to BLM sensitive species or Utah SGCN are not anticipated from continued O&M activities.	Direct short-term impacts to BLM sensitive species/Utah SGCN (Arizona toad and burrowing owl) are not expected. Indirect long-term adverse impacts to SGCN (if present) may occur downstream of the channel improvements in Gould Wash and at the Virgin River confluence from increases in future damaging flood flows at larger flood events.	Direct short-term impacts to BLM sensitive species/Utah SGCN (Arizona toad and burrowing owl) are not expected. Indirect long-term benefits to SGCN (if present) may occur downstream of the channel improvements in Gould Wash and at the Virgin River confluence from reduction in future damaging flood flows at larger flood events.

Resource Concern/Item	No Action Alternative	Increase Channel Capacity Through Hurricane for 8,820 cfs	New Detention Dam and 3,000 cfs Channel Modifications
Migratory Birds/Bald and Golden Eagles	The continued O&M activities are not anticipated to have measurable impacts to migratory birds, bald eagles, or golden eagles based on timing outside of the breeding/nesting season.	Direct minor short-term impacts would occur from temporary human activity/noise nuisances that would discourage birds from foraging and nesting in the construction areas. Indirect long-term adverse impacts may occur downstream of the channel improvements in Gould Wash and at the Virgin River confluence from increases in future damaging flood flows at larger flood events.	Direct minor short-term impacts would occur from temporary human activity/noise nuisances that would discourage birds from foraging and nesting in the construction areas. Indirect long-term benefits may occur downstream of the channel improvements in Gould Wash and at the Virgin River confluence from reduction in future damaging flood flows at larger flood events.
Human			
Social Issues and Local Economy	The long-term indirect adverse impact for people and property in Hurricane City would remain. Direct moderate adverse impacts to social issues would continue over the long term from community unrest and political turmoil surrounding the new FEMA floodplain mapping regulations for structures within SFHAs.	Long-term indirect benefits for people and property in Hurricane City would occur for future flood prevention up to a 100-year flood and substantial reduction in flooding at a 500-year flood. The flood damage reduction costs are estimated at $2,444,300 annually. Direct moderate benefits for social issues are expected over the long term from structures being removed from SFHAs that eliminate political turmoil/ community unrest over new FEMA regulations. Minor direct adverse impacts may occur over the long term from discontent with the larger channel modifications.	Long-term indirect benefits for people and property in Hurricane City would occur for future flood prevention up to a 100-year flood and substantial reduction in flooding at a 500-year flood. The flood damage reduction costs are estimated at $2,444,300 annually. Direct moderate benefits for social issues are expected over the long term from structures being removed from SFHAs that eliminate political turmoil/ community unrest surrounding FEMA regulations for the newly mapped SFHAs.

Resource Concern/Item	No Action Alternative	Increase Channel Capacity Through Hurricane for 8,820 cfs	New Detention Dam and 3,000 cfs Channel Modifications
Historic / Cultural Resources	The moderate indirect threat of flooding to 101 historic properties would continue over the long term.	There would be no direct adverse effects to historic/cultural resources. Moderate indirect long-term benefits to historic resource would be achieved from reduced flooding in the benefited area that includes 101 historic properties. NRCS determined there would be **No Adverse Effect to Historic Properties** from alternative actions and submitted the determination to the SHPO on November 6, 2024 to comply with Section 106 of the NHPA. The SHPO concurred with the determination in a letter dated December 24, 2024 (Appendix A). Fifteen tribes were consulted pursuant to EO 13007, EO 13175, the NHPA, and the AIRFA (Appendix A). No Native American religious concerns were identified by the tribes.	
Public Health and Safety	There would be indirect adverse impacts to the health and safety of Hurricane City residents from the risk of future flooding over the long term. The community would suffer from degraded physical and mental health if a damaging flood were to occur. The risk of serious injury and potential loss of life would remain.	Indirect benefits to the health and safety of Hurricane City residence would occur from the reduced risk of future flooding over the long term. The community would no longer be at risk of injury and loss of life for all flood events up to and including a 100-year flood. The physical and mental health of the community would be improved following a large flood event due to avoided flooding and safe flood routing through the city.	
Recreation	No impacts to recreation are anticipated.	No measurable impacts to recreation are anticipated.	
Land Use	There would be no impacts to land use.	No long-term or short-term adverse effects on land use are expected with proper establishment and purchase of easements to construct and maintain the installed measures.	
Visual Resources	There would be no impacts to visual resources.	Minor short-term direct impacts to visual quality would occur during construction from construction equipment and disturbance but these areas would be restored after construction completion.	The impacts would be the same as those described for the other Action Alternative. Alterations on BLM-managed lands would comply with the BLM designated Visual Resource Management Class III.

Resource Concern/Item	No Action Alternative	Increase Channel Capacity Through Hurricane for 8,820 cfs	New Detention Dam and 3,000 cfs Channel Modifications
Transportation Infrastructure	Risk of flooding would continue to have a minor indirect adverse impact to transportation infrastructure.	Short-term direct impacts would occur for four culvert and three bridge replacements that would pose a moderate nuisance that could delay local traffic and commuters on major collector roads and arterials A minor long-term indirect benefit to transportation infrastructure would occur from flood protection to roads for a 100-year flood and substantial reduction in flooding at a 500-year flood.	Short-term direct impacts would occur for two culvert replacements that would pose a minor nuisance that could delay local traffic on minor collector roads. This alternative has the same indirect benefit as described for the other Action Alternative.
Noise and Vibration	No noise would be produced above and beyond what is currently produced and there would be no noise impacts.	A short-term direct increase in noise and vibration would occur near sensitive receptors (primarily residences), during installation of alternative measures. Proper BMPs would be implemented to reduce noise and vibration impacts. Applicable noise regulations would be adhered to for construction activities and short-term impacts would be moderate. Noise levels would return to normal after construction completion. An indirect minor adverse impact in Hurricane City from increased future O&M activities along Gould Wash would occur, increasing the frequency of O&M noise.	Short-term direct impacts for increased noise and vibration during construction would occur. Impacts in the western segment of the Project area would be moderate due to the proximity of the construction area adjoining sensitive receptors (primarily residences). Impacts in the eastern segment of the Project area would be minor. An indirect minor benefit in Hurricane City from a decrease in future O&M activities along Gould Wash would occur, reducing frequency of O&M noise.

5.25.2 Ecosystem Services Tradeoff

A comparison of ecosystem services covering long-term effects was performed for the final array of alternatives and is provided in Table 5-19. An Ecosystem Services Tradeoff Analysis is provided in Appendix E. Ecosystem service effects overlap with the resource concerns effects. Refer to Table 3-2 of Section 3.1 for information on overlapping resource concerns used in determination of ecosystem service effects. Refer to Sections 5.1 through 5.24 for detailed effects to resource concerns that include ecosystem services.

Table 5-19. Summary and Comparison of Alternatives – Ecosystem Services Tradeoff

Resource Concern/Item	No Action Alternative	Increase Channel Capacity Through Hurricane for 8,820 cfs	New Detention Dam and 3,000 cfs Channel Modifications
Provisioning			
Food/Biomass (crop yield)	Up to 101.6 acres of crop land is at risk of flooding for up to and including a 500-year flood. Flood damage is estimated to reduce crop productivity by $200 annually.	Flooding to cropland would be avoided for up to and including a 500-year flood. This would reduce flood damage to cropland by $200 annually.	Same as Increase Channel Capacity Through Hurricane for 8,820 cfs Alternative.
Regulating			
Water Regulation (quality) & Biological Regulation (plants & animals)	Risk of water quality degradation to the Virgin River from floodwater contaminants would remain. Contaminated water could adversely impact downstream water uses, ecosystems, and state- and federally-listed species.	Reduces risk of water quality degradation to the Virgin River benefiting downstream water uses, ecosystems, and state- and federally-listed species.	Reduces risk of water quality degradation to the Virgin River benefiting downstream water uses, ecosystems, and state- and federally-listed species.
Flood Moderation	Future flood damage risk remains for Hurricane City along with risk of injury or death to residents. Annual flood damage is estimated at $2,462,600 ($2,367,400 for structures, $200 for crops, and 95,000 for roads)	Flood damage risk is substantially reduced with life and property protected from flooding for up to and including a 100-year flood. Annual flood damage reduction benefits are estimated at $2,444,300 ($2,349,900 for structures, $200 for crops, and $94,200 for roads).	Same as Increase Channel Capacity Through Hurricane for 8,820 cfs Alternative.

Resource Concern/Item	No Action Alternative	Increase Channel Capacity Through Hurricane for 8,820 cfs	New Detention Dam and 3,000 cfs Channel Modifications
Cultural			
Cultural/Historical Identity and Heritage	The historical identity and cultural heritage of Hurricane City are impacted from flooding risk to 101 historic properties and four places of worship.	The historical identity and cultural heritage of Hurricane City would benefit from flood protection to 101 historic properties and four places of worship.	Same as Increase Channel Capacity Through Hurricane for 8,820 cfs Alternative.
Peace and Sustainability	The people who live and work within the floodplain would continue to be threatened from risk of flooding which could adversely impact their daily lives, source of income, peace of mind, mental/physical health, and safety.	The threat of flooding would be reduced benefiting the daily lives, source of income, peace of mind, mental/physical health, and safety of the community.	Same as Increase Channel Capacity Through Hurricane for 8,820 cfs Alternative.
Well-being and safety	The flood risk would remain. Flooding could result in mental and physical health impacts from injury, potential loss of life, destruction of property, business closures, financial stressors, etc.	Flood damage is substantially reduced with life and property protected from flooding for up to and including a 100-year flood. This would improve the mental/physical well-being and safety for all people who live, work, or are present within the floodplain that are currently at risk.	Same as Increase Channel Capacity Through Hurricane for 8,820 cfs Alternative.
Economic Analysis – Cost and Benefit Summary			
Federal Installation Cost (PL-53566)	-	$61,415,000	$56,051,000
Sponsor Installation Cost	-	$13,805,000	$6,626,000
Total Installation Cost	-	$75,220,000	$62,677,000
Annual Installation Cost[1]	-	$2,270,300	$1,864,300
Annual O&M Cost[1]	$16,000	$89,000	$17,000

Resource Concern/Item	No Action Alternative	Increase Channel Capacity Through Hurricane for 8,820 cfs	New Detention Dam and 3,000 cfs Channel Modifications
Total Annual Costs	**$16,000**	**$2,279,200**	**$1,881,300**
Total Annual Benefits	-	$2,444,300	$2,444,300
Benefit-Cost Ratio	**-**	**1.1**	**1.3**
Net Annual Benefits	**($16,000)**	**$165,100**	**$563,000**

[1] Calculated using FY 2025 Water Resources Discount Rate (3.0 percent), annualized over 100-year evaluation period, and using 102-year period of analysis.

6.0 Preferred Alternative

6.1 Rationale for Preferred Alternative Selection

Alternatives were compared to select one alternative that "best" maximized public benefits (environmental, economic, and social) with appropriate consideration of costs, guiding principles, the federal objective, PL 83-566 general purposes, and ecosystem services (refer to the Ecosystem Services Tradeoff Analysis Evaluation Table included in Appendix E). This alternative is known as the NRCS preferred alternative. In addition, the USACE LEDPA is required to be selected for 404 permitting.

Based on the effects to resources and ecosystem services tradeoffs, the New Detention Dam and 3,000 cfs Channel Modifications Alternative was determined to be the NRCS preferred alternative that best maximized environmental, economic, and social benefits (see Section 5.25 and Ecosystem Services Tradeoff Analysis Evaluation Table included in Appendix E). This alternative was also determined to be the USACE LEDPA as identified in the 404(b)(1) Alternatives Analysis included in Appendix E.

The alternative was designed to maintain the natural Gould Wash flow and sediment transport condition to the greatest extent possible. Construction of the detention dam substantially reduces the amount of channel modifications needed along Gould Wash through Hurricane City. It transfers the floodplain from a developed area that adversely impacts ecological floodplain functions to a natural area upstream capable of providing beneficial ecological and hydrological floodplain functions for the ephemeral system. The alternative incorporates BMPs during construction, avoids disturbance to ESA species and habitats, avoids adverse disturbance to sensitive cultural resources, and minimizes unavoidable impacts to other resources. Refer to Section 4.4.1 for more information on design consideration to avoid and reduce resource impacts and Section 6.6 for a list of BMPs, avoidance measures, and minimization measures.

The preferred alternative measures incorporate restoration components that offset long-term adverse impacts and the alternative would not require mitigation measures. No measurable long-

term adverse impacts are anticipated and long-term environmental, social, and economic benefits would be realized from implementation of the alternative.

6.2 Measures to be Installed

The flood prevention measures for the preferred alternative are listed below. Refer to Section 4.2.2.2 for a detailed description of alternative measures.

- A new earthen detention dam (approximately 3,880 feet long and 92 feet tall) would be constructed upstream of Hurricane City along Gould Wash on BLM-managed lands. The detention dam would be dry dam and would not store water permanently, but only attenuate water temporarily to slow down flood flows during large flood events (approximate 10-year flood and greater). Structural data for the detention dam is provided in Table 6-6 of Section 6.12.2.
- Modifications along approximately 12,540 linear feet of Gould Wash channel through Hurricane City would be required. This includes installing a 9-foot-tall, engineered flood wall along approximately 3,200 linear feet and placing riprap on channel banks along approximately 9,340 linear feet. Recontouring along Gould Wash through Hurricane City would be performed as needed along the riprap bank sections to maintain a 30-foot-wide bottom width and 2:1 side slopes. The riprap would be covered with sediment excavated from the channel banks during construction, to match the look (color/texture) and characteristics of the existing Gould Wash channel banks. To maintain the same ephemeral stream function for water infiltration, the channel bottom would be left open along the entire modified length, but would require grouted rock boulder grade control structures to prevent head cutting. Two culverts would be replaced, one at 1580 W Street and the other at 1150 W Street. Structural data for the channel improvements is included in Table 6-7 of Section 6.12.2.

6.3 Irreversible and Irretrievable Resource Commitments

NEPA requires that environmental analysis include identification of "… any irreversible and irretrievable commitments of resource which would be involved in the Proposed Action should it be implemented." Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects this use could have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species or the disturbance of a cultural resource).

Implementing the preferred alternative would involve a commitment of a range of natural, physical, human, and fiscal resources. Considerable amounts of fossil fuels, labor, and construction materials would be expended. Additionally, large amounts of labor and natural resources would be used in the fabrication and preparation of construction materials. These materials are generally not retrievable. They are not, however, in short supply, and their use would not have an adverse effect upon continued availability of these resources. Any construction would also require a substantial one-time expenditure of federal and cost-share funds that would not be retrievable.

The commitment of these resources would be based on the premise that residents in the immediate area, the state, and the region would benefit by the improved quality of post-construction conditions. These benefits generally are anticipated to outweigh the permanent commitment of resources.

6.4 Areas of Controversy

No areas of controversy have been identified for the implementation of the preferred alternative measures.

6.5 Permits and Compliance

The federal, state, and local permits and compliance actions described in this section would be required for construction of the preferred alternative. A Watershed Agreement and a Memorandum of Understanding (MOU) shall be completed and signed by the NRCS and the SLOs prior to the obligation of construction funds for the Project.

6.5.1 Federal

6.5.1.1 National Historic Preservation Act

During the NEPA Scoping process, the NRCS reached out to 15 tribes/THPOs listed in Table 7-1 of Section 7.1.3, regarding historic properties or places of traditional religious and cultural importance near the APE and assistance in identifying other applicable tribes. Per 36 CFR 800.3, 800.4, and 800.5, the NRCS consulted with the SHPO, cooperating agencies (USACE, BLM, and EPA), and 15 tribes on the description of the APE, site eligibility, and determination of **No Adverse Effect to Historic Properties**. A SHPO concurrence letter, dated December 24, 2024, was received and has been included in Appendix A. The NRCS followed-up with tribes/THPOs via email on December 20, 2024, and via telephone on February 13, 2025. Three tribe responses were received as described in Section 7.1.3. Additional details for Section 106 consultation to comply with the NHPA are included in Section 7.1.9. Refer to Appendix A for all Section 106 consultation correspondence.

In the event that cultural resources or human remains/funerary objects are found during construction activities, construction would stop, and the appropriate agencies would be notified according to NRCS protocol outlined in the NRCS Prototype Programmatic Agreement with the Utah SHPO. If the discovery is made on BLM-administered land, BLM post review discovery procedures would be followed.

6.5.1.2 U.S. Army Corps of Engineers

A Section 404 Individual Permit would be required for the preferred alternative. The USACE evaluates applications for Section 404 Individual Permits under the environmental criteria set forth in the CWA Section 404(b)(1) Guidelines from the EPA Federal Regulations (40 CFR Section 230). A 404(b)(1) Alternatives Analysis was completed by AEP and the USACE for the Project to assist in determination of the USACE LEDPA. The USACE is a cooperating agency on the Project and has determined the preferred alternative is the LEDPA. A draft copy of the 404(b)(1) Alternatives Analysis is included in Appendix E.

6.5.1.3 U.S. Fish and Wildlife Service

A BA was completed for the Project and is included in Appendix E. The BA was submitted to the USFWS on February 11, 2025 for informal consultation, with a **May Effect, Not Likely to Adversely Affect** determination for desert tortoise and **No Effect** determination for all other ESA species to comply with Section 7 of the ESA (Appendix A). The USFWS concurred with the determination on February 26, 2025 (Appendix A). No further Section 7 consultation is required for the Project unless the proposed action changes or ESA-listed species designations change within the Project area.

6.5.2 State

6.5.2.1 Utah State Historic Preservation Office

NRCS determined there would be **No Adverse effect to Historic Properties** for alternative measures based on a Cultural Resources Assessment (Certus 2024). Per 36 CFR 800.3-800.5, the APE delineation, site eligibility, and effect determination with the Cultural Resources Assessment was submitted to the Utah SHPO for concurrence on November 6, 2024 (Appendix A). A SHPO concurrence letter, dated December 24, 2024 was received and has been included in Appendix A.

6.5.2.2 Utah Department of Environmental Quality

A Utah Pollutant Discharge Elimination System Construction General Permit is required for construction activities that disturb more than one acre and discharge pollutants to surface waters. An SWPPP would be developed, including submitting a Notice of Intent (NOI) to the Utah DEQ.

6.5.2.3 Utah Division of Water Resources

Utah Division of Water Resources requires written authorization from the state engineer to comply with the state Stream Alternation Program before any natural stream bed or banks could be altered. The division also requires written approval from the Dam Safety State Engineer for construction of a new dam.

6.5.2.4 Utah Trust Lands Administration

Installation of alternative measures would occur on TLA lands requiring an easement, purchase of TLA lands, or exchange of TLA lands. Applications would be required for these activities and coordinated with TLA prior to installation of preferred alternative measures.

6.5.3 Local

6.5.3.1 Hurricane City

Hurricane City requires a grading permit for any grading activities within the city limits. The city also requires an encroachment permit for any activities performed within the specified city roads, streets, and ROW. Grading activities and work within city road ROWs would occur for implementation of preferred alternative measures. A grading permit and ROW encroachment permit shall be obtained prior to construction activities for work within Hurricane City.

6.5.3.2 Washington County

Washington County requires an excavation and grading permit for activities within county ROWs and/or county owned properties. The county also requires an encroachment permit for any activities performed within county ROWs and/or county owned properties. Excavation activities and work within county owned properties would occur for implementation of preferred alternative measures. A county excavation and grading permit and encroachment permit shall be obtained prior to construction activities for preferred alternative measures.

6.6 Avoidance, Minimization, and Mitigation of Potential Effects

Compensatory mitigation would not be required for the preferred alternative. The general avoidance and minimization measures proposed are described in Sections 6.6.1 through 6.6.13 below.

6.6.1 Upland Erosion

Proper BMPs would be installed during and after construction to offset short-term impacts that would help prevent and control soil erosion, such as, but not limited to, silt fences, fiber wattles, and/or earthen berms. A SWPPP would be implemented that contains erosion and sediment control BMPs (see measures in Section 6.6.2 below). Areas disturbed would be restored and/or stabilized through establishment of ground cover after construction completion.

6.6.2 Surface Water Quality

Project design elements, including required BMPs, would be implemented to reduce the quantity of sediment (1) entering drainages, and (2) flowing downstream and violating any federal or state water quality rules and regulations. Construction BMPs would include, but are not limited to, the following:

- A Storm Water Pollution Prevention Plan would be required and implemented that contains erosion and sediment control and pollution prevention BMPs, such as, but not limited to, silt fences, fiber wattles, and/or earthen berms.
- Water bodies adjacent to construction and staging areas would be identified, and such measures as straw bales, silt fences, and other appropriate sediment control BMPs would be implemented to prevent the entry of sediment and other contaminants into waters.
- To ensure that accidental spills do not enter waters, the storage of petroleum-based fuels and the refueling of construction machinery would not occur outside of approved designated staging/batch plant areas. Furthermore, the alternative would comply with state and federal water quality standards and toxic effluent standards to minimize any potential adverse impacts from discharges to waters of the U.S.
- No construction materials would be stockpiled or deposited in or near any water bodies.

6.6.3 Surface Water Quantity and Flow

The attenuation provided by the Hurricane City floodplain would be transferred to the upstream detention dam to maintain similar flow conditions downstream of the proposed improvements. The detention dam would be designed to have pass-through flows for an approximate 10-year event to maintain natural flow conditions to the greatest extent reasonable.

6.6.4 Waters of the U.S. and Wetlands

No wetlands would be impacted because none are present. The design incorporates measures to maintain an open channel bottom to allow Gould Wash to maintain its natural stream function. Armoring measures (riprap and floodwall) are limited to the channel banks avoiding placement of fill within the delineated OHWM to the greatest extent feasible. Soil would be placed over the riprap then revegetated and vegetation would be incorporated into the flood wall to preserve the existing channel bank functions. Disturbed areas that may support riparian vegetation in the channel would be restored by seeding or hydroseeding with a NRCS and USACE approved native riparian seed mix after construction. Types of vegetation for restoration of riparian areas would be selected in consideration of soil, hydrology, and climate conditions at the time of construction completion and determined in coordination with the USACE.

6.6.5 Air Quality

Fugitive dust, MSAT, and GHG emission increases associated with construction would be minimized through implementation of the following applicable BMPs:

- Spraying the soil on-site with water or other similar approved dust suppressant/soil binder.
- Wetting materials hauled in trucks, providing adequate freeboard (space from the top of the material to the top of the truck), or covering loads to reduce emissions during material transportation/handling.
- Providing a stabilized construction entrance (track-out pad), wheel washers, and/or other similar BMPs at construction site access to reduce track-out of site materials onto the adjacent roadway network.
- Removing tracked-out materials deposited onto adjacent roadways.
- Wetting material stockpiles to prevent wind-blown emissions.
- Establishing vegetative cover on bare ground as soon as possible after grading to reduce wind-blown dust.
- Requiring appropriate emission-control devices on all construction equipment.
- Requiring the use of cleaner-burning fuels.
- Using only properly operating, well-maintained construction equipment.

Concrete would be sourced from a nearby distributor located within 5 miles of Hurricane City to reduce vehicle GHG emissions. Cement would incorporate reusable wastes including a fly ash binder, granulated slag, and post-consumer glass as reasonable or available to reduce the carbon footprint. Concrete mixture optimization would be facilitated through performance-based specifications. Engineering fill and armoring materials will be sourced from the nearest possible location to reduce vehicle GHG emissions.

6.6.6 Vegetation Communities including Riparian Areas

There are no sensitive plant communities (sensitive plant species, protected natural areas, conservation areas, or ecologically critical areas) in the Project area. Temporarily disturbed areas would be restored upon construction completion with a native weed free NRCS approved (as applicable) seed mix to match the existing surrounding plant communities. Disturbed areas that may support riparian vegetation would be seeded or hydroseeded with a NRCS and USACE approved native riparian seed mix. Types of vegetation for restoration would be selected in

consideration of soil, hydrology, and climate conditions. The BLM and USACE would be included in approval and decision-making for vegetation restoration measures within their jurisdictional areas.

6.6.7 Noxious Weeds and Invasive Plants

BMPs would be implemented during construction to prevent the spread of N&I plant species and comply with Executive Order 13112. During construction and until restoration areas are fully established, they would be maintained on a regular basis to prevent the establishment of N&I plant species. Non-desirable plant species would be controlled by cleaning equipment prior to delivery to the Project site and eradicating these species before the start and during construction as discovered. In addition, a PCRP would be developed and would include mechanisms for addressing weed establishment and treatment. Disturbed areas would be restored to preconstructions conditions or better after construction completion.

6.6.8 Wildlife, Migratory Birds, and Special Status Animal Species

Construction activities would be limited to the smallest extent practicable within the Project area. Disturbed areas would be restored after construction completion. Tree vegetation clearing would be performed outside of the bird breeding season. For construction activities that occur during migratory bird breeding/nesting periods, the Project area (and surrounding habitats) would be surveyed by a qualified biologist for active nests no more than 5 days prior to the commencement of work. If active nests are found during surveys, spatial buffers would be established around them in coordination with USFWS and NRCS. Construction activities within the buffer areas would be prohibited until a qualified biologist confirms that all nests are no longer active.

Conservation measures would be implemented to avoid and minimize impacts to BLM sensitive species/Utah SGCN Arizona toad and burrowing owl. Preconstruction surveys would be performed for Arizona toad and burrowing owl, as applicable and determined in coordination with UDWR (within non-BLM lands) and BLM (within BLM-managed lands), prior to the commencement of work activities in areas of suitable habitat for either species. If the species were found during surveys, conservation measures would be implemented in coordination with UDWR. Refer to the paragraph above for additional surveys, avoidance, and minimization measures applicable for burrowing owl that would be implemented for migratory birds.

Presence/absence surveys for desert tortoise will be completed during the active season prior to construction and in coordination with USFWS and BLM. If desert tortoises or their signs are discovered during surveys (indicating presence), Section 7 Consultation will be reinitiated. If no desert tortoise or their signs are discovered during pre-construction presence/absence surveys, the conservation measures for USFWS Utah 2018 Desert Tortoise Section 7 Guidelines for Unoccupied, Medium or Low Quality Habitat will be adhered to. These conservation measures are detailed in the BA attached in Appendix E.

6.6.9 Historic/Cultural Resources and Native American Religious Concerns

Disturbance to historic canals, ditches, or laterals within the western segment of the Project area would be avoided. The historic properties (specifically prehistoric sites) identified in the eastern segment of the Project area would be avoided during construction with exclusionary fencing installed where appropriate at site 42WS5323 (Gould's shearing corral and prehistoric camp) and site 42WS6990 (prehistoric camp). The historic roads at sites 42W4397 and 42WS6188 would be

used for construction access. Site 42WS4397 is an improved road and would not be improved over its existing condition. Site 42WS6188 is a gravel road that would not be improved over existing conditions except for light grading to smooth the road surface.

6.6.10 Recreation

Preferred alternative measures along Gould Wash through Hurricane City would occur near the Three Falls Trailhead. The trail would remain open to recreationists during construction to avoid impacts to recreation use. Improvements on BLM-managed lands avoid disturbance to recreation trails and maintain access to the trails.

6.6.11 Visual Resources

Construction disturbance would not block scenic views of the surrounding landscape. Areas disturbed during construction would be restored and vegetation reestablished after the measures are installed.

6.6.12 Noise

The noise and vibration levels would not be continuous throughout the entire workday and would move with construction equipment as activities progressed along the channel alignment. Noise control programs (42 U.S.C. 4913) and any appliable noise/vibration regulations within BLM, Washington County, or Hurricane City jurisdiction (as applicable and identified in Section 3.2.23) would be followed. Noise minimization efforts may include avoiding operation of mechanical equipment between the hours of 10:00 p.m. and 6:00 a.m. per Hurricane City and Washington County Code, and outfitting construction equipment with noise dampening measures (if needed). The following measures would also be implemented in the western portion of the Project area to inform sensitive receptors of work activities and address noise complaints.

- Property owners within 500 feet of the work boundary would be notified by the Hurricane City of the anticipated noise/vibration disturbances at least two weeks prior to construction.
- A vibration monitoring specification will be developed during the design phase that will be implemented by the contractor during construction.
- A contact number to register noise/vibration complaints would be provided in the owner notification.
- Noise complaints and resolutions would be documented and handled by Hurricane City.

6.6.13 Hazardous Materials

NRCS requires that contractors comply with all federal, state, and local laws and regulations pertaining to pollution and contamination of the environment to prevent pollution of surface water, groundwater, soil, and air with any hazardous materials. If any hazardous materials/sediment or suspect hazardous materials/sediment are encountered during ground disturbing activities, the contractor shall follow all applicable state and federal regulations for handling, disposing, and reporting of hazardous materials.

6.7 Costs and Cost-Sharing

The Watershed Plan must be authorized before funding may be made available for Project operations. NRCS would provide funding from the Watershed Protection and Flood Prevention Act (PL 83-566, as amended by PL 106-472). The funding program for this project is through the NRCS Watershed and Flood Prevention Operations (WFPO) Program.

Federal assistance varies by authorized purpose, and the Project authorized purpose is flood prevention. For this authorized purpose, NRCS federal cost share covers 100 percent installation, construction, engineering, and technical assistance. However, the SLOs are responsible for funding measures associated with modifications of existing or new bridge/culvert structures needed for safe conveyance of flood flows. NRCS does not provide federal cost share for permitting or real property rights and those items are funded by the SLOs. Funding for O&M of facilities after construction would be derived from normal revenues of the SLOs. This O&M cost would be budgeted annually so that the facilities are kept in good condition. Administrative time for NRCS and the SLOs to design and install the preferred alternative measures is the responsibility of each individual entity. Please refer to Table 6-2 in Section 6.12.1 for the installation cost share breakout.

6.8 Ecosystem Services Benefits

Applicable ecosystem service benefits include provisioning, regulating, and cultural services. Benefits for provisioning services include increased crop yield from reduced flooding. Regulating services consist of climate, water quality, and natural hazard (flood) moderation. The preferred alternative increases resilience to the project rise in flood frequency and intensity. Water quality would be improved from reduction in floodwater contaminants and sediment entering the Virgin River. It was not possible to quantify the benefits for water quality, but benefits for crop yield and flood damage reduction were quantified. Average annual flood damage reduction was estimated at $2,444,100 for structures/roads and at $200 for crops, for a total of $2,444,300.

Benefits for cultural services consist of cultural/historical identity and heritage, peace/ sustainability, and well-being/safety. Historic features and places of worship would be protected from flooding benefiting community heritage. The reduced risk of flooding benefits the daily lives, source of income, and peace of mind of the community. This would improve the mental/physical well-being and safety for all people who inhabit the floodplain that are currently at risk. These benefits could not be calculated due to uncertainties in calculation methods, but they are important to note as they influence impacted individuals financially. Refer to the Ecosystem Services Tradeoff Analysis Evaluation Table included in Appendix E for more information.

6.9 Installation and Financing

6.9.1 Installation

Installation of preferred alternative measures would be sequenced to complete the critical path items first. Construction would take place over approximately 2 ½ years beginning in the Spring of 2027 and ending in the Fall of 2029. Construction of the detention dam would occur first, starting in spring of 2027 and take 1 ½ to 2 years to complete. The channel modifications through Hurricane City would be initiated after most of the detention dam has been constructed beginning approximately 1 ½ years into the construction schedule and take approximately one year to complete. Site stabilization and restoration activities would be completed at the detention dam

and borrow areas after the detention dam is constructed (spring 2028 through fall 2028). Site stabilization and restoration activities along Gould Wash through Hurricane City would occur throughout the 1 ½-year schedule as construction activities progress along the channel alignment.

Gould Wash is normally dry and only flows in direct response to large precipitation events. Shallow groundwater conditions do not exist and are not anticipated to be encountered during construction. Therefore, construction activities would be performed in the dry. However, if precipitation events or conditions are anticipated that could result in activation of flow in the ephemeral channel, work would be stopped or avoided during those periods.

6.9.2 Responsibilities

This Watershed Work Plan sets forth the responsibilities of NRCS and the SLOs. The roles and responsibilities for NRCS and the SLOs would be in accordance with this Plan-EIS, the Watershed Agreement, MOU, and the O&M Agreement. NRCS is responsible for leading the planning efforts and providing engineering support. The SLOs are responsible for environmental permits and construction implementation, and NRCS or the SLOs are responsible for the Project design. The SLOs would complete all approvals and permits for the Project prior to the start of construction; these may take up to 18 months to obtain. NRCS would assist the SLOs during construction by providing oversight and certifying completion of the Project. The SLOs are responsible for O&M and replacement costs associated with the improvements installed.

6.9.3 Contracting

Improvements installed from NRCS funding mechanisms would be procured using contracts awarded. The SLOs would oversee and administer construction of the Project in coordination with NRCS.

6.9.4 Real Property and Relocations

No relocations would be required for preferred alternative measures. Permanent and temporary easements would be needed for the preferred alternative and are depicted in Appendix C, Maps C11.1 through C.11.4.

The SLOs would secure a long-term ROW for the life of the Project on approximately 265.8 acres of BLM land for the detention dam, flood storage basin behind the dam (up to the dam crest), and access in an around the dam to perform O&M activities. The SLOs would also purchase a permanent easement on 16.3 acres for the modified Gould Wash channel and associated O&M access through Hurricane City. The easement would secure real property rights for Hurricane City to protect and maintain the channel for flood conveyance.

Temporary easements during construction would include:

- 20.6 acres adjoining the Gould Wash channel through Hurricane City for construction access and staging.
- Up to 70.1 acres for borrow areas in the eastern segment of the Project area. Approximately 40 acres of the temporary authorization could either be entirely on BLM-managed lands or divided between private and BLM-managed land, depending on the final placement of the 40-acre borrow/disposal area. The remaining 30.1 acres of temporary easement for borrow areas would be on private lands.

6.10 Operation, Maintenance, and Replacement

Operation of facilities includes the administration, management, and performance of non-maintenance actions needed to keep the facilities safe and functioning as designed. Maintenance includes performance of work, measuring the recording instrumentation data, preventing deterioration of facility components, and repairing damage or replacing the facility components as needed. Repairing damage to completed facilities caused by normal deterioration, droughts, flooding, or vandalism is considered maintenance. Maintenance includes both routine and as-needed measures.

The SLO would be responsible for the operation, maintenance, and future modifications to facilities. A specific O&M Plan would be prepared by NRCS and the SLOs in accordance with the NRCS National Operation and Maintenance Manual (NRCS 2003). This plan and agreement would be entered into prior to the start of construction activities and would be in place for the extended life of the Project. The agreement would provide for inspections, reports, and procedures for performing the maintenance items. The agreement would include specific provisions for retention, use, and property improved with PL 83-566 assistance.

6.11 Emergency Action Plan

An Emergency Action Plan (EAP) must be completed by the SLOs and must be prepared as a standalone document. NRCS would need to approve the EAP prior to the execution of fund-obligating documents for construction of the preferred alternative. EAPs shall be reviewed and updated by the SLO annually for consistency with the project and to include all local points of contact necessary for an emergency response. The EAP assists the SLOs in recognizing and responding to emergency and non-emergency events and should include the items outlined in the Utah Dam Safety Guide to Emergency Action Plans Development and Implementation (UDNR 2020).

6.12 Economic and Structural Tables

6.12.1 Economic Tables

Economic tables have been included to present information relevant to the costs and benefits of the preferred alternative. The costs for the preferred alternative are conceptual-level cost estimates only, with a level of detail judged appropriate for the purpose of identifying the NRCS preferred alternative. Detailed structural designs and construction cost estimates would be prepared for the Project during the final design phase and prior to the start of the competitive bidding process. The final cost of the Project would be the price received from the winning construction bid plus or minus the amount of contract modifications. Assessments, considerations, and calculations are based on a 100-year evaluation period, a 102-year period of analysis, and a FY 2025 discount rate of 3.0 percent.

The estimated installation cost in Table 6-1 documents land status upon which the Project works of improvement are installed, as well as federal and non-federal funding sources. NRCS is the only federal agency participating in the funding for installation of works of improvement.

Table 6-1. Estimated Installation Cost Warner Draw Watershed, Utah

Warner Draw Watershed, Utah
(Dollars) 1/

Works of Improvement	Unit	Number			PL 83-566	Other Funds	Total
		Federal Land	Non-Federal Land	Total			
New Detention Dam and Channel Modifications	acres	23.0	16.3	39.3	$57,743,000	$4,934,000	$62,677,000

1/ - Price base: 2023 *Prepared July 2024*

The estimated cost distribution in Table 6-2 shows the estimated installation cost works of improvement between PL 83-566 funds and the costs borne by the SLO (other).

Table 6-2. Estimated Cost Distribution - Water Resource Project Measures Warner Draw Watershed, Utah

Warner Draw Watershed, Utah
(Dollars) [1/]

Works of Improv	Installation Cost - Public Law 83-566				Installation Cost - Other Funds					Total
	Const	Eng	Project Admin	Total Public Law 83-566	Const[2/]	Real Prop Rights[3/]	Permits	Project Admin	Total Other	Installation Costs
New Detention Dam and Channel Modifications	$50,777,000	$6,531,000	$435,000	**$57,743,000**	$0	$3,963,000	$100,000	$871,000	**$4,934,000**	**$62,677,000**

1/ Price base: 2023 *Prepared: July 2024*
2/ Construction cost for other funds includes cost for culvert work.
3/ Includes cost to obtain easements for installation of works of improvement at $2,488,000 and construction costs to replace culverts at $1,475,000.
Const = Construction, Eng = Engineering, Prop = Property, Admin = Administration

Table 6-3 shows the average annal costs for the preferred alternative.

Table 6-3. Average Annual Preferred Alternative Costs

Warner Draw Watershed, Utah
(Dollars) [1/]

Works of Improvements	Project Outlays Amortization of Installation Cost	Project Outlays O&M and Replacement Cost	Total
New Detention Dam and Channel Modifications	$1,864,300	$17,000	**$1,881,300**

1/ - Price base: 2023 *Prepared: May 2025*
Calculated using FY 2025 Water Resources Discount Rate (3.0%), annualized over 100 years, and 102-year period of analysis (period of analysis = 100-year project life plus 2 years for installation).

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The preferred alternative includes monetary and non-monetary benefits. Table 6-4 summarizes the results of the monetary benefits calculated for the preferred alternative. Monetary benefits include flood damage reduction for a rural community, which are considered agricultural related benefits per the NWPM.

Non-monetary benefits were also considered in determining the preferred alternative. Non-monetary benefits include: a reduction in channel erosion potential; improved water quality for the Virgin River; improved resilience to the project rise in flood frequency and intensity; reduced disturbance for O&M in Gould Wash benefiting vegetation/wildlife/habitat; and improved public safety, peace and sustainability, and well-being for the community within the floodplain

Table 6-4. Estimated Average Annual Flood Damage Reduction Benefits

Warner Draw Watershed, Utah
(Dollars)[1/]

Item	Estimated Average Annual Damage				Damage Reduction Benefit	
	Without Project		With Project			
	Agriculture Related	Non-Agriculture Related	Agriculture Related	Non-Agriculture Related	Agriculture Related	Non-Agriculture Related
Floodwater						
Residential	$2,018,100	$0	$17,500	$0	$2,000,600	$0
Commercial	$57,100	$0	$0	$0	$57,100	$0
Other	$292,200	$0	$0	$0	$292,200	$0
Roads	$95,000	$0	$800	$0	$94,200	$0
Crop	$200	$0	$0	$0	$200	$0
Total	**$2,462,600**	**$0**	**$18,300**	**$0**	**$2,444,300**	**$0**

1/ - Price base: 2025 *Prepared: May 2025*
Calculated using FY 2025 Water Resources Discount Rate (3.0%), annualized over 100 years, and 102-year period of analysis (period of analysis = 100-year project life plus 2 years for installation).

Table 6-5 summarizes the benefits and costs of the preferred alternative and documents the benefit to cost ratio of the preferred alternative.

Table 6-5. Economic Table 6 - Comparison Preferred Alternative Benefits and Costs

Warner Draw Watershed, Utah
(Dollars) [1/]

Item	Average Annual Costs[2/]	Total Benefits[3/]	Benefit Cost Ratio	Net Economic Benefits
New Detention Dam and Channel Modifications	$1,881,300	$2,444,300	1.3	$563,000

1/ - Price base: 2023 *Prepared: May 2025*
2/ - From Table 6-3
3/ - From Table 6-4

6.12.2 Structural Tables

Table 6-6 identifies the structural data for the planned storage capacity for the preferred alternative debris basins and Table 6-7 includes the structural data drainage channel work. Stream reaches for Table 6-7 are depicted in Figure 6-1.

Table 6-6. Structural Data - Dams with Planned Storage Capacity

Warner Draw Watershed, Utah

Item	Unit	Gould Wash Detention Dam
Class of structure	N/A	High
Peak Ground Acceleration	g	0.1
Uncontrolled drainage area	mi^2	57.2
Controlled drainage area	mi^2	0
Total Drainage Area	mi^2	57.2
Runoff curve N. (1-day) (AMC II)	N/A	75.6
Time of concentration (Tc)	hours	2.05
Elevation top dam	feet	4382.0
Elevation crest auxiliary spillway	feet	4376.0
Elevation crest high stage inlet	feet	4360.4
Elevation crest low stage inlet	feet	4294.0
Auxiliary spillway type	N/A	Concrete Chute
Auxiliary spillway bottom width	feet	300
Auxiliary spillway exit slope	%	6.0
Maximum height of dam	ft	92
Volume of fill in dam embankment	yd^3	469,170
Total capacity	ac-ft	3,055
Sediment submerged	ac-ft	0
Sediment aerated	ac-ft	1,150
Beneficial use	ac-ft	0
Floodwater retarding	ac-ft	1,905
Between high and low stage	ac-ft	1,066
Surface Area		
Sediment pool	acres	100.6
Beneficial use pool	acres	0
Floodwater retarding pool	acres	187.2
Principal Spillway Design		
Rainfall volume (1-day)	inches	3.28
Rainfall volume (10 day)	inches	6.15
Runoff volume (10 day)	inches	1.17
Capacity of low stage (max)	cfs	740.9
Capacity of high stage (max)	cfs	2,021.3
Dimension of conduit	feet	11 x 10.5

Item	Unit	Gould Wash Detention Dam
Type of conduit	N/A	Concrete box
Frequency operation-auxiliary spillway[1/]	% chance	>1%
Auxiliary Spillway Hydrograph (Stability Design Hydrograph)		
Rainfall volume	inches	4.59
Runoff volume	inches	2.52
Storm duration	hours	24
Velocity of flow (Ve)	ft/s	11.36
Max. reservoir water surface elevation	feet	4378.7
Freeboard Hydrograph		
Rainfall volume	inches	8.33
Runoff volume	inches	5.91
Storm duration	hours	24
Max. reservoir water surface elevation	feet	4382.0
Capacity Equivalents		
Sediment volume	inches	1.76
Floodwater retarding volume	inches	2.91
Beneficial volume	inches	0

The structural data for the channel work along Gould Wash through Hurricane City is provided in Table 6-2. Figure 6-1 depicts the reaches described in Table 6-2.

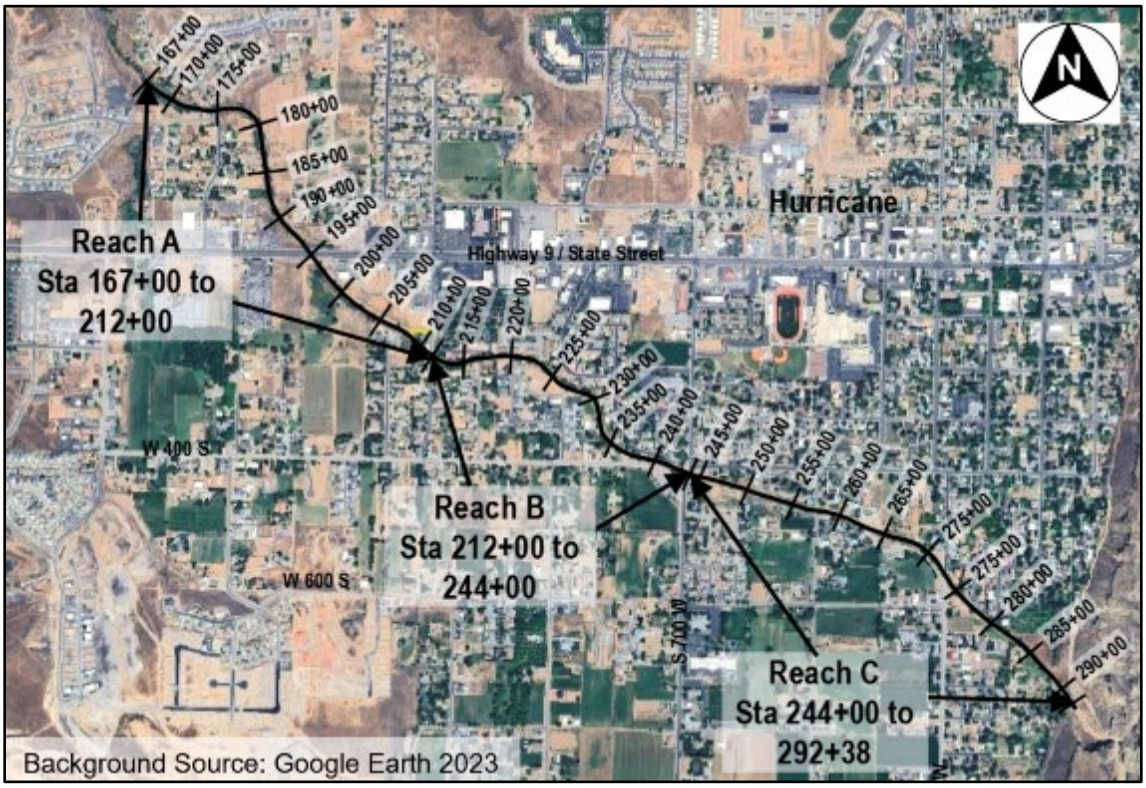

Figure 6-1. Channel Reaches

Table 6-7. Structural Data - Channel Work

Warner Draw Watershed, Utah

Channel Reach	Station	Drain Area (mi^2)	Year Freq Design Discharge (cfs)	Water Surface Elevation (ft)	Hydraulic Gradient (ft/ft)	Channel Dimensions				*n* Value		Velocities (ft/s)[4]		Excavation Volume (yd^3)	Type of Work[1]	Existing Channel Type[2]	Present Flow Condition[3]
						Gradient (ft/ft)	Bottom Width (ft)	Elevation (ft)	Side Slope (H:V)	Aged	As Built	Aged[4]	As-Built[4]				
A	167+00 to 212+00	72.1	3,000	3190.13	0.01	0.01	30	3182.44	2:1	0.035	0.035	12.91	12.91	96,840	V	M	E
B	212+00 to 244+00	69.8	3,000	3216.69	0.01	0.01	30	3223.49	0..25:1	0.035	0.035	14.79	14.79	79,530	II	M	E
C	244+00 to 292+38	63.5	3,000	3286.05	0.02	0.02	30	3279.34	2:1	0.035	0.035	10.63	10.63	103,630	V	M	E

1 - II Enlargement or realignment of existing channel or stream.
V Stabilization as primary purpose (by continuous treatment or localized problem areas – present capacity adequate).
2 - M = Manmade ditch or previously modified channel or stream
3 - E = Ephemeral
4 - Velocities are based on peak 100-year flood flow of 3,000 cfs

7.0 Consultation, Coordination, and Public Participation

This section describes the coordination efforts with the public, agencies, tribes, stakeholders, and the SLO for the Project.

7.1 Consultation

7.1.1 Bureau of Land Management

A formal request to be a cooperating agency on the Project was submitted to the BLM on January 16, 2020 (Appendix A). The BLM accepted cooperating agency status in a letter dated February 5, 2020 (Appendix A). Resource concerns, the project purpose and need, alternatives for detailed study, and selection of the preferred alternative were coordinated with input and approval from the BLM. The NRCS consulted with the BLM for Section 106 as detailed in Section 7.1.9. The BLM was provided copies of the preliminary Plan-EIS for review prior to issuance of the Draft Plan-EIS to the public. The BLM's report comments or concerns were addressed and/or corrected prior to issuance of the Draft Plan-EIS to the public.

7.1.2 Federal Emergency Management Agency

A formal request to be a cooperating agency on the Project was submitted to the FEMA on May 29, 2020 (Appendix A). The FEMA did not accept cooperating agency status and indicated that floods are the most devastating of all-natural disasters in the county, any efforts to reduce flooding impacts is worthwhile (Appendix A). They also indicated by email they do not have any concerns from a floodplain management perspective as long as a local floodplain development permit is applied for and received, and the project meets all locally adopted floodplain management regulations (Appendix A).

7.1.3 Tribal Consultation

Tribes who hold ancestral land, traditional use, and/or TCP claims in and near the APE were identified using the NPS Native American Graves Protection and Repatriation Act Native American Consultation Database (NACD), a database through which any federally recognized tribe could identify those counties in Utah where they have consultation interests. The BLM St. George Field Office Tribal consultation list, the U.S. Department of Housing and Urban Development Tribal Directory Assessment Tool (TDAT), the BIA, and the Utah Division of Indian Affairs (UDIA) websites were also used as supplemental sources to identify tribes with consultation interests. The assembled list of tribes is included in Table 7-1.

Tribes were consulted to comply with EO 13007, 13175, the AIRFA, and the NHPA (Appendix A). A reasonable and good faith effort was made per 36 CFR pt. 800.4(b)(1) to consult with these tribes via letter, email, and telephone. During the scoping process, the NRCS reached out to tribes regarding known historic properties or places of traditional religious and cultural importance near the APE in scoping letters sent on January 16, 2020 (see Scoping Report in Appendix A). The Cultural Resource Assessment and consultation letters for concurrence with the APE, site eligibility, and **No Adverse Effect to Historic Properties** from Project actions were sent on November 12, 2024, to the 15 tribes listed in Table 7-1 (Appendix A). Table 7-1 summarizes the tribe consultation. A detailed tribal consultation table and all tribal consultation correspondence may be found in Appendix A. No tribe concerns were identified during the consultation and a

summary of tribe responses received are provided below Table 7-1 and further described below the table.

Table 7-1. Tribe Consultation Summary

Tribe	Cultural Resource Package Sent	Follow Up #1	Follow Up #2	Response Received	Consultation Outcome
Cedar Band of Paiutes	11/12/2024	12/20/2024	2/13/2025	none	No response
Chemehuevi Indian Tribe	11/12/2024	12/20/2024	2/13/2025	none	No response
Hopi Tribe	11/12/2024	12/20/2024	2/13/2025	none	No response
Kanosh Band of Paiutes	11/12/2024	12/20/2024	2/13/2025	none	No response
Kaibab Band of Paiute Indians of the Kaibab Indian Reservation	11/12/2024	12/20/2024	2/13/2025	2/28/2025	Concurs with determination
Koosharem Band of Paiutes	11/12/2024	12/20/2024	2/13/2025	none	No response
Las Vegas Tribe of Paiute Indians of the Las Vegas Indian Colony	11/12/2024	12/20/2024	2/13/2025	none	No response
Moapa Band of Paiute Indians of the Moapa River Indian Reservation	11/12/2024	12/20/2024	2/13/2025	2/19/2015	No cultural concerns
Navajo Nation	11/12/2024	12/20/2024	2/13/2025	2/19/2025	No Concerns
Navajo Utah Commission	11/12/2024	12/20/2024	2/13/2025	none	No response
Paiute Indian Tribe of Utah	11/12/2024	12/20/2024	2/13/2025	2/22/2025	Concurs with determination
Pueblo of Zuni	11/12/2024	12/20/2024	2/13/2025	none	No response
San Juan Southern Paiute Tribe of Arizona	11/12/2024	12/20/2024	2/13/2025	none	No response
Shivwits Band of Paiute Indians	11/12/2024	12/20/2024	2/13/2025	none	No response
Ute Indian Tribe of the Uintah & Ouray Reservation	11/12/2024	12/20/2024	2/13/2025	none	No response

Responses received from the tribes include:

- Moapa Band of Paiute Indians of the Moapa River Indian Reservation: The tribe has no cultural concerns, but recommends using native seeds for reseeding due to noxious weed concerns.

- Navajo Nation: The tribe does not have any concerns with the proposed undertaking and concurs with the proposed treatment of the two prehistoric sites. They indicated proceeding without further consultation with the Navajo Nation.

- Paiute Indian Tribe of Utah: The tribe concurs with the no adverse effect to historic properties per CFR 800.5 and suggests implementing the fence beforehand at site 42WS6990 to be proactive.

- Kaibab Band of Paiute Indians: The tribe concurs with the no adverse effect to historic properties

The tribes will also be offered a chance to review and comment on the Draft Plan-EIS, and the results will be documented in the Final Plan-EIS. Tribal consultation will continue during the Draft Plan-EIS review period, and the results will be documented in the Final Plan-EIS.

7.1.4 U.S. Army Corps of Engineers

A formal request to be a cooperating agency on the Project was submitted to the USACE on January 16, 2020 (Appendix A). The USACE accepted cooperating agency status in a letter dated May 20, 2022 (Appendix A). Resource concerns, the project purpose and need, alternatives for detailed study, and selection of the preferred alternative were coordinated with input and approval from the USACE. The NRCS consulted with the USACE for Section 106 but no response from the USACE was received, as detailed in Section 7.1.9. The USACE was provided copies of the preliminary Plan-EIS for review prior to issuance of the Draft Plan-EIS to the public. The USACE's report comments or concerns were addressed and/or corrected prior to issuance of the Draft Plan-EIS to the public.

An individual permit for the Project is anticipated. The USACE evaluates applications for Section 404 individual permits under the environmental criteria set forth in the CWA Section 404(b)(1) Guidelines from the EPA Federal Regulations (40 CFR Section 230). A 404(b)(1) Alternatives Analysis was completed by AEP and the USACE for the Project to assist in determination of the USACE LEDPA. A copy of the 404(b)(1) Alternatives Analysis is included in Appendix E. The New Detention Dam and 3,000 cfs Channel Modifications Alternative was determined to be the LEDPA based on the analysis completed.

7.1.5 U.S. Environmental Protection Agency

A formal request to be a cooperating agency on the Project was submitted to the EPA on May 29, 2020 (Appendix A). The EPA accepted cooperating agency status in a letter dated June 16, 2020 (Appendix A). Resource concerns, the project purpose and need, alternatives for detailed study, and selection of the preferred alternative were coordinated with input and approval from the EPA. The NRCS consulted with the EPA for Section 106 as detailed in Section 7.1.9. The EPA was provided copies of the preliminary Plan-EIS for review prior to issuance of the Draft Plan-EIS to the public. The EPA's report comments or concerns were addressed and/or corrected prior to issuance of the Draft Plan-EIS to the public.

7.1.6 U.S. Fish and Wildlife Service

A formal request to be a cooperating agency on the Project was submitted to USFWS on January 16, 2020 (Appendix A). In accordance with Section 12 of PL 83-566, a letter was sent to the

USFWS on May 17, 2024 to welcome their participation in preparation of the Plan-EIS (Appendix A). No response was received from the USFWS for the cooperating agency request or Section 12 letter. A Draft BA was submitted to the USFWS on December 17, 2024, for review but no response was received (Appendix A). The BA was submitted to the USFWS on February 11, 2025, for informal consultation with a **May Effect, Not Likely to Adversely Affect** determination for desert tortoise and **No Effect** determination for all other ESA species to comply with Section 7 of the ESA (Appendix A). The USFWS concurred with the determination on February 26, 2025 (Appendix A).

7.1.7 Utah Department of Transportation

A formal request to be a cooperating agency on the Project was submitted to the UDOT on January 16, 2020 (Appendix A). The UDOT declined to participate in the planning and development of the Plan-EIS in a letter dated January 28, 2020, but asked to be kept informed of any proposed activities that may take place within the UDOT ROW (Appendix A).

7.1.8 Utah State Historic Preservation Office

Utah SHPO was invited to comment on the Project during the scoping period, but no comment was received. Per 36 CFR 800.5, NRCS determined the Project would have **No Adverse Effect to Historic Properties** and submitted the determination of effect, site eligibilities, and delineation of the APE to the SHPO on November 6, 2024. The SHPO concurred with the determinations in a letter dated December 24, 2024 (Appendix A).

If undocumented cultural resources are found during construction activities, construction would stop, and the appropriate agency officials would be notified, per procedures described in the NRCS Prototype Programmatic Agreement. Consultation with SHPO will continue during the Draft Plan-EIS review period, and the results will be documented in the Final Plan-EIS. If the discovery is made on BLM-administered land, BLM post review discovery procedures would be followed.

7.1.9 Section 106 Consultation

The NRCS established itself as lead federal agency (36 CFR 800.2), and consulted with the SHPO, cooperating agencies (USACE, BLM, and EPA), and tribes on the delineation of the APE, determinations of NRHP site eligibility, and determination of **No Adverse Effect to Historic Properties** for the preferred alternative (36 CFR 800.3-800.5). A consultation letter was sent to SHPO on November 6, 2024, to tribes on November 12, 2024, and USACE on November 13, 2024. No consultation response has been received from the USACE. The EPA declined participation in consultation because they suggested that NRCS rely on the SHPO or THPO for consultation related to the APE and determination of NRHP site eligibility due of lack of expertise. The BLM reviewed the cultural resource report, APE, determination of NRHP site eligibility, and determination of effect, and provided their approval for the documented information. The SHPO concurred with determinations of site eligibility and determination of effect in a letter dated December 24, 2024. Refer to Appendix A for Section 106 consultation correspondence.

7.2 Coordination

7.2.1 Stakeholders

Coordination was conducted with private landowners having a stake in the Project. These include

landowners of parcels where temporary and permanent easements are required to install alternative measures. Coordination included a landowner outreach notification sent from Hurricane City to applicable owners prior to distribution of the Draft Plan-EA.

7.2.2 Sponsoring Local Organizations

Financial assistance for the Project was requested by the SLOs from NRCS through Standard Form 424-Application for Federal Assistance. Initial coordination was conducted with the SLOs regarding the Project and the proposed measures. Meetings were conducted throughout the planning and engineering process to discuss the Project measures and identify potential concerns. The SLOs were provided with copies of the preliminary Plan-EIS for review prior to issuance of the Draft Plan-EIS to the public. SLOs report comments or concerns were addressed and/or corrected prior to issuance of the Draft Plan-EIS to the public.

1.1.1 Utah Division of Emergency Management

Coordination with the Utah Division of Emergency Management (UDEM) was performed. The UDEM provided comments during the scoping period that a LOMR or Conditional Letter of Map Revision (CLOMR) may be required for the Project and that it should be reviewed by Washington County and Hurricane City floodplain administrators. Project information and floodplain modeling data was shared with the UDEM for their coordination with Hurricane City (Appendix A).

7.2.3 Utah Division of Wildlife Resources

Coordination with the UDWR was performed to identify state sensitive species of concern that should be considered in the Plan-EIS analysis for the Project. The UDWR did not have any immediate concerns for species or habitat for consideration for the Project (Appendix A).

7.3 Public Involvement

7.3.1 Public Participation Plan

A Public Participation Plan was prepared to provide effective procedures that define outreach to the general public, recreationists, tribes, local businesses, associations, stakeholders, affected landowners, and affected government agencies. The main goal of public participation is to involve a diverse group of public and government agency participants to solicit input and provide timely information throughout the NEPA review process. As part of the public participation process, the plan seeks to meaningfully engage minority, low-income, and traditionally under-represented populations during the NEPA review process.

7.3.2 Project Scoping

The participation of the public is a vital component of the Project so that those who are interested in or potentially affected by proposed alternatives have an opportunity to share their concerns and provide input regarding the Plan-EIS during the initial stages of the process. The Project Scoping Report (Appendix A) outlines the scoping efforts and comments received from the agencies and public during the scoping process.

Project scoping questions, comments, and concerns were requested from the public and government agencies during the preliminary scoping period, both orally at public meetings and via written submittal of comments.

7.3.3 Public Outreach

Table 7-2 lists the Project's public outreach activities. The public, tribes, agencies, and organizations were notified of activities as described below and provided with opportunities to comment on the Project. The NRCS established a Project website for the public to access Project information, announce outreach activities, and post outreach materials.

Table 7-2. Public Outreach Activities

Date	Item
October 29, 2019	Project Kickoff Meeting
January 2020	Scoping – Public Comment Period Open Scoping Notice, Meeting Announcements, and Scoping Notice Posted in the Spectrum Daily News Tribe Scoping Notices Mailed
February 4, 2020	Scoping Public Meeting Held
June 3, 2021	NOI posted in the Federal Register
June 7, 2021	Email announcement of NOI and updated comment period close date sent
July 6, 2021	Scoping – Public Comment Period Closed
September 22, 2025	Draft Plan-EIS Open Comment Period and Notice of Availability (NOA)
October 22, 2025	Draft Plan-EIS Public Meeting
November 6, 2025	Draft Plan-EIS Comment Period Closed
Est. January 2026	Final Plan-EIS and NOA
Est. April 2026	Record of Decision (ROD)

7.4 Plan Development and Review

7.4.1 Cooperating Agencies

Cooperating agencies consisting of the BLM, USACE, and EPA were involved in development of the Plan-EIS and provided technical expertise where appropriate. Concurrence was received from cooperating agencies during the scoping process and Plan-EIS development on the Project purpose and need statement, resource concerns, alternatives included/eliminated from detailed study, and selection of the preferred alternative. A preliminary Plan-EIS was provided to cooperating agencies for review prior to issuance of the Draft Plan-EIS to the public. The cooperating agencies report comments or concerns were addressed and/or corrected prior to issuance of the Draft Plan-EIS to the public.

7.4.2 NRCS Plan-EIS Reviews

Agency Plan-EIS reviews included appropriate NRCS reviews prior to issuance of the Draft Plan-EIS to the public. The sequential review process included the following.

1) NRCS Utah review/s
2) NRCS National Water Management Center (NWMC) review
3) NRCS National Headquarters review
4) Issue the Draft Plan-EIS for public review

7.4.3 Draft Plan-EIS Public Comment

This portion will be completed in the Final Plan-EIS to document the Draft Plan-EIS public comment process. Comments and responses on the Draft Plan-EIS will be included in Appendix A of the Final Plan-EIS.

7.4.4 Final Plan-EIS and ROD Public Comment

When the Final Plan-EIS and ROD are issued, a NOA will be published in the federal register and locally to notify the public of the finding and copies made available on the Project website.

7.5 Distribution List

Table 7-3 lists the government agencies and organizations that are included on the Project distribution list for scoping notice and/or notice of availability for the Draft Plan-EIS.

Table 7-3. Distribution List

Federal Government	
BIA	FEMA
BLM	USACE
BOR	USFWS
EPA	USGS
State Government	
State Representatives	Utah Department of Public Safety
State Senators	Utah Department of Transportation
TLA	Utah Division of Forestry, Fire & State Lands
U.S. Representatives	Utah Division of Water Rights
U.S. Senators	Utah Division of Wildlife Resources
Utah Department of Agriculture	Utah Natural Heritage Program
Utah Department of Environmental Quality	Utah Public Land & Policy Coordination Office
Utah Department of Heritage and Arts	Utah Reclamation Mitigation & Conservation
Local Government	
Hurricane City	Toquerville
La Verkin	Washington City
Leeds	Washington County
St. George	
Business and Organizations	
Ash Creek Special Service District	Virgin River Program
Dixie Power	Western Land Exchange Project
Sierra Club Utah Chapter	Wild Earth Guardians
Southwest Back County Horseman	Wild Utah Project
Tribes	
Cedar Band of Paiutes	Navajo Nation
Chemehuevi Indian Tribe	Navajo Utah Commission
Hopi Tribe	Paiute Indian Tribe of Utah
Kanosh Band of Paiutes	Pueblo of Zuni
Kaibab Band of Paiute Indians of the Kaibab Indian Reservation	San Juan Southern Paiute Tribe
Koosharem Band of Paiutes	Shivwits Band of Paiute Indians
Las Vegas Tribe of Paiute Indians of the Las Vegas Indian Colony	Ute Indian Tribe of the Uintah & Ouray Reservation
Moapa Band of Paiute Indians	
Private Parties	
The names of private parties receiving notice are not listed in this section for privacy.	

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9.0 List of Preparers

Table 9-1 lists the people who participated in the preparation of this document.

Table 9-1. List of Preparers

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10.0 Index

11.0 Acronyms, Abbreviations, and Short Forms

ac-ft	acre-feet
ACEC	Area of Critical Environmental Concern
AEP	Adaptive Environmental Planning, LLC
AIRFA	American Indian Religious Freedom Act
AO	New Source Review Approval Order
APE	Area of Potential Effect
AU	Assessment Unit
BA	Biological Assessment
BC&A	Bowen Collins and Associates
BLM	U.S. Bureau of Land Management
BMPs	Best Management Practices
BOR	U.S. Bureau of Reclamation
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH_4	methane
CLOMR	Conditional Letter of Map Revision
CO	Carbon Monoxide
CWA	Clean Water Act
dB	decibel
dBA	“A” weighted decibel
DM	Department Manual
EAP	Emergency Action Plan
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Federal Insurance Rate Map
FR	Federal Register
ft	feet
ft/sec	feet per second
FTA	Federal Transit Administration
GIS	Geographic Information System
GHG	greenhouse gas
HAP	Hazardous Air Pollutant
HUC	Hydrologic Unit Code
in/sec	Inches per second
IPaC	Information for Planning and Consultation

LEDPA	Least Damaging Practicable Alternative
LOMR	Letter of Map Revision
MBCC	Migratory Birds of Conservation Concern
MBTA	Migratory Bird Treaty Act
mg/l	milligrams per liter
mi^2	square miles
MRLC	Multi-Resolution Land Characteristics Consortium
MSAT	Mobile Source Air Toxics
N&I	Noxious and invasive weeds
NAAQS	National Ambient Air Quality Standards
NACD	Native American Consultation Database
NECH	National Environmental Compliance Handbook
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NO_2	nitrogen dioxide
N_2O	nitrous oxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Association
NOI	Notice of Intent
NPPH	National Planning Procedures Handbook
NPS	National Park Service
NRCS	U.S. Department of Agriculture Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSHT	National Scenic and Historic Trails
NWPH	National Watershed Program Handbook
NWPM	National Watershed Program Manual
NWSRS	National Wild and Scenic River System
O&M	Operations and Maintenance
O_3	ozone
OHV	Off Highway Vehicle
OHWM	Ordinary High Water Mark
Pb	lead
PCRP	Post Construction Rehabilitation Plan
PL	Public law
Plan-EA	Supplemental Watershed Plan and Environmental Assessment
Plan-EIS	Supplemental Watershed Plan and Environmental Impact Statement
PM	particulate matter
ppb	parts per billion
ppm	parts per million

PPV	peak particle velocity
PR&G	Principles, Requirements, and Guidelines for Federal Investments in Water Resources
Project	Gould Wash Flood Protection Project
RNA	Research Natural Area
ROD	Record of Decision
ROW	Right-of-Way
SCS	Soil Conservation Service
SFHA	Special Flood Hazard Area
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SLO	Sponsoring Local Organization
SO_2	sulfur dioxide
SR	State Route
SWPPP	Storm Water Pollution Prevention Plan
TCP	Traditional Cultural Properties
TDAT	Tribal Directory Assessment Tool
TDS	total dissolved solids
TLA	Utah Trust Lands Administration
TM	Technical Memorandum
TMDL	total maximum daily load
UDAF	Utah Department of Agriculture and Food
UDAQ	Utah Division of Air Quality
UDEM	Utah Division of Emergency Management
UDEQ	Utah Department of Environmental Quality
UDIA	Utah Division of Indian Affairs
UDNR	Utah Department of Natural Resources
UDOT	Utah Department of Transportation
UDWR	Utah Division of Wildlife Resources
UGS	Utah Geological Survey
µg/m3	micrograms per cubic meter
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
UWQA	Utah Water Quality Act
VdB	velocity units of one micro-inch per second
VOC	volatile organic compound
Watershed	Warner Draw Watershed
WCWCD	Washington County Water Conservancy District
WFPO	Watershed and Flood Prevention Operations
yd3	cubic yards