1. Agenda

    Documents:

        021826.PCRM.NOTICE.PDF

2. Packet Materials

    Documents:

        ITEM A1 - DDR THE TOWN OF SPRINGDALE IS SEEKING APPROVAL OF PLANS FOR THE EXPANSION OF THE GEORGE A BARKER RIVER PARK INTO PARCEL S-150-D.PDF
        ITEM A2 - EROSION HAZARD PERMIT TOS REQUESTING EROSION HAZARD PERMIT IN CONNECTION WITH THE EXPANSION PLANS FOR GEORGE A BARKER RIVER PARK.PDF

118 Lion Blvd ◦ PO Box 187 ◦ Springdale, UT 84767 ◦ (435) 772-3434

PLANNING COMMISSION NOTICE AND AGENDA

THE SPRINGDALE PLANNING COMMISSION WILL HOLD A REGULAR MEETING ON WEDNESDAY, FEBRUARY 18, 2026, AT 5:00 PM AT THE CANYON COMMUNITY CENTER, 126 LION BLVD – SPRINGDALE, UT 84767

A live broadcast of this meeting will be available to the public for viewing/listening only.
****Please see the stream information below****

Approval of the agenda
General announcements
Declaration of Conflicts of Interest

A. Action Items

1. Design Development Review: The Town of Springdale is Seeking Approval of Plans for the Expansion of The George A Barker River Park into Parcel S-150-D. Staff Contact: Niall Connolly

2. Erosion Hazard Permit: The Town of Springdale is Requesting an Erosion Hazard Permit in Connection with the Expansion Plans for the George A Barker River Park. Staff Contact: Niall Connolly

B. Adjourn

***To access the live stream for this public meeting, please visit or click the link below:**

https://www.youtube.com/@SpringdaleTownPublicMeeting

This notice is provided as a courtesy to the community and is not the official notice for this meeting/hearing. This notice is not required by town ordinance or policy. Failure of the Town to provide this notice or failure of a property owner, resident, or other interested parties to receive this notice does not constitute a violation of the Town's noticing requirements or policies.

NOTICE: In compliance with the Americans with Disabilities Act, individuals needing special accommodations or assistance during this meeting should contact Town Clerk Robin Romero at 435.772.3434 at least 48 hours before the meeting. *Packet materials for this meeting will be available at: https://www.springdaletown.com/agendacenter/planning-commission-7*

Memorandum

To: **The Planning Commission**
From: **Niall Connolly**
Date: **February 13, 2026**
Re: **Design Development Review for the River Park Expansion Project**

Introduction

The Town has acquired a parcel of land directly adjacent to the George A Barker River Park (parcel S-150-D). The Town proposes to extend the park to include this parcel. The existing park is 57,321 sq ft, and this new parcel is 39,824 sq ft, which combined gives a total of 97, 145 sq ft, or 2.23 acres.

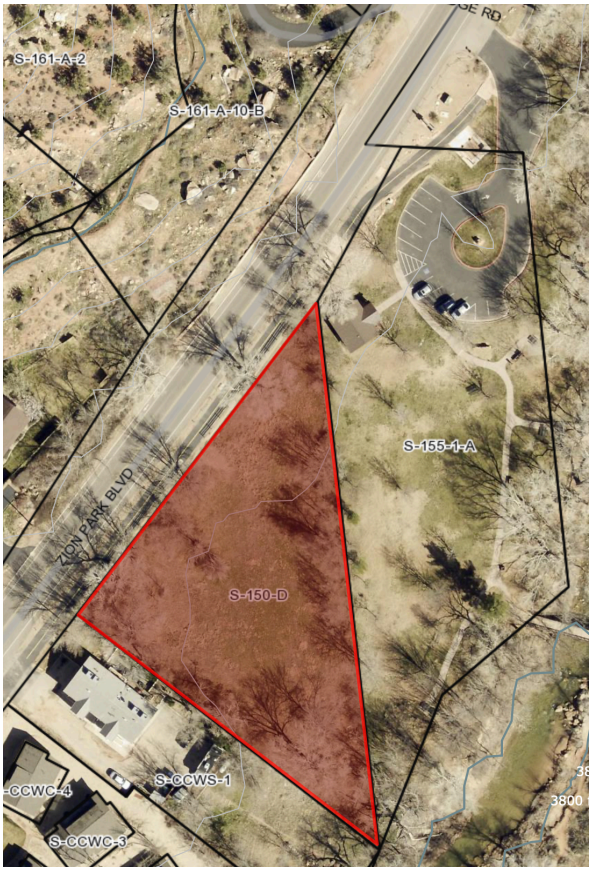


Figure 1. Parcel S-150-D highlighted in red

The Town is seeking Design Development Review approval for this project. The proposed design has been informed by community design charrettes and other public consultation which has taken place over the past couple of years. The general design intent is to expand the area of the park, while keeping its character and function largely unchanged from the present day condition. The Planning Commission's

role is to review the proposed expansion project to ensure that the proposals comply with all relevant land use regulations.

Park Expansion Design

The proposed design includes the following:

- Reconfiguring and resurfacing the vehicular entry and parking area. The size and shape of the paved area is not increasing, although the vegetated island in the middle of the turning circle is being slightly reduced in size.

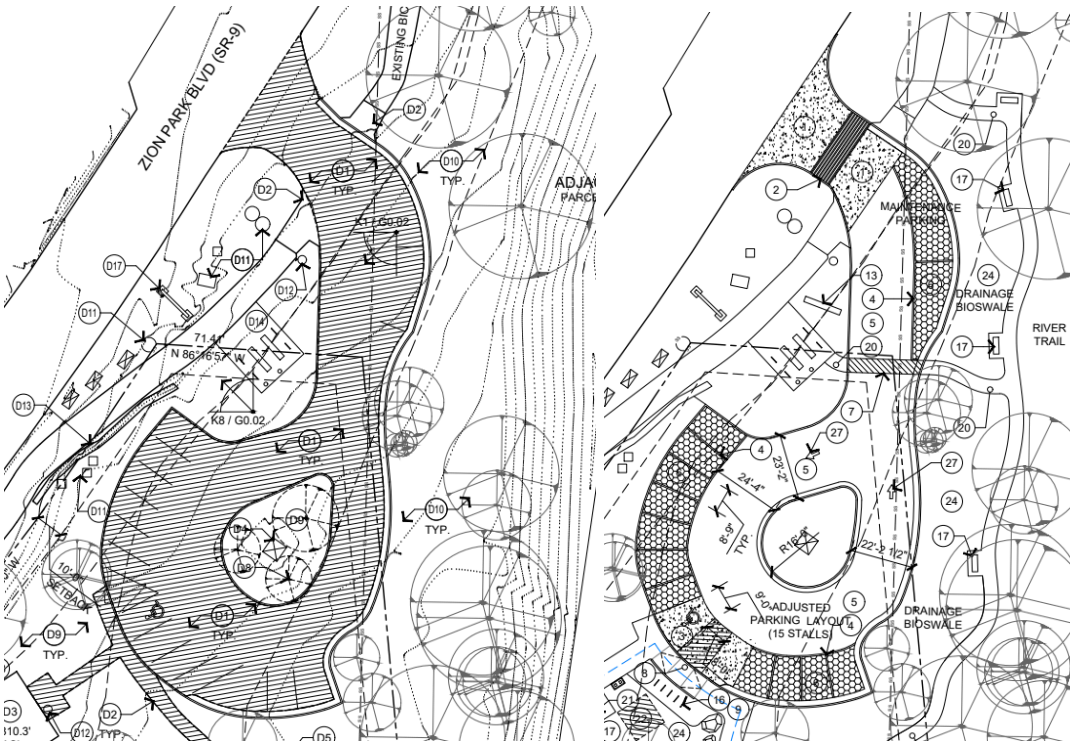


Figure 2. Existing and Proposed vehicular entry and parking area

- New paved trails, some of which will be concrete, some of which will be stabilized decomposed granite, with metal edging.
- Refurbishment of the existing restrooms. This will consist of refinishing the siding, removing a defunct drinking fountain and reroofing.
- New drinking fountain and pet fountain.
- An expanded, central lawn area, along with xeriscape landscaped areas
- New pedestrian and cycling entrance, to connect with the multipurpose trail that runs along SR-9.

Figure 3. Proposed new pedestrian and cycle entrance

- Some grading in the area of the new lawn. Also some grading in two locations beside the river, to restore bank conditions and also to create a native riparian amphitheater. This is shown in the submitted grading plan.
- New benches and trash/ recycling receptacles.
- Removal of some trees and shrubs (in particular along the existing boundary of the two parcels to create a new lawn area). Planting of new native, drought tolerant trees and shrubs in various locations across the park.

The design also anticipates the possibility of a cell tower in the park at some future date. This is envisaged by the Town's adopted Wireless Master Plan. The design includes a potential location for such a facility. However, it should be noted that any such development would be subject to its own design and approval process, if such a proposal were ever to come to fruition.

Flooding and Erosion

The River Park is partially within the Special Flood Hazard Area and the Erosion Hazard Zone. The design proposals are relatively light on the land, and so no significant impacts on the floodplain or erosion zone are anticipated. However, because some grading is proposed, an erosion hazard study has been submitted. Both an erosion hazard permit and a floodplain development permit will be required. No erosion protection (riprap etc) is proposed as part of this application.

The erosion hazard study and engineering drawings show some improvements that may be part of a future phase of development, but are not proposed at this time. These potential future phase improvements include a new restroom building and a river viewing platform. The Commission should note that permission for these improvements is not being sought at this time. The Commission should evaluate the application based only on the improvements proposed for the first phase of the project. The

Commission may wish to emphasize that any approval given includes only the phase one improvements and any additional future development must be submitted for additional review.

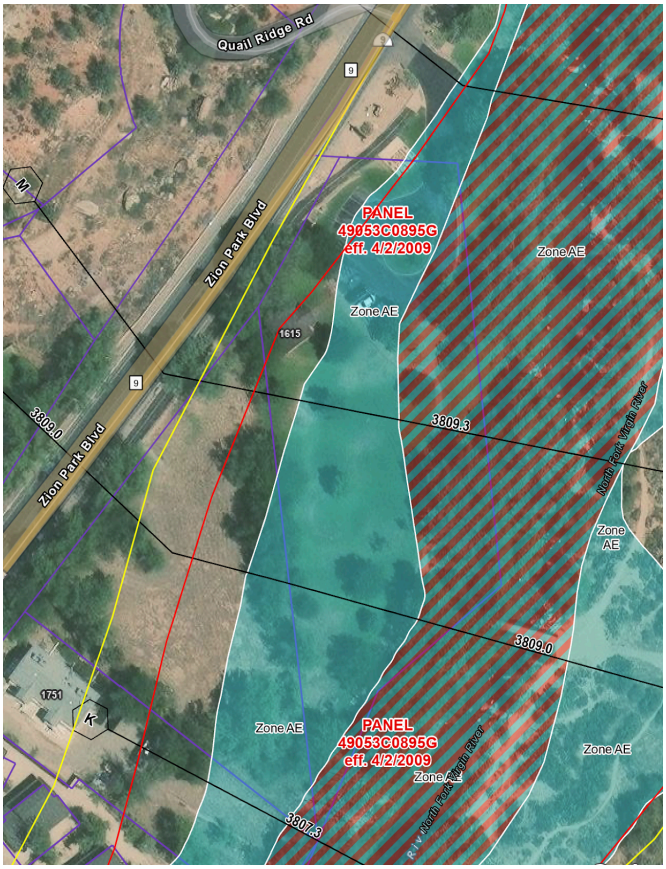


Figure 4. The River Park overlaid by the Special Flood Hazard and Erosion Hazard Zones.

Staff Analysis

The three parcels which are involved in the River Park expansion project are as follows:

Parcel Number	**Zone**
S-162-A-1E-1	Foothill Residential
S-155-1-A	Valley Residential
S-150-D	Valley Residential

Public Parks are permitted in all zones. The table below sets out how the improvements comply with the Town Code.

Proposed Improvement	Zoning Requirement	Compliance Status
Reconfiguring and resurfacing the vehicular entry and parking area.	Acceptable parking area surfaces are listed in section 10-23-9 A of the Code. New asphalt is proposed to replace the old, and the parking stalls will be stabilized gravel.	Complies.
New paved trails, some of which will be concrete, some of which will be stabilized decomposed granite, with metal edging.	Pedestrian trials are permitted in landscaped areas.	Complies.
Refurbishment of the existing restrooms. This will consist of refinishing the siding, removing a defunct drinking fountain and reroofing.	The existing siding will be refinished. The existing roof material will be replaced with architectural grade shingles to match existing. Acceptable roofing materials are listed in 10-16-4 (B) 7 of the Town Code.	Complies.
New drinking fountain and pet fountain. New benches and trash/ recycling receptacles.	Proposed benches are sandstone, and trash receptacles are framed in sandstone. Sandstone is an approved material.	Complies.
An expanded, central lawn area, along with xeriscape landscaped areas	The proposed plant species must be 80% drought tolerant. No invasive species are permitted. The proposed plant species meet this requirement. Existing non-functional lawn areas will be removed and landscaped with drought tolerant vegetation. Between removal of existing non-functional lawn and expansion of the central lawn area the total amount of lawn is increasing slightly.	Complies.

Some grading in the area of the new lawn. Also some grading in two locations beside the river, to restore bank conditions and also to create a native riparian amphitheater.	The erosion hazard permit and floodplain development permit address the potential impacts of this grading.	Complies.
Removal of some trees and shrubs (in particular along the existing boundary of the two parcels to create a new lawn area). Existing trees to be removed are mostly non-native (either ornamental species planted in the original development of the park, or volunteer species such as Chinese Elm). Planting of new native, drought tolerant trees and shrubs in various locations across the park.	For every native tree taller than 6 ft to be removed, two similar replacements are needed. Substantial tree planting is proposed to replace the trees being removed.	Complies.

Planning Commission Action

The Planning Commission should review the proposed Design Development Review application to determine if it complies with the applicable standards in the Town Ordinance. Staff recommends the Commission specifically consider the following:

- Does the proposal meet the zoning standards for the Valley Residential and Foothill Residential zones?
- Does the proposal meet all the requirements of the Architectural Standards and Design Guidelines ordinance?

Sample Motion Language

The Planning Commission may refer to the following sample language when making a motion on the application:

The Planning Commission approves/ denies the proposed Design Development Review for expansion of the George A Barker River Park, as discussed at the Commission meeting on February 18th, 2026. The motion is based on the following findings:

[LIST FINDINGS]

Appendix: Application Documents

TOWN OF SPRINGDALE DESIGN/DEVELOPMENT REVIEW SUBMITTAL REQUIREMENTS

Classes of Applications:

Tier One Applications: Accessory structures and additions less than 500 sf, not located on a high visual impact parcel.

Tier Two Applications: 1) Accessory structrures and additions larger than 500 sf on residential property or between 500 and 999 sf on commercial property, 2) new single and two family residential development, 3) any development on high visual impact parcels that is not a Tier 3 application.

Tier Three Applications: 1) Accessory structures and additions 1,000 sf or larger on commercial property, 2) All new multi-family residential development, 3) All new commercial development, 4) Any development the DCD determines to be complex or controversial and subject to Planning Commission review.

Submittal Requirements:

	Tier One	Tier Two	Tier Three	SUBMITTAL CHECKLIST
Table of Contents / Sheet Index				
		X	X	☑
Natural Features Map				
Reference map showing property in relation to rest of community	X(1)	X(1)	X	☑
North arrow and scale	X(1)	X(1)	X	☑
Property boundaries and dimensions	X(1)	X(1)	X	☑
Show topography on the property with 1' contour intervals	X(1)	X(1)	X	☑
Highlight all slopes of 30% or greater grade (any 1 foot or greater elevation change in any 3 and 1/3 foot horizontal direction)	X(1)	X(1)	X	☑
Show any significant rock outcrops or large boulders larger than 10' in diameter	X(1)	X(1)	X	☑
Identify any other significant topographic features	X(1)	X(1)	X	☑
Show any drainage running through or within 50 feet of the site	X(1)	X(1)	X	☑
Show the Special Flood Hazard Area, as mapped by the Flood Insurance Rate Map for Springdale	X(1)	X(1)	X	☑
Show the floodway, as mapped by the Flood Insurance Rate Map for Springdale	X(1)	X(1)	X	☑
Show any drainage improvements on or within 50 feet of the site	X(1)	X(1)	X	☑
Show the boundary of the Erosion Hazard Zone	X(1)	X(1)	X	☑
Show the location and indicate the type of existing native trees over six feet in height	X(1)	X(1)	X	☑
(1) Required if any natural features will be distrubed with the project				
Existing Development				
Include north arrow and scale	X(2)	X(2)	X	☑
Show all property boundaries and dimensions	X(2)	X(2)	X	☑
Show the footprint locations of all existing built structures on property. Label each as" To Be Demolished", "To Remain Unchanged", or "To Be Renovated / Remodeled" *Note: Structures to be demolished show in light line weight with cross hatched area. Structures to remain unchanged show in light line weight. Structures to be renovated or remodeled show in standard line weight with dashed lines.*	X(2)	X(2)	X	☑
Indicate the height and size of all existing buildings greater than 500 square feet in area	X(2)	X(2)	X	☑
Show the setback distanced from existing buildings to property lines	X(2)	X(2)	X	☑
Show the amount of existing landscape and/or natural open space on the property, as definedby section 10-18-4, in both total square feet and as a percentage of lot area	X(2)	X(2)	X	☑
(2) Required if any existing development is proposed to be removed, renovated, or remodeled				
Photographs showing viewsheds across property from valley floor / SR-9 and adjacent properties*				
	X	X	X	☑
**Photographs must be labeled indicating from which direction they were taken*				
Site Plan				
Include north arrow and scale	X	X	X	☑
Show all property boundaries and dimensions	X	X	X	☑
Show the footprint locations of existing development that will remain on the property with the project	X	X	X	☑

Note: Structures to remain unchanged show in light line weight. Structures to be renovated or remodeled show in standard line weight with dashed lines.				
Show the location and footprint of all proposed new buildings	X	X	X	☑
Show the setback distance of each building and structure to property lines, as measured from the furthest projection of the building (including roof overhangs, exterior stairways, etc) to the property line	X	X	X	☑
Show the distance between all buildings and structures, as measured from the furthest projection each building (including roof overhangs, exterior stairways, etc)	X	X	X	☑
Label each building with the ASL elevation of finished building pad (include multiple measurements for terraced structures)		X	X	☐
Show the location of special flood hazard area, floodway, and erosion hazard boundary	X(3)	X(3)	X(3)	☑
Identify ingress / egress to property as well as any roads, streets, lanes, or access drives within or immediately adjacent to the site		X	X	☑
Show the location and dimensions of all required parking spaces		X	X	☑
Include a note showing the total number of parking spaces on the property			X	☐
Show the location of all exterior mechanical equipment, heating and cooling units, propane tanks, trash receptacles, solar panels, etc. and method of screening		X	X	☑
Show the location of nearest fire hydrant, proposed fire lanes, and fire truck turn arounds			X	☐
Show the location and ASL elevation of an elevation benchmark which will remain undisturbed and in place during the entire course of construction		X	X	☑
(3) Show these features if they are on or within 50 feet of the property				

Grading plan in conformance with the requirements of chapter 10-15B of the land use ordinance showing:				
Include north arrow and scale		X	X	☑
Show all property boundaries and dimensions		X	X	☑
Show accurate pre-development contours in no greater than 1-foot contour intervals shown as dashed lines		X	X	☑
Show proposed post-development contours shown as solid lines		X	X	☑
Show all proposed new buildings, structures, and other development		X	X	☑
Show all existing development on the property which will remain		X	X	☑
Show the project grading limits in conformance with section 10-15B-5		X	X	☑
Cross hatch or highlight any areas of 30% or greater natural grade		X	X	☑
Include details about the location, height, and finished slope of all cut and fill slopes		X	X	☑
Include engineered plans for slope stabilization if the project contains any cut or fill slopes steeper than 1.5:1 and greater than four (4) feet in height		X	X	☑
Label each building and structure with the ASL elevation of the finished building pad elevation		X	X	☑
Show rock ledges, boulders, and native vegetation within the grading limits that will be preserved pursuant to the section 10-15B-4(A)		X	X	☑
Show all areas requiring revegetation as well as quantities, locations, sizes, and types of plants used to satisfy the revegetation requirements of section 10-15B-8		X	X	☑
Provide details regarding irrigation of vegetation used to fill the revegetation requirements of 10-15B-8			X	☐
Include a note indicating all areas outside of the grading limits will be fenced or taped off during construction to prevent accidental or incidental disturbance of these areas		X	X	☑
Include color renderings, to scale, of any cut or fill slope over four (4) feet in height that will be visible from the valley floor or the SR-9 highway corridor			X	☐

Landscape plan showing:				
Designer's name, address, and phone number		X	X	☑
Landscaping as required by the landsacsape ordinance shown in sufficient detail to be easily legible		X	X	☑
Property lines, adjacent rights-of-way, building footprints, parking lots, driveways, walkways, utilities, garbage and equipment storage structures, drainage structures, and other site improvements, drawn to scale with dimensions and scale (bar and numerical) indicated		X	X	☑
Locations and boundaries of all landscaped areas and natural open space		X	X	☑
Plant schedules and key which includes plant names (common and botanical), sizes (e.g., height, caliper, diameter, gallons) and quantities		X	X	☑
Plant locations and spacing corresponding to plant key		X	X	☑

Notations and locations of all natural features retained either in landscaped areas or natural open space, including locations of rivers and streams, designated floodplain, natural vegetation, including trees and shrubs (identified by botanical and common name, height and caliper size, if applicable), grasses, large rocks and any other significant features			X	☑
Details showing the method for preservation or protection of existing significant vegetation selected to be retained		X	X	☑
Screening details to lessen the impacts of buildings, parking lots and parking structures, mechanical equipment, service areas, utility meters, transformers, trash receptacles, storage facilities, and similar facilities, from public view		X	X	☑
Summary data including:				
--> The total area (in square feet and as a percentage of the site) that will be landscaped			X	☑
--> The total area (in square feet and as a percentage of the site) that will be retained as natural open space			X	☑
--> The percentage of landscaped area coverage from water conserving plants expected after maturity, not including tree canopies (see definition of "water conserving plants" in section 10-18-11 of this chapter)			X	☑
Floor plan(s) including:				
ASL elevation of the finished floor in each level of the structure (For Tier 2 and Tier 3 projects)		X	X	☑
Locations of all proposed exterior doors and windows	X	X	X	☑
Location of all cross sections (see below, for Tier 2 and Tier 3 projects)		X	X	☑
Total size of each level of the structure *Note: For development in FR and VR zones this includes attached garages, covered porches, covered entryways, and covered patios. For development in all other zones this includes total area measured from face of outside wall to face of outside wall.*	X	X	X	☑
Building elevations from all directions showing:				
Accurate locations and configurations of all exterior walls, rooflines, doors, and windows	X	X	X	☑
Accurate representation of the contact between all exterior walls and finished grade	X	X	X	☑
At least two cross sections (drawn perpendicular to each other) at the tallest section(s) of the structure showing compliance with building height ordinance and identifying				
Natural grade		X	X	☐
Finished grade (labeled as cut, fill, or uniform grade)		X	X	☐
Building height envelope, in conformance with chapter 10-15A of the land use ordinance, drawn above the entire structure		X	X	☐
Roof Plan				
		X	X	☐
Color and material samples (unless the project is a single or two family exempt project)				
	X	X	X	☐
Outdoor Lighting Plan				
Plans or drawings indicating the proposed location of lighting fixtures, height of lighting fixtures on the premises, and type of illumination devices, lamps, supports, shielding and reflectors used and installation and electrical details.	X(4)	X	X	☑
Illustrations, such as contained in a manufacturer's catalog cuts, of all proposed lighting fixtures. The applicant must provide sufficient information regarding the light fixture, bulb wattage, and shielding mechanisms for the Planning Commission (or DCD, when applicable) to be able to determine compliance with the provisions of this chapter.	X(4)	X	X	☑
A table showing the total amount of proposed exterior lights, by fixture type, lumens, color temperature, and lamp type.	X(4)	X	X	☑
A calculation of the total lumen output from all outdoor fixtures on the property. *(4) only include these items if there is any new outdoor lighting proposed*	X(4)	X	X	☑
Perspective drawings of all new buildings from two different perspectives, one from a front angle and one from a rear angle				
		X	X	☐
Photo-simulations depicting the appearance of all new buildings on the site as seen from the street				
			X	☐

Geo technical report and Geologic Hazards Investigation (if required by the Geotechnical Report)			
	X	X	☑
Traffic Study			
		X(5)	☐

(5) If warranted per Transportation Master Plan

NOTES:

The site analysis must be compiled into one PDF document.

The elements must appear in the order and organization presented above.

Plans, elevations, and drawings must be scaled with the scale clearly shown on the plan. The PDF must be scalable in Adobe Acrobat, according to the scale shown on the plan. Some plans converted from drafting software do not allow scaling of the PDF in Adobe. Please ensure your plans are scalable in Adobe prior to submitting.

Only the information listed above should be included. Construction details are not necessary at this stage of review. Please do not include information and details not listed above.

Information must be organized in the application in the order shown above.

By signing and dating below you certify that you have included all the information as required above.

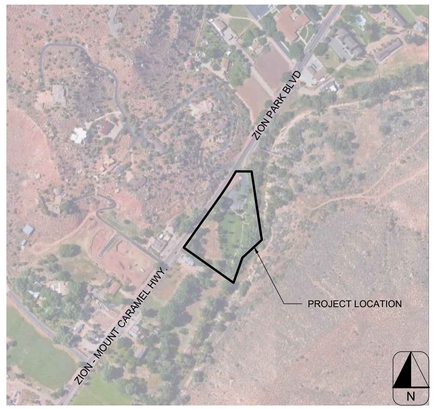
Jason Wheeler, AIA	1/28/26
Electronic Signature	Date

SPRINGDALE RIVER PARK EXPANSION & RE-DEVELOPMENT

1615 ZION PARK BLVD., SPRINGDALE, UT, 84767

01.28.2026 - DESIGN DEVELOPMENT REVIEW SUBMISSION

Vicinity Map



Project Contact Information

OWNER:
TOWN OF SPRINGDALE
CONTACT: RYAN GUBLER
118 LION BLVD.
SPRINGDALE, UT 84767
435.772.3434

ARCHITECT:
ASSIST INC. COMMUNITY DESIGN CENTER
CONTACT: JASON W. WHEELER
218 EAST 500 SOUTH
SALT LAKE CITY, UT 84111
801.355.7085

CIVIL ENGINEER:
ROSENBERG ASSOCIATES
CONTACT: JARED BATES
352 EAST RIVERSIDE DRIVE, SUITE A-2
ST. GEORGE, UT 84790
435.673.8586

GEOTECHNICAL ENGINEER:
LANDMARK TESTING & ENGINEERING
CONTACT: STEVEN WELLS
759 EAST FACTORY DRIVE
ST. GEORGE, UT 84790
435.986.0566

LANDSCAPE:
F & S LANDSCAPE
CONTACT: NATE FERGUSON
13894 SOUTH BANGERTER PARKWAY
SUITE 200- #6047
DRAPER UTAH, 84020
801.803.2270

Project Description

THE TOWN OF SPRINGDALE IS EXPANDING AND REDEVELOPING THE EXISITNG GEORGE A. BARKER RIVER PARK. THE PROJECT INCLUDES ADJUSTMENTS TO THE EXISTING PARKING LOT ALONG WITH PICNIC AREAS AND TRAILS. IN ADDITON, ALL OF THE LANDSCAPING WILL BE UPDATED TO INCLUDE A LARGE VARIETY OF NATIVE OR DROUGHT RESISTANT PLANTINGS, XERISCAPING, AND NATIVE GROUND COVERINGS.

Drawing Sheet Index

Springdale River Park Expansion

George A. Barker River Park
1615 Zion Park Blvd.
Springdale, UT 84767

Town of Springdale
435.772.3434

assist
COMMUNITY DESIGN CENTER
Tel: 801.355.7085 | TTY: 711 | Salt Lake City, UT 84111 | www.assistutah.org
218 East 500 South

STATE OF UTAH
JASON WHEELER
9484230-0301
LICENSED ARCHITECT

January 28, 2026

Revision Date

Project No:

Date: 01.28.2026

Title Sheet

G0.00

ABREVIATIONS

&	AND	DEG	DEGREE	ID	INSIDE DIAMETER	RAD	RADIUS
L	ANGLE	DEMO	DEMOLISH	INCL	INCLUDE OR INCLUDED	RCP	REFLECTED CEILING PLAN
@	AT	DIM	DIMENSION	INSUL	INSULATION	REF	REFERENCE
℄	CENTERLINE	DN	DOWN	INT	INTERIOR	REINF	REINFORCE
Ø	DIAMETER OR ROUND	DDTL	DETAIL			REQ'D	REQUIRED
#	POUND OR NUMBER	DW	DISHWASHER	LAV	LAVATORY	RFI	REQUEST FOR INFORMATION
		DWG	DRAWING	LF	LINEAR FEET		
A/C	AIR CONDITIONING			LVT	LUXURY VINYL TILE	S	SOUTH
ABS	ACRYLONITRILE-BUTADIENE-STYRENE	E	EAST			SCHED	SCHEDULE
ADJ	ADJUSTABLE	EA	EACH	MAX	MAXIMUM	SECT	SECTION
AFF	ABOVE FINISHED FLOOR	ELEC	ELECTRICAL	MAU	MAKEUP AIR UNIT	SF	SQUARE FOOT
ALT	ALTERNATE	ELEV	ELEVATOR	MECH	MECHANICAL	SHT	SHEET
ALUM	ALUMINUM	EPDM	ETHYLENE PROPYLENE DIENE MONOMER	MET	METAL	SIM	SIMILAR
APC	ACOUSTIC PANEL CEILING	EPS	EXPANDED POLYSTYRENE	MFG	MANUFACTURING	SPEC	SPECIFICATION
APPROX	APPROXIMATE	EQ	EQUAL	MFR	MANUFACTURER	SPF	SPRAYED POLYURETHANE FOAM
ARCH	ARCHITECTURAL	EQUIP	EQUIPMENT	MIN	MINIMUM	SS	STAINLESS STEEL
ASI	ARCHITECT'S SUPPLEMENTAL INSTRUCTION	EVAP	EVAPORATIVE / EVAPORATING	MISC	MISCELLANEOUS	SYM	SYMMETRICAL
		EXIST	EXISTING	MTRL	MATERIAL		
ASPH	ASPHALT	EXST'G	EXISTING			T&G	TONGUE AND GROOVE
		EXT	EXTERIOR	N	NORTH	T.O.	TOP OF...
BITUM	BITUMINOUS			N/A	NOT APPLICABLE	TPO	THERMOPLASTIC POLYOLEFIN
BLDG	BUILDING	FE	FIRE EXTINGUISHER	NIC	NOT IN CONTRACT	TV	TELEVISION
BLKG	BLOCKING	FF	FINISHED FLOOR	NO	NUMBER	TYP	TYPICAL
BRG	BEARING	FT	FOOT OR FEET	NTS	NOT TO SCALE		
BSMT	BASEMENT	FTG	FOOTING			VIF	VERIFY IN FIELD
		FURR	FURRING	OC	ON CENTER	VERT	VERTICAL
CEM	CEMENT			OD	OUTSIDE DIAMETER		
CF	CUBIC FOOT	GA	GAUGE	OFCI	OWNER-FURNISHED, CONTRACTOR-INSTALLED	WM	WASHING MACHINE
CFM	CUBIC FEET PER MINUTE	GALV	GALVINIZED			W	WEST
CIPC	CAST-IN-PLACE CONCRETE	GC	GENERAL CONTRACTOR	OH	OVERHEAD	W/	WITH
CJ	CONTROL JOINT	GEN	GENERAL			WB	WEATHER BARRIER
CLG	CEILING	GPS	GRAPHITE POLYSTYRENE	PCF	POUNDS / CUBIC FOOT	WC	WATER CLOSET
CMU	CONCRETE MASONRY UNIT	GND	GROUND	PERP	PERPENDICULAR	WD	WOOD
CONC	CONCRETE	GWB	GYPSUM WALL BOARD	PL	PLATE	WH	WATER HEATER
CONSTR	CONSTRUCTION			PLYWD	PLYWOOD	W/O	WITHOUT
CONT	CONTINUOUS	HDWD	HARDWOOD	PNT	PAINT	WP	WATERPROOF
CT	CERAMIC TILE	HORIZ	HORIZONTAL	PT	PRESSURE-TREATED	WWM	WELDED WIRE MESH
CY	CUBIC YARD	HSS	HOLLOW STEEL SECTION	PTD	PAINTED		
		HTG	HEATING	PVC	POLYVINYL CHLORIDE	XPS	EXTRUDED POLYSTYRENE

REFERENCE SYMBOLS

- DETAIL NUMBER / SHEET NUMBER (J1 / A5.1)
- BUILDING SECTION (J1 / A3.1)
- DETAIL REFERENCE (J1 / A5.1)
- DETAIL CALLOUT (J1 / A5.1)
- INTERIOR ELEVATION (J5, J1, J9 / A6.1)
- KEY NOTE (1, 1)
- GRID LINE (1)
- EXISTING LEVEL (100'-0" FLOOR)
- NEW LEVEL (100'-0" FLOOR)
- SPOT ELEVATION (+100.0')
- CUT LINE
- DOOR NUMBER (101)
- WINDOW TYPE (W)
- ROOM NAME / NUMBER (BATHROOM, 101-A)
- CEILING HEIGHT (8'-0")
- WALL TYPE (P4)
- NORTH ARROW (N)
- PHOTO KEY (J1 / A1.1)
- IMPORTANT TO NOTICE (!)
- REVISION / ADDENDUM (A1)

MATERIAL SYMBOLS

- EARTH
- GRANULAR FILL
- CONCRETE
- FACE BRICK
- STEEL
- WOOD
- CONTINUOUS DIMENSION LUMBER
- NON-CONTINUOUS BLOCKING
- BATT INSULATION
- RIGID INSULATION
- SPRAY FOAM INSULATION
- PLYWOOD
- STONE

Springdale River Park Expansion

George A. Barker River Park
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Town of Springdale
435.772.3434

assist
COMMUNITY DESIGN CENTER
Tel: 801.355.7085 | TTY: 711
918 East 500 South | Salt Lake City, UT 84111 | www.assistutah.org

STATE OF UTAH
JASON WHEELER
9484230-0301
LICENSED ARCHITECT

January 28, 2026

Revision	Date

Project No:
Date: 01.28.2026

Symbols & Abbreviations

G0.01

K1 — Existing Development & Natural Features
G1.00 — 1" = 30'-0"

PROPERTY DETAILS

STREET ADDRESS:
1701 ZION PARK BLVD.
SPRINGDALE, UT 84767

PROPERTY AREA:

EXISTING PARK PARCEL:	57,321 SF (1.32 AC)
EXPANSION PARCEL:	39,824 SF (0.91 AC)
TOTAL AREA:	97,145 SF (2.23 AC)

TOWN OF SPRINGDALE ZONING DESIGNATION:
PUBLIC USE (PU)

PROPERTY LEGAL DESCRIPTION:
S: 32 T: 41S R: 10W BEGINNING POINT N 36°06' E 359.26 FT FROM POINT SOUTHEASTERLY RIGHT-OF-WAY LINE OF STATE HIGHWAY SR-9 & NORTHEASTERLY B/L LOT 4 NORTH UP FIELD SUR SW1/4 SEC 31 T42S R10W THENCE 36°06' E 143 FT; THENCE S 83°15' E 71.94 FT; THENCE S 02°10' E 315.48 FT; THENCE S 53°36'W 120.78 FT; THENCE S 26° W 121 FT; THENCE N 02°32' W 389 FT TO POINT OF BEGINNING. LESS: ANY POINT OF REFERENCE LYING WITHIN STATE HWY U-15

BEGINNING AT A POINT ON THE SOUTHEASTERLY RIGHT-OF-WAY LINE OF STATE HIGHWAY SR-9, SAID POINT BEING NORTH 0°43'11" EAST 1585.30 FEET ALONG THE SECTION LINE AND EAST 1785.31 FEET FROM THE SOUTHWEST CORNER OF SECTION 32, TOWNSHIP 41 SOUTH, RANGE 10 WEST, SALT LAKE BASE AND MERIDIAN, WASHINGTON COUNTY, UTAH AND RUNNING THENCE NORTH 37°45'30" EAST 286.13 FEET ALONG SAID RIGHT-OF-WAY LINE; THENCE SOUTH 6°27'23" EAST 399.18 FEET; THENCE NORTH 52°14'46" WEST 278.37 FEET TO THE POINT OF BEGINNING.

GENERAL SITE NOTES

1. THE CONTRACTOR SHALL ASSUME FULL RESPONSIBILITY AND COMPLETING ALL OF THE WORK OUTLINED WITHIN THE CONTRACT DOCUMENTS, INCLUDING ANY NECESSARY COORDINATION WITH SUBCONTRACTORS. ANY DISCREPANCIES OF OMISSIONS IN THE CONTRACT DOCUMENTS MUST BE BROUGHT TO THE ATTENTION OF THE OWNER AND ARCHITECT IMMEDIATELY. THE CONTRACTOR IS RESPONSIBLE FOR RESOLVING ANY AND ALL DISCREPANCIES TO ENSURE PROJECT COMPLETION ACCORDING TO THE INTENDED DESIGN.
2. THE CONTRACTOR MUST VERIFY ALL SITE CONDITIONS AND DIMENSIONS PRIOR TO COMMENCING WORK AND REPORT ANY DISCREPANCIES TO THE OWNER AND ARCHITECT.
3. SEE GEOTECHNICAL REPORT FOR EXISTING SOIL CONDITIONS AND RECOMMENDED SOIL ADJUSTMENTS.

KEY NOTES

(D1) REMOVE EXISTING ASPHALT PARKING LOT & DRIVEWAY SURFACE; CONCRETE CURB & GUTTER TO REMAIN; PREPARE GRADE FOR INSTALLATION OF NEW PARKING & LANDSCAPING PER SITE PLAN; SEE PARK LAYOUT PLAN & CIVIL DRAWINGS

(D2) REMOVE EXISTING CONCRETE HARDSCAPING; PREPARE GRADE FOR INSTALLATION OF NEW CONCRETE HARDSCAPING & LANDSCAPING PER SITE PLAN; SEE ARCHITECTURAL SITE PLAN & CIVIL DRAWINGS

(D3) EXISTING RESTROOM BUILDING TO REMAIN, WITH UPDATES TO EXTERIOR FINISHES; EXISTING UTILITIES TO REMAIN IN PLACE

(D4) SANDSTONE SCULPTURE TO REMAIN; SEE PARK LAYOUT PLAN

(D5) EXISTING MONUMENT SIGN TO REMAIN

(D6) REMOVE EXISTING GARBAGE & RECYCLING ENCLOSURES, TYP.

(D7) REMOVE EXISTING FENCING BETWEEN EXISTING PARCEL & EXPANSION PARCEL; REMOVE POST FOOTINGS

(D8) REMOVE EXISTING TREES; GRIND & REMOVE STUMP/ROOT SYSTEM; COORD. w/ LANDSCAPE DRAWINGS

(D9) REMOVE EXISTING SOD GRASS LANDSCAPING; PREPARE FOR SITE GRADING PER CIVIL; COORD. w/ CIVIL DRAWINGS

(D10) REMOVE EXISTING DEADFALL TREES, DEBRIS, & UNDERBRUSH; TYPICAL ACROSS ENTIRE SITE; COORD. w/ LANDSCAPE DRAWINGS

(D11) EXISTING UTILITY PEDESTALS & METERS TO REMAIN; SEE CIVIL DRAWINGS FOR UTILITY RELOCATIONS

(D12) EXISTING SEWER MANHOLE OR CLEANOUT TO REMAIN

(D13) EXISTING RETAINING WALLS TO REMAIN, TYP.

(D14) EXISTING CONCRETE PAD & BENCHES TO REMAIN

(D15) EXISTING FENCING TO REMAIN

(D16) EXISTING PEDESTRIAN BRIDGE TO REMAIN

(D17) EXISTING MARQUEE SIGN TO REMAIN

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9484230-0301
LICENSED ARCHITECT

January 28, 2026

Revision	Date

Project No:
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Existing Development & Natural Features

G1.00

F1 Photo From Pedestrian Bridge

G1.01 NTS

F8 Photo of Existing Restroom

G1.01 NTS

K1 Photo

G1.01 NTS

K8 Photo of Park Entry Sign

G1.01 NTS

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Revision Date

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Site Photos

G1.01

K1 Architectural Site Plan

G2.00 1" = 30'-0"

0' 7.5' 15' 30' 60'

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2. THE CONTRACTOR MUST VERIFY ALL SITE CONDITIONS AND DIMENSIONS PRIOR TO COMMENCING WORK AND REPORT ANY DISCREPANCIES TO THE OWNER AND ARCHITECT.
3. SEE CIVIL DRAWINGS FOR ALL HARDSCAPE, GRADING, ELEVATIONS, UTILITIES, AND STORM DRAIN MANAGEMENT.
4. SEE LANDSCAPE DRAWINGS FOR ALL PLANTINGS, GROUND COVER, IRRIGATION, AND SITE ELEMENT DETAILS.
5. SEE GEOTECHNICAL REPORT FOR EXISTING SOIL CONDITIONS AND RECOMMENDED SOIL ADJUSTMENTS.
6. ACCESSIBLE ROUTE MARKED IN BLUE DASHED LINES TO MEET ALL ADA REQUIREMENTS FOR SLOPE AND CROSS SLOPE

KEY NOTES

1. NEW CONCRETE DRIVEWAY APRON & CURB; SEE CIVIL DRAWINGS
2. DRIVEWAY DRAINAGE GRATE & STORM WATER DRAINAGE BOX; SEE CIVIL DRAWINGS
3. CONCRETE ADA PARKING STALL SURFACE; SEE CIVIL DRAWINGS
4. 6" WIDE CONCRETE PARKING STRIPING, TYP.; SEE CIVIL DRAWINGS
5. NEW ASPHALT DRIVE SURFACE; TYP.
6. STABILIZED GRAVEL PARKING SURFACE; SEE CIVIL DRAWINGS
7. CROSSWALK STRIPING ON ASPHALT DRIVE SURFACE
8. CONCRETE PEDESTRIAN ADA ACCESS; SEE CIVIL DRAWINGS
9. CONCRETE PEDESTRIAN WALKWAY; SEE CIVIL DRAWINGS
10. CONCRETE ADA PICNIC TABLE AREA; SEE CIVIL DRAWINGS
11. CONCRETE STAIRS; SEE CIVIL DRAWINGS
12. RECONSTRUCTED CONCRETE RIVER ACCESS POINT; SEE CIVIL DRAWINGS
13. MONUMENT SIGN; SEE SITE DETAILS
14. SANDSTONE RETAINING WALL; SEE CIVIL DRAWINGS
15. SANDSTONE BENCH SEATING ON CONCRETE PAD; SEE CIVIL DRAWINGS
16. CUSTOM TOWN OF SPRINGDALE BICYCLE RACKS; SEE SITE DETAILS
17. SANDSTONE BENCH SEATING WITH STABILIZED DECOMPOSED GRANITE PAD BELOW; SEE LANDSCAPE SITE DETAILS
18. SANDSTONE TRASH & RECYCLING ENCLOSURES; SEE SITE DETAILS
19. PICNIC TABLE ON STABILIZED DECOMPOSED GRANITE PAD
20. STABILIZED DECOMPOSED GRANITE PEDESTRIAN PATHWAY w/ METAL EDGING; SEE LANDSCAPE SITE DETAILS
21. FREE STAND OUTDOOR DRINKING FOUNTAIN INCLUDES A DOG-BOWL / PET FOUNTAIN
22. DESIGNATED LOCATION FOR FUTURE TELECOMMUNICATIONS TOWER STRUCTURE; CONDUIT RUN FROM TELECOMMUNICATIONS ROOM TO THIS LOCATION PER OWNER REQUIREMENTS
23. SOD GRASS LAWN AREA; SEE LANDSCAPE DRAWINGS
24. XERISCAPED & NATIVE VEGETATION PLANTING AREAS, TYP.; SEE LANDSCAPE DRAWINGS
25. NEW 3-RAIL RUSTIC WOOD FENCING TO MATCH EXISTING FENCING ON-SITE; TYP. ALONG SECTIONS OF THE RIVER BANK
26. GENTLY SLOPING GRADE DOWN TO RIVER BANKS; SEE CIVIL DRAWINGS
27. ONE-WAY DIRECTIONAL ARROW STRIPING ON ASPHALT DRIVE SURFACE

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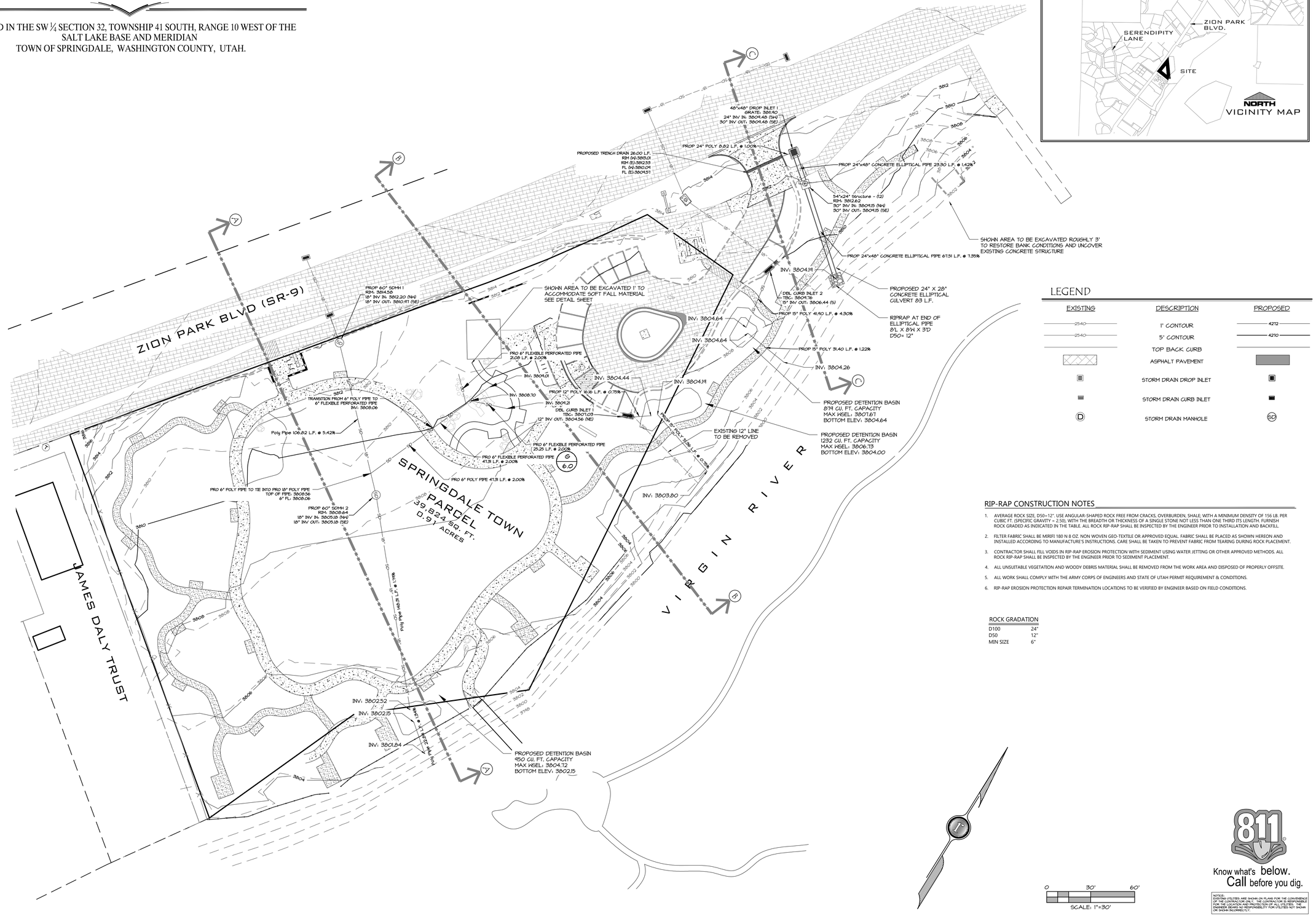
Architectural Site Plan

G2.00

RIVER PARK EXPANSION

LOCATED IN THE SW ¼ SECTION 32, TOWNSHIP 41 SOUTH, RANGE 10 WEST OF THE SALT LAKE BASE AND MERIDIAN
TOWN OF SPRINGDALE, WASHINGTON COUNTY, UTAH.



LEGEND

EXISTING	DESCRIPTION	PROPOSED
2540	1' CONTOUR	4212
2540	5' CONTOUR	4210
	TOP BACK CURB	
	ASPHALT PAVEMENT	
	STORM DRAIN DROP INLET	
	STORM DRAIN CURB INLET	
D	STORM DRAIN MANHOLE	SD

RIP-RAP CONSTRUCTION NOTES

1. AVERAGE ROCK SIZE, D50=12". USE ANGULAR-SHAPED ROCK FREE FROM CRACKS, OVERBURDEN, SHALE; WITH A MINIMUM DENSITY OF 156 LB. PER CUBIC FT. (SPECIFIC GRAVITY = 2.50), WITH THE BREADTH OR THICKNESS OF A SINGLE STONE NOT LESS THAN ONE THIRD ITS LENGTH. FURNISH ROCK GRADED AS INDICATED IN THE TABLE. ALL ROCK RIP-RAP SHALL BE INSPECTED BY THE ENGINEER PRIOR TO INSTALLATION AND BACKFILL.
2. FILTER FABRIC SHALL BE MIRIFI 180 N 8 OZ. NON WOVEN GEO-TEXTILE OR APPROVED EQUAL. FABRIC SHALL BE PLACED AS SHOWN HEREON AND INSTALLED ACCORDING TO MANUFACTURE'S INSTRUCTIONS. CARE SHALL BE TAKEN TO PREVENT FABRIC FROM TEARING DURING ROCK PLACEMENT.
3. CONTRACTOR SHALL FILL VOIDS IN RIP-RAP EROSION PROTECTION WITH SEDIMENT USING WATER JETTING OR OTHER APPROVED METHODS. ALL ROCK RIP-RAP SHALL BE INSPECTED BY THE ENGINEER PRIOR TO SEDIMENT PLACEMENT.
4. ALL UNSUITABLE VEGETATION AND WOODY DEBRIS MATERIAL SHALL BE REMOVED FROM THE WORK AREA AND DISPOSED OF PROPERLY OFFSITE.
5. ALL WORK SHALL COMPLY WITH THE ARMY CORPS OF ENGINEERS AND STATE OF UTAH PERMIT REQUIREMENT & CONDITIONS.
6. RIP-RAP EROSION PROTECTION REPAIR TERMINATION LOCATIONS TO BE VERIFIED BY ENGINEER BASED ON FIELD CONDITIONS.

ROCK GRADATION	
D100	24"
D50	12"
MIN SIZE	6"

0 30' 60'
SCALE: 1"=30'

Know what's below. Call before you dig.

NOTICE:
EXISTING UTILITIES ARE SHOWN ON PLANS FOR THE CONVENIENCE OF THE CONTRACTOR ONLY. THE CONTRACTOR IS RESPONSIBLE FOR THE LOCATION AND PROTECTION OF ALL UTILITIES. THE ENGINEER BEARS NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR SHOWN INCORRECTLY.

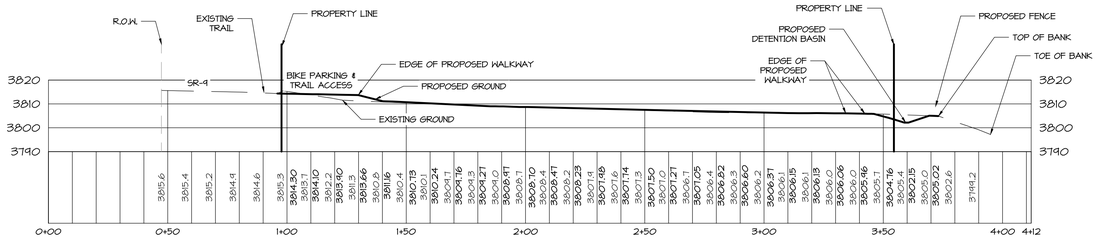
DATE: 1-10-25
JOB NO.: #2848-24-002
DESIGNED BY: ETY
CHECKED BY: JWB
DWG: CONST SET
DATE
REVISIONS

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS
352 East Riverside Drive, Suite A-2
St. George, Utah 84790
Ph (435) 673-8586 Fx (435) 673-8397
www.racivil.com

GRADING & DRAINAGE PLAN
FOR
SPRINGDALE RIVER PARK EXPANSION
SPRINGDALE
UTAH

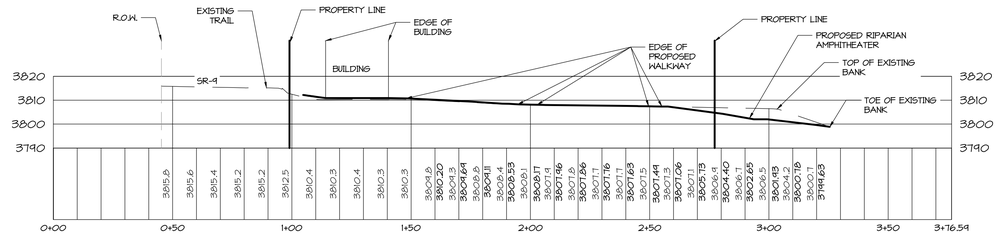
PROFESSIONAL ENGINEER
JARED W. BATES
1/3/2026
7886
STATE OF UTAH

SHEET
4.0
4 OF 8 SHEETS



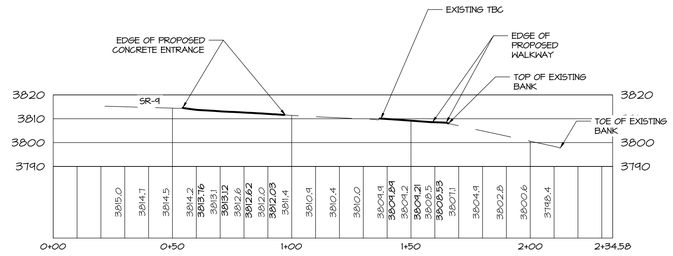
SECTION A-A STATION 0+00 - 3+12

HORIZ. SCALE = 1" = 30'
VER. SCALE = 1" = 30'



SECTION B-B STATION 0+00 - 3+76

HORIZ. SCALE = 1" = 30'
VER. SCALE = 1" = 30'



SECTION C-C STATION 0+00 - 2+34

HORIZ. SCALE = 1" = 30'
VER. SCALE = 1" = 30'

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FOR
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UTAH

PROFESSIONAL ENGINEER
JARED W. BATES
1/13/26
7888S
STATE OF UTAH

SHEET
4.2
6 OF 8 SHEETS

Know what's **below.**
Call before you dig.

SOURCE OF BASE INFORMATION

THE PROJECT SITE WAS SURVEYED BY XXX OF XXX AND PROVIDED TO F&S LANDSCAPE.

CONTRACTOR IS TO VERIFY EXISTING SITE CONDITIONS AND NOTIFY LANDSCAPE ARCHITECT OF DISCREPANCIES IN WRITING.

THE BASIS OF BEARING IS XXX. PROPERTY IS LOCATED IN THE XXX. THE BENCHMARK ELEVATION XXX.

GENERAL NOTES

1. THIS DESIGN IS AN ORIGINAL UNPUBLISHED WORK AND MAY NOT BE DUPLICATED, PUBLISHED, AND/OR USED WITHOUT THE WRITTEN CONSENT OF THE LANDSCAPE ARCHITECT.
2. NOTHING CONTAINED IN THE CONTRACT DOCUMENTS SHALL CREATE, NOR SHALL BE CONSTRUED TO CREATE A CONTRACTUAL RELATIONSHIP BETWEEN THE LANDSCAPE ARCHITECT AND THE CONTRACTOR OR SUBCONTRACTOR.
3. THE LANDSCAPE ARCHITECT AND THE OWNER/OWNER'S REPRESENTATIVE ARE NOT RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, OR FOR SAFETY PRECAUTIONS OR PROGRAMS UTILIZED IN CONNECTION WITH THE WORK.
4. THE LANDSCAPE ARCHITECT AND OWNER SHALL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S FAILURE TO CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
5. THE CONTRACTOR SHALL PROVIDE LABOR, MATERIALS, AND EQUIPMENT NECESSARY TO INSTALL THE WORK INDICATED ON THE CONSTRUCTION DOCUMENTS.
6. IT IS THE CONTRACTOR'S RESPONSIBILITY TO REVIEW AND COORDINATE THE WORK OF ALL SUBCONTRACTORS, TRADES AND SUPPLIERS TO COMPLETE THE WORK SHOWN ON THESE DRAWINGS. AND TO ASSURE THAT ALL PARTIES ARE AWARE OF ALL REQUIREMENTS.
7. THE CONTRACTOR SHALL VERIFY THE EXISTING SITE CONDITIONS AND INSTALLATION CONDITIONS AND NOTIFY THE LANDSCAPE ARCHITECT OF DIMENSIONAL ERRORS, OMISSIONS, OR DISCREPANCIES BEFORE BEGINNING OR FABRICATING WORK. CONTRACTOR IS RESPONSIBLE TO OBTAIN CLARIFICATION BEFORE PROCEEDING FURTHER WITH OTHER RELATED WORK. DISCREPANCIES FOUND BETWEEN PLAN DIMENSIONS AND ACTUAL FIELD CONDITIONS SHALL BE REPORTED TO THE LANDSCAPE ARCHITECT. WRITTEN DIMENSIONS SHALL GOVERN OVER SCALED DIMENSIONS.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CAREFUL SITE INSPECTION, DETAILED REVIEW OF THE PLANS, SEQUENCING, AND COORDINATION WITH OTHER CONTRACTORS ON SITE PRIOR TO INSTALLATION. DISCREPANCIES IN THE PLANS SHALL BE BROUGHT TO THE ATTENTION OF THE LANDSCAPE ARCHITECT IN WRITING IMMEDIATELY.
9. EQUIPMENT AND MATERIALS NOT SHOWN OR SPECIFIED ON THE PLANS BUT REQUIRED TO COMPLETE THIS INSTALLATION SHALL BE SUPPLIED BY THE CONTRACTOR AS A PART OF THIS CONTRACT WORK.
10. THE CONTRACTOR SHALL INFORM THE LANDSCAPE ARCHITECT IF THERE IS ANY NEED OR DESIRE TO DEVIATE FROM THESE PLANS. IF ANY WORK IS COMPLETED THAT DEVIATES FROM THESE PLANS OR THE LANDSCAPE ARCHITECTS DESIGN INTENT; THEN THE CONTRACTOR IS INFORMED THAT SUCH WORK IS AT THEIR OWN RISK. ANY WORK DEVIATING FROM THESE PLANS MAY BE REQUIRED TO BE CHANGED, MODIFIED, OR REPLACED TO BRING THE WORK INTO ACCEPTANCE AT THE CONTRACTOR'S EXPENSE.
11. THE CONTRACTOR SHALL COMPLY WITH LOCAL, STATE, AND FEDERAL LAWS, CODES, AND REGULATIONS APPLICABLE TO THE WORK COVERED BY THESE PLANS AND SPECIFICATIONS. THIS INCLUDES, BUT IS NOT LIMITED TO, STORM WATER POLLUTION PREVENTION PLAN PERMITTING AND COMPLYING WITH LOCAL CODES GOVERNING DUST CONTROL, HOURS OF OPERATION, AND SAFETY MEASURES. ANY CONFLICT BETWEEN DESIGN AND REQUIREMENTS SHALL BE REPORTED TO THE LANDSCAPE ARCHITECT BEFORE PROCEEDING.
12. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING AND COMPLYING WITH PERMITS REQUIRED TO COMPLETE THE WORK COVERED BY THESE PLANS. ALL WORK SHALL BE INSPECTED BY GOVERNING AGENCIES IN ACCORDANCE WITH THEIR REQUIREMENTS. JURISDICTIONAL APPROVAL SHALL BE SECURED BEFORE PROCEEDING WITH WORK.
13. SOME PLANS OR DETAILS SHOWN HEREIN MAY NOT BE DRAWN TO SCALE OR SHOWN IN THEIR EXACT LOCATION. SOME ELEMENTS OF THIS DESIGN MAY BE SCHEMATIC IN NATURE. IF THERE IS ANY QUESTION REGARDING THE EXACT LOCATION OR ASSEMBLY OF ANY FEATURE THE CONTRACTOR SHALL REQUEST SUCH INFORMATION FROM THE LANDSCAPE ARCHITECT PRIOR TO PROCEEDING WITH THE WORK.
14. THE CONTRACTOR SHALL LOCATE SURVEY MARKS, INCLUDING BENCH MARKS AND PROPERTY LINES, IN ORDER THAT THE EXACT LINES OF CONSTRUCTION LIMITS MAY BE DETERMINED.
15. THE CONTRACTOR SHALL PROTECT EXISTING OR TEMPORARY TOPOGRAPHIC TRAVERSE POINTS AND BENCH MARKS UNTIL THE CONSTRUCTION BENCH MARKS AND BASELINES ARE ESTABLISHED AND REFERENCED BY THE CONTRACTOR. PROJECT CONTROL POINTS, WHICH MAY BE LOST OR DESTROYED SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE.
16. THE CONTRACTOR SHALL VERIFY BUILDING SETBACK LINES, RIGHT-OF-WAY LINES, EASEMENT LINES, VISIBILITY LINES, ETC., IN THE FIELD. THE CONTRACTOR SHALL REPORT DISCREPANCIES TO THE LANDSCAPE ARCHITECT IN WRITING PRIOR TO CONSTRUCTION.
17. THE CONTRACTOR SHALL CONFIRM BOUNDARY LOCATION WITH THE LANDSCAPE ARCHITECT. NEED FOR WORK OUTSIDE THE LIMIT OF WORK BOUNDARY SHALL BE CONFIRMED BY THE LANDSCAPE ARCHITECT PRIOR TO PERFORMING WORK OUTSIDE THE LIMIT OF WORK BOUNDARY.
18. PRIOR TO COMMENCEMENT OF WORK, THE CONTRACTOR SHALL BE RESPONSIBLE FOR BECOMING FAMILIAR WITH THE LOCATIONS OF UTILITIES, PIPES, AND STRUCTURES. THE LANDSCAPE ARCHITECT AND OWNER/OWNER'S REPRESENTATIVE ASSUME NO RESPONSIBILITY FOR THE UTILITIES OR STRUCTURES NOT SHOWN, OR NOT IN THE LOCATION SHOWN ON THE DRAWINGS. THE CONTRACTOR SHALL VERIFY THE EXACT LOCATION OF UTILITIES PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL TAKE SOLE RESPONSIBILITY FOR COSTS INCURRED DUE TO DAMAGES TO SAID UTILITIES CAUSED AS A RESULT OF THE CONTRACTOR'S WORK. THREE DAYS PRIOR TO START OF CONSTRUCTION THE CONTRACTOR SHALL CONTACT BLUE STAKES (1-800-662-4111) TO VERIFY LOCATIONS AND DEPTHS OF UNDERGROUND UTILITIES THAT MAY BE AFFECTED BY THIS WORK. THE CONTRACTOR SHALL USE EXTREME CAUTION WHEN WORKING OVER OR NEAR EXISTING GAS MAINS, SEWER LINES, WATER LINES, COMMUNICATION LINES, AND ELECTRICAL LINES. IF UNDERGROUND OR ABOVE GROUND CONSTRUCTION IS LOCATED AS TO SIGNIFICANTLY HINDER INSTALLATION OR FUNCTION OF THE WORK, THE LANDSCAPE ARCHITECT SHALL BE NOTIFIED IMMEDIATELY.
19. THE CONTRACTOR SHALL VERIFY QUANTITIES. IN CASE OF DISCREPANCIES, GRAPHICALLY SHOWN QUANTITIES SHALL TAKE PRECEDENCE. THE CONTRACTOR SHALL NOTIFY THE LANDSCAPE ARCHITECT OF DISCREPANCIES. ANY QUANTITIES OR DIMENSIONS GIVEN HERE ARE SCHEMATIC IN PLAN SPACE AND MAY VARY FROM ACTUAL OR REAL FIGURES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ALL ACTUAL AND REAL CONDITIONS AND CONSULT THE LANDSCAPE ARCHITECT IF THERE IS ANY CONCERN.
20. THE CONTRACTOR SHALL TAKE PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING IMPROVEMENTS FROM DAMAGE. SUCH IMPROVEMENTS OR STRUCTURES DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED OR RECONSTRUCTED SATISFACTORILY TO REQUIRED STANDARDS OF THE OWNER AT NO EXPENSE TO THE OWNER. THE CONTRACTOR SHALL BE ENTIRELY AND SOLELY RESPONSIBLE TO REPAIR OR REPLACE AND DAMAGED OR DESTROYED EXISTING AND NEWLY INSTALLED FEATURES. THE OWNER SHALL HAVE THE FINAL SAY REGARDING WHAT IS DAMAGED OR DESTROYED AND WHEN IT HAS BEEN REPAIRED OR REPLACED.
21. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPENSATING THE LANDSCAPE ARCHITECT AND OWNER/OWNER'S REPRESENTATIVE FOR ADDITIONAL COORDINATION AND/OR DESIGN CHANGES DUE TO ERRORS, FAULTY MATERIAL, OR FAULTY WORKMANSHIP.
22. THE CONTRACTOR SHALL FINE GRADE AREAS DISTURBED DURING CONSTRUCTION. AREAS OUTSIDE LIMIT OF WORK BOUNDARIES DAMAGED OR DISTURBED DURING CONSTRUCTION SHALL BE RESTORED TO THEIR ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.
23. THE CONTRACTOR IS RESPONSIBLE FOR REMOVAL AND APPROPRIATE DISPOSAL OFFSITE OF CLEARED VEGETATION, DEBRIS, CONSTRUCTION WASTE, ETC. FROM THE SITE.
24. THE JOB SITE, AT THE COMPLETION OF THE CONSTRUCTION AND PRIOR TO FINAL REVIEW, SHALL BE CLEARED OF DEBRIS OR SPOIL RESULTING FROM THE CONSTRUCTION.
25. MATERIALS REQUIRED SHALL BE OF A GRADE AND QUALITY SPECIFIED AND CONSISTENT WITH ACCEPTED INDUSTRY STANDARDS.
26. THE CONTRACTOR SHALL PROVIDE OWNER WITH WARRANTY INFORMATION, INSTRUCTION MANUALS AND OTHER PRODUCT INFORMATION FOR NEW EQUIPMENT OR MACHINERY INSTALLED PRIOR TO THE REQUEST FOR SUBSTANTIAL COMPLETION REVIEW BY THE LANDSCAPE ARCHITECT AND/OR THE OWNER OR THEIR REPRESENTATIVE.
27. SOME WORK REQUIRED TO COMPLETE THIS DESIGN MAY NOT BE SHOWN, HOWEVER IT IS THE RESPONSIBILITY OF THE CONTRACTOR, WITHIN REASON, TO FORESEE OR ACCOUNT FOR SUCH WORK.

0 60 120 180 feet

SCALE: 1" = 60'

F&S Landscape

Nate Ferguson, PLA
nferguson@fslandscape.net
801.207.8223

DRAFT
REVIEW
NOT FOR
CONSTRUCTION

SPRINGDALE RIVER PARK EXPANSION

GEORGE A. BARKER RIVER PARK
1615 ZION PARK BLVD.
SPRINGDALE, UT 84767

LANDSCAPE PLAN PROGRESS SET

REV	DATE	DESCRIPTION

DESIGNED BY: NF
DRAWN: NF
CHECKED: NF/RS
ISSUE DATE: 02-17-25
PROJ #: ASSIST001

Sheet Name:
LANDSCAPE PLAN COVER AND NOTES

Sheet Number:
L-LP00

Know what's below. Call before you dig.

PLANT SCHEDULE

SYMBOL	CODE	BOTANICAL NAME	COMMON NAME	SIZE	QTY	DETAIL
TREES						
	ACE GRA	ACER GRANDIDENTATUM	BIGTOOTH MAPLE	2" CAL.	8	1/L-PP04
	ACE SNS	ACER NEGUNDO 'SENSATION'	SENSATION BOX ELDER	2" CAL.	15	1/L-PP04
	CEL OCC	CELTIS OCCIDENTALIS	COMMON HACKBERRY	2" CAL.	3	1/L-PP04
	JUN B15	JUNIPERUS SCOPULORUM 'BLUE ARROW'	BLUE ARROW JUNIPER	10 GAL.	4	1/L-PP04
	PIN PON	PINUS PONDEROSA	PONDEROSA PINE	8` HT.	1	1/L-PP04
	PLA WRI	PLATANUS WRIGHTII	ARIZONA SYCAMORE	2" CAL.	13	1/L-PP04
	PRU CHO	PRUNUS VIRGINIANA	CHOKECHERRY	2" CAL.	7	1/L-PP04
	QUE GAM	QUERCUS GAMBELII	GAMBEL OAK	10 GAL.	14	1/L-PP04
SHRUBS						
	AME UTA	AMELANCHIER UTAHENSIS	UTAH SERVICEBERRY	5 GAL.	9	2/L-PP04
	ARC PUN	ARCTOSTAPHYLOS PUNGENS	POINT LEAF MANZANITA	5 GAL.	8	2/L-PP04
	CHR RUB	CHRYSOTHAMNUS NAUSEOSUS	RUBBER RABBITBRUSH	5 GAL.	57	2/L-PP04
	EPH VIR	EPHEDRA VIRIDIS	MORMON TEA	5 GAL.	23	2/L-PP04
	HES PAR	HESPERALOE PARVIFLORA	RED YUCCA	5 GAL.	101	2/L-PP04
	MAH REP	MAHONIA REPENS	CREEPING MAHONIA	5 GAL.	34	2/L-PP04
	PUR MEX	PURSHIA MEXICANA	MEXICAN CLIFFROSE	5 GAL.	5	2/L-PP04
	RHU TRI	RHUS TRILOBATA	SKUNKBUSH SUMAC	5 GAL.	14	2/L-PP04
	ROS WOO	ROSA WOODSII	WOODS' ROSE	5 GAL.	26	2/L-PP04
	SAL DOR	SALVIA DORRII	DESERT SAGE	1 GAL.	84	3/L-PP04
	YUC UTA	YUCCA UTAHENSIS	UTAH YUCCA	5 GAL.	56	2/L-PP04
GRASSES						
	ARI PUR	ARISTIDA PURPUREA	PURPLE THREEAWN	1 GAL.	64	3/L-PP04
	FES ARI	FESTUCA ARIZONICA	ARIZONA FESCUE	1 GAL.	179	3/L-PP04
	ORY HYM	ORYZOPSIS HYMENOIDES	INDIAN RICEGRASS	1 GAL.	57	4/L-PP04
	SCH LIT	SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	1 GAL.	151	3/L-PP04

SYMBOL	CODE	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	QTY	DETAIL
GROUND COVERS							
	ACH ESX	ACHILLEA X 'FIREFLY SUNSHINE'	FIREFLY SUNSHINE YARROW	1 GAL.	24" o.c.	16	4/L-PP04
	CAS LIN	CASTILLEJA LINARIIFOLIA	WYOMING PAINTBRUSH	1 GAL.	18" o.c.	36	4/L-PP04
	ERI UTA	ERIGERON UTAHENSIS	UTAH DAISY	1 GAL.	12" o.c.	178	4/L-PP04
	PEN PEN	PENSTEMON EATONII	FIRECRACKER PENSTEMON	1 GAL.	24" o.c.	116	4/L-PP04
	TUR SOD	TURF SOD	DROUGHT TOLERANT FESCUE BLEND	SOD		28,435 SF	
		GRANITE SEED - NATIVE CABIN GRASS MIX				11,609 SF	
	BRO MAR	BROMUS MARGINATUS	MOUNTAIN BROME	SEED	20%	2,322 SF	
	ELY TRA	ELYMUS TRACHYCAULUS	SLENDER WHEATGRASS	SEED	20%	2,322 SF	
	FES ID2	FESTUCA IDAHOENSIS	IDAHO FESCUE	SEED	20%	2,322 SF	
	PAS SMI	PASCOPYRUM SMITHII	WESTERN WHEATGRASS	SEED	20%	2,322 SF	
	POA GAD	POA SECUNDA SANDBERGII	SANDBERG BLUEGRASS	SEED	20%	2,322 SF	
		GRANITE SEED - INTERMOUNTAIN POLLINATOR BLEND				14,037 SF	
	ACH OCD	ACHILLEA MILLEFOLIUM OCCIDENTALIS	WESTERN YARROW	SEED	9%	1,263 SF	
	ASC SYR	ASCLEPIAS SYRIACA	COMMON MILKWEED	SEED	3%	421 SF	
	ASC TUB	ASCLEPIAS TUBEROSA	BUTTERFLY MILKWEED	SEED	4%	561 SF	
	GAI ARI	GAILLARDIA ARISTATA	BLANKET FLOWER	SEED	12%	1,684 SF	
	HEL ANN	HELIANTHUS ANNUUS	SUNFLOWER	SEED	12%	1,684 SF	
	LIN BLU	LINUM LEWISII 'BLUE FLAX'	BLUE FLAX	SEED	12%	1,684 SF	
	LOT COR	LOTUS CORNICULATUS	BIRDFOOT TREFOIL	SEED	6%	842 SF	
	LUP EPA	LUPINUS ARGENTEUS RUBRICAULIS	SILVERY LUPINE	SEED	3%	421 SF	
	MED SAT	MEDICAGO SATIVA	ALFALFA	SEED	9%	1,263 SF	
	MEL YEL	MELILOTUS OFFICINALIS	YELLOW SWEETCLOVER	SEED	6%	842 SF	
	ONO SVF	ONOBRYCHIS VICIIFOLIA	SAINFOIN	SEED	12%	1,684 SF	
	SOL VDN	SOLIDAGO CANADENSIS VAR. ELONGATA	CANADA GOLDENROD	SEED	3%	421 SF	
	TRI REP	TRIFOLIUM REPENS	WHITE CLOVER	SEED	9%	1,263 SF	

PLANTING NOTES

1. TREES AND OTHER PLANT MATERIAL SHALL CONFORM TO GRADE, TYPE, ETC. AS SET FORTH IN THE AMERICAN STANDARD FOR NURSERY STOCK BY THE AMERICAN ASSOCIATION OF NURSERYMEN.
2. PLANT MATERIAL SHALL BE HEALTHY, VIGOROUS, WELL BRANCHED, AND DENSELY FOLIATED (WHEN IN LEAF) AS IS TYPICAL FOR THE SPECIES. THEY SHALL HAVE HEALTHY, WELL-DEVELOPED ROOT SYSTEMS (NOT POT BOUND); A NORMAL HABIT OF GROWTH CONSISTENT WITH INDUSTRY STANDARDS; AND BE FREE OF BRUISES, CUTS, OR OTHER ABNORMALITIES.
3. QUANTITIES SHOWN ON PLANT LIST ARE FOR THE CONTRACTOR'S CONVENIENCE ONLY. IN THE EVENT OF A DISCREPANCY BETWEEN QUANTITIES SHOWN ON THE PLAN AND QUANTITIES SHOWN ON THE PLANT LIST, THE QUANTITIES ON THE PLAN SHALL GOVERN.
4. NO PLANT SUBSTITUTIONS OR TYPE, SIZE, OR QUANTITY DEVIATIONS FROM THE APPROVED LANDSCAPE PLANS ARE ALLOWED WITHOUT PRIOR WRITTEN APPROVAL FROM THE LANDSCAPE ARCHITECT.
5. THE LANDSCAPE ARCHITECT, OWNER AND/OR OWNER'S REPRESENTATIVE RESERVES THE RIGHT TO REJECT PLANT MATERIAL THAT DOES NOT SATISFY THE INTENT OF THE LANDSCAPE DESIGN BASED ON SIZE, SHAPE, EVIDENCE OF STRESS, OR IMPROPER CARE BOTH AT THE NURSERY AND ON THE SITE FOLLOWING DELIVERY, UNLOADING OF PLANT MATERIAL, AND PLANTING.
6. PROTECTED PLANT MATERIAL THAT IS DESTROYED OR DIES DURING CONSTRUCTION OR THE MAINTENANCE PERIOD WILL BE REPLACED WITH A PLANT OF THE SAME SIZE AND TYPE BY THE RESPONSIBLE PARTY A MINIMUM OF 90 DAYS BEFORE THE COMPLETION OF THE PROJECT. REPLACEMENT MATERIAL SHALL BE APPROVED BY THE LANDSCAPE ARCHITECT.
7. PLANT MATERIALS BEST SIDE SHALL BE ALIGNED TO THE WALKS, PEDESTRIAN AREAS, ROADS, AND PARKING AREAS UNLESS OTHERWISE SHOWN ON THESE PLANS. SPACING SHALL BE ADJUSTED AS NECESSARY, SUBJECT TO REVIEW BY LANDSCAPE ARCHITECT.
8. PLANTINGS AT MATURITY SHALL MAINTAIN 6-0" CLEARANCE AROUND FIRE HYDRANTS AND FIRE SUPPRESSION DEVICES.
9. PLANTINGS SHALL NOT INTERFERE WITH TRAFFIC CONTROL SIGNS AND SHALL MAINTAIN A MAXIMUM HEIGHT OF 2'-6" WITHIN SIGHT DISTANCE TRIANGLES.
10. TREES SHALL MAINTAIN A MINIMUM 6'-0" CLEARANCE FROM CITY WATER OR SEWER LINES. PLANTINGS SHALL MAINTAIN A SUFFICIENT DISTANCE TO SANITARY AND STORM SEWER MANHOLES TO ALLOW ACCESS BY MAINTENANCE VEHICLES.
11. SHRUBS SHALL BE INSTALLED FROM BACK OF CURB, EDGE OF WALK, OR EDGE OF PAVING A MINIMUM OF 2' AT MATURE SIZE.
12. PLANT MATERIAL LOCATIONS SHALL BE STAKED IN THE FIELD BY THE CONTRACTOR AND APPROVED BY THE LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
13. THE IRRIGATION SYSTEM IS TO BE FULLY OPERATIONAL AND EFFECTIVE PRIOR TO THE INSTALLATION OF PLANT MATERIAL.
14. THE LANDSCAPE CONTRACTOR OR ANY OTHER INSTALLING PLANTS IS RESPONSIBLE FOR UNDERSTANDING THE LOCATION OF ALL UNDERGROUND UTILITIES. THEY SHALL NOTIFY BLUE STAKES 3 DAYS BEFORE ANY EXCAVATION FOR PLANTING BEGINS.
15. THE CONTRACTOR SHALL HAND DIG ANY PLANTING PITS WITHIN THE 3' OFFSET LIMITS OF ANY MARKED UTILITY.
16. THE CONTRACTOR SHALL PROVIDE A SOILS TEST FOR THE SITE IF ONE HAS NOT YET BEEN PROVIDED. AND REPORT THE FINDINGS TO THE LANDSCAPE ARCHITECT 3 DAYS PRIOR TO PLANTING OR PLACING TOPSOIL.
17. THE CONTRACTOR SHALL NOTIFY THE LANDSCAPE ARCHITECT 2 DAYS PRIOR TO WHEN PLANTS WILL BE LAID OUT SO THAT THE LANDSCAPE ARCHITECT MAY ADJUST THEM ONSITE AS REQUIRED.
18. IF TREES AND PLANTS ARE TO BE STOCKPILED ONSITE, A TEMPORARY IRRIGATION SYSTEM ON AN AUTOMATIC TIMER MUST BE SET UP PRIOR TO THEIR DELIVERY. ANY PLANTS ON SITE NOT SUFFICIENTLY MAINTAINED WILL BE REJECTED AT THE FULL DISCRETION OF THE LANDSCAPE ARCHITECT. BALL AND BURLAP PLANTS MUST BE PLACED IN TEMPORARY BERM AND ROOT BALLS FULLY PROTECTED.
19. UNLESS OTHERWISE SPECIFIED THE CONTRACTOR SHALL AMEND AND TILL EXISTING SOILS TO A DEPTH OF AT LEAST 6" OBTAIN A NEUTRAL PH WITH APPROXIMATELY 2% MINIMUM ORGANIC CONTENT.
20. DO NOT STAKE TREES UNLESS THEY ARE PLACED ON 30% SLOPE OR GREATER, UNLESS OTHERWISE IDENTIFIED ON LANDSCAPE PLAN.
21. CONTRACTOR WILL INSTALL ALL PLANTINGS PER THE DETAILS PROVIDED. SCARIFYING ROOTBALLS AND PLANTING HOLES AND BACK FILLING PLANNING PITS WITH MINIMUM 1/3 TOPSOIL OR APPROVED PLANTING MULCH
22. ALL PLANTING PITS ARE TO BE 3 TIMES AS LARGE AS PLANT ROOTBALL OR CONTAINER.
23. CONTRACTOR INSTALLING PLANTS WILL BE RESPONSIBLE FOR THEM FOR ONE YEAR AFTER INSTALLATION. CONTRACTOR HAS RESPONSIBILITY FOR THEIR SURVIVAL AND ESTABLISHMENT REPLACING ANY FAILING PLANTS QUICKLY. REPLACEMENTS SHALL BE THE SAME SPECIES AND SIZE.

SHEET INDEX

0 40 80 120 feet

SCALE: 1" = 40'

F&S Landscape

Nate Ferguson, PLA
nferguson@fslandscape.net
801.207.8223

DRAFT REVIEW NOT FOR CONSTRUCTION

SPRINGDALE RIVER PARK EXPANSION

GEORGE A. BARKER RIVER PARK
1615 ZION PARK BLVD.
SPRINGDALE, UT 84767

LANDSCAPE PLAN PROGRESS SET

REV	DATE	DESCRIPTION

DESIGNED BY: NF
DRAWN: NF
CHECKED: NF/RS
ISSUE DATE: 02-17-25
PROJ #: ASSIST001

Sheet Name:
PLANTING PLAN NOTES AND LEGEND

Sheet Number:
L-PP00

Know what's **below.**
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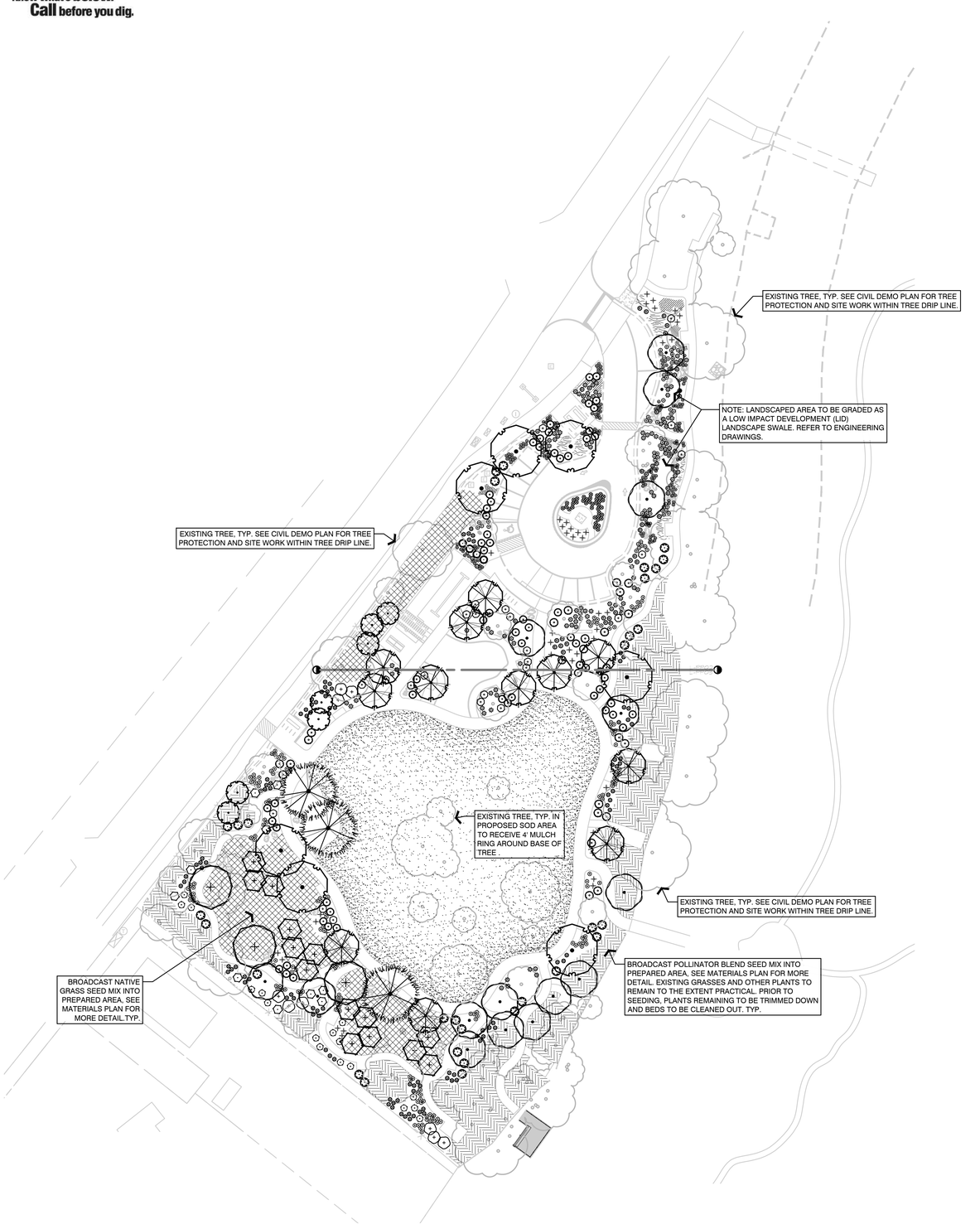

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PLANT SCHEDULE

SYMBOL	CODE	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	QTY	DETAIL
TREES							
	ACE GRA	ACER GRANDIDENTATUM	BIGTOOTH MAPLE	2" CAL.		7	1/L-PP04
	ACE SNS	ACER NEGUNDO 'SENSATION'	SENSATION BOX ELDER	2" CAL.		15	1/L-PP04
	CEL OCC	CELTIS OCCIDENTALIS	COMMON HACKBERRY	2" CAL.		3	1/L-PP04
	JUN B15	JUNIPERUS SCOPULORUM 'BLUE ARROW'	BLUE ARROW JUNIPER	10 GAL.		4	1/L-PP04
	PIN PON	PINUS PONDEROSA	PONDEROSA PINE	8` HT.		3	1/L-PP04
	PLA WRI	PLATANUS WRIGHTII	ARIZONA SYCAMORE	2" CAL.		12	1/L-PP04
	PRU CHO	PRUNUS VIRGINIANA	CHOKECHERRY	2" CAL.		7	1/L-PP04
	QUE GAM	QUERCUS GAMBELII	GAMBEL OAK	10 GAL.		14	1/L-PP04
SHRUBS							
	AME UTA	AMELANCHIER UTAHENSIS	UTAH SERVICEBERRY	5 GAL.		9	2/L-PP04
	ARC PUN	ARCTOSTAPHYLOS PUNGENS	POINT LEAF MANZANITA	5 GAL.		24	2/L-PP04
	CAL BER	CALYLOPHUS BERLANDIERI	BERLANDIER'S SUNDROPS	1 GAL.		106	2/L-PP04
	DAL GRE	DALEA GREGGII	TRAILING INDIGO BUSH	5 GAL.		64	2/L-PP04
	EPH VIR	EPHEDRA VIRIDIS	MORMON TEA	5 GAL.		23	2/L-PP04
	HES PAR	HESPERALOE PARVIFLORA	RED YUCCA	5 GAL.		42	2/L-PP04
	MAH REP	MAHONIA REPENS	CREEPING MAHONIA	5 GAL.		31	2/L-PP04
	PUR MEX	PURSHIA MEXICANA	MEXICAN CLIFFROSE	5 GAL.		10	2/L-PP04
	RUE SIM	RUELLIA SIMPLEX	MEXICAN PETUNIA	1 GAL.		17	2/L-PP04
	SAL DOR	SALVIA DORRII	DESERT SAGE	1 GAL.		106	3/L-PP04
	YUC UTA	YUCCA UTAHENSIS	UTAH YUCCA	5 GAL.		39	2/L-PP04
GRASSES							
	ARI PUR	ARISTIDA PURPUREA	PURPLE THREEAWN	1 GAL.		63	3/L-PP04
	FES ARI	FESTUCA ARIZONICA	ARIZONA FESCUE	1 GAL.		178	3/L-PP04
	ORY HYM	ORYZOPSIS HYMENOIDES	INDIAN RICEGRASS	1 GAL.		39	4/L-PP04
	SCH LIT	SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	1 GAL.		154	3/L-PP04
SYMBOL	CODE	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	QTY	DETAIL
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	ERI UTA	ERIGERON UTAHENSIS	UTAH DAISY	1 GAL.	12" o.c.	178	4/L-PP04
	PEN PEN	PENSTEMON EATONII	FIRECRACKER PENSTEMON	1 GAL.	24" o.c.	116	4/L-PP04
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0 40 80 120 feet

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DRAFT REVIEW NOT FOR CONSTRUCTION

SPRINGDALE RIVER PARK EXPANSION

GEORGE A. BARKER RIVER PARK
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LANDSCAPE PLAN PROGRESS SET

REV	DATE	DESCRIPTION

DESIGNED BY: NF
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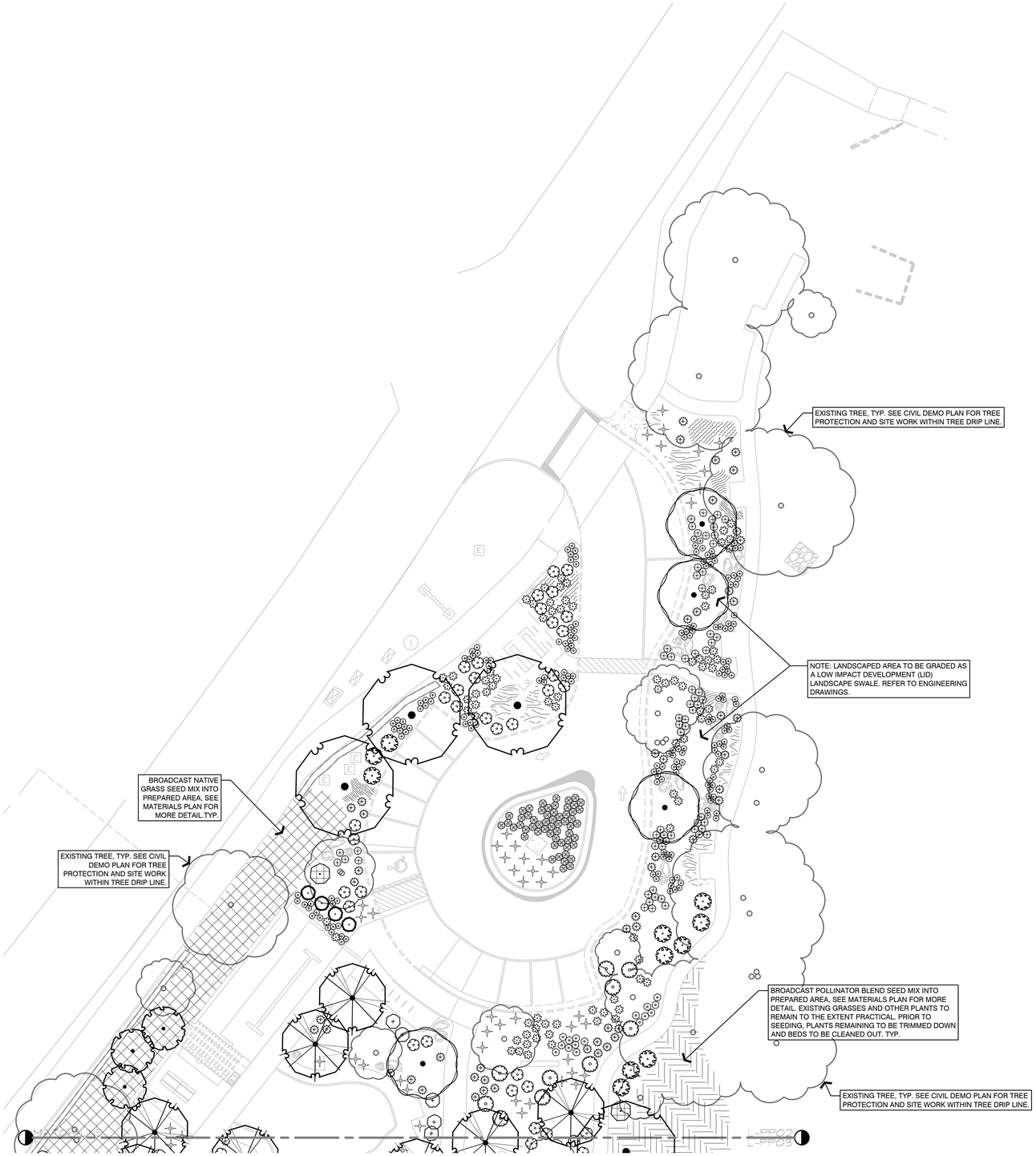

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	RHU TRI	RHUS TRILOBATA	SKUNKBUSH SUMAC	5 GAL.
	ROS WOO	ROSA WOODSII	WOODS' ROSE	5 GAL.
	SAL DOR	SALVIA DORRII	DESERT SAGE	1 GAL.
	YUC UTA	YUCCA UTAHENSIS	UTAH YUCCA	5 GAL.
GRASSES				
	ARI PUR	ARISTIDA PURPUREA	PURPLE THREEAWN	1 GAL.
	FES ARI	FESTUCA ARIZONICA	ARIZONA FESCUE	1 GAL.
	ORY HYM	ORYZOPSIS HYMENOIDES	INDIAN RICEGRASS	1 GAL.
	SCH LIT	SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	1 GAL.

SYMBOL	CODE	BOTANICAL NAME	COMMON NAME	SIZE	SPACING
GROUND COVERS					
	ACH ESX	ACHILLEA X 'FIREFLY SUNSHINE'	FIREFLY SUNSHINE YARROW	1 GAL.	24" o.c.
	CAS LIN	CASTILLEJA LINARIIFOLIA	WYOMING PAINTBRUSH	1 GAL.	18" o.c.
	ERI UTA	ERIGERON UTAHENSIS	UTAH DAISY	1 GAL.	12" o.c.
	PEN PEN	PENSTEMON EATONII	FIRECRACKER PENSTEMON	1 GAL.	24" o.c.
	TUR SOD	TURF SOD	DROUGHT TOLERANT FESCUE BLEND	SOD	
		GRANITE SEED - NATIVE CABIN GRASS MIX			
	BRO MAR	BROMUS MARGINATUS	MOUNTAIN BROME	SEED	20%
	ELY TRA	ELYMUS TRACHYCAULUS	SLENDER WHEATGRASS	SEED	20%
	FES ID2	FESTUCA IDAHOENSIS	IDAHO FESCUE	SEED	20%
	PAS SMI	PASCOPYRUM SMITHII	WESTERN WHEATGRASS	SEED	20%
	POA GAD	POA SECUNDA SANDBERGII	SANDBERG BLUEGRASS	SEED	20%
		GRANITE SEED - INTERMOUNTAIN POLLINATOR BLEND			
	ACH OCD	ACHILLEA MILLEFOLIUM OCCIDENTALIS	WESTERN YARROW	SEED	9%
	ASC SYR	ASCLEPIAS SYRIACA	COMMON MILKWEED	SEED	3%
	ASC TUB	ASCLEPIAS TUBEROSA	BUTTERFLY MILKWEED	SEED	4%
	GAI ARI	GAILLARDIA ARISTATA	BLANKET FLOWER	SEED	12%
	HEL ANN	HELIANTHUS ANNUUS	SUNFLOWER	SEED	12%
	LIN BLU	LINUM LEWISII 'BLUE FLAX'	BLUE FLAX	SEED	12%
	LOT COR	LOTUS CORNICULATUS	BIRDFOOT TREFOIL	SEED	6%
	LUP EPA	LUPINUS ARGENTEUS RUBRICAULIS	SILVERY LUPINE	SEED	3%
	MED SAT	MEDICAGO SATIVA	ALFALFA	SEED	9%
	MEL YEL	MELILOTUS OFFICINALIS	YELLOW SWEETCLOVER	SEED	6%
	ONO SVF	ONOBRYCHIS VICIIFOLIA	SAINFOIN	SEED	12%
	SOL VDN	SOLIDAGO CANADENSIS VAR. ELONGATA	CANADA GOLDENROD	SEED	3%
	TRI REP	TRIFOLIUM REPENS	WHITE CLOVER	SEED	9%

0 20 40 60 feet

SCALE: 1" = 20'

F&S Landscape

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nferguson@fslandscape.net
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REVIEW
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SPRINGDALE RIVER PARK EXPANSION

GEORGE A. BARKER RIVER PARK
1615 ZION PARK BLVD.
SPRINGDALE, UT 84767

LANDSCAPE PLAN PROGRESS SET

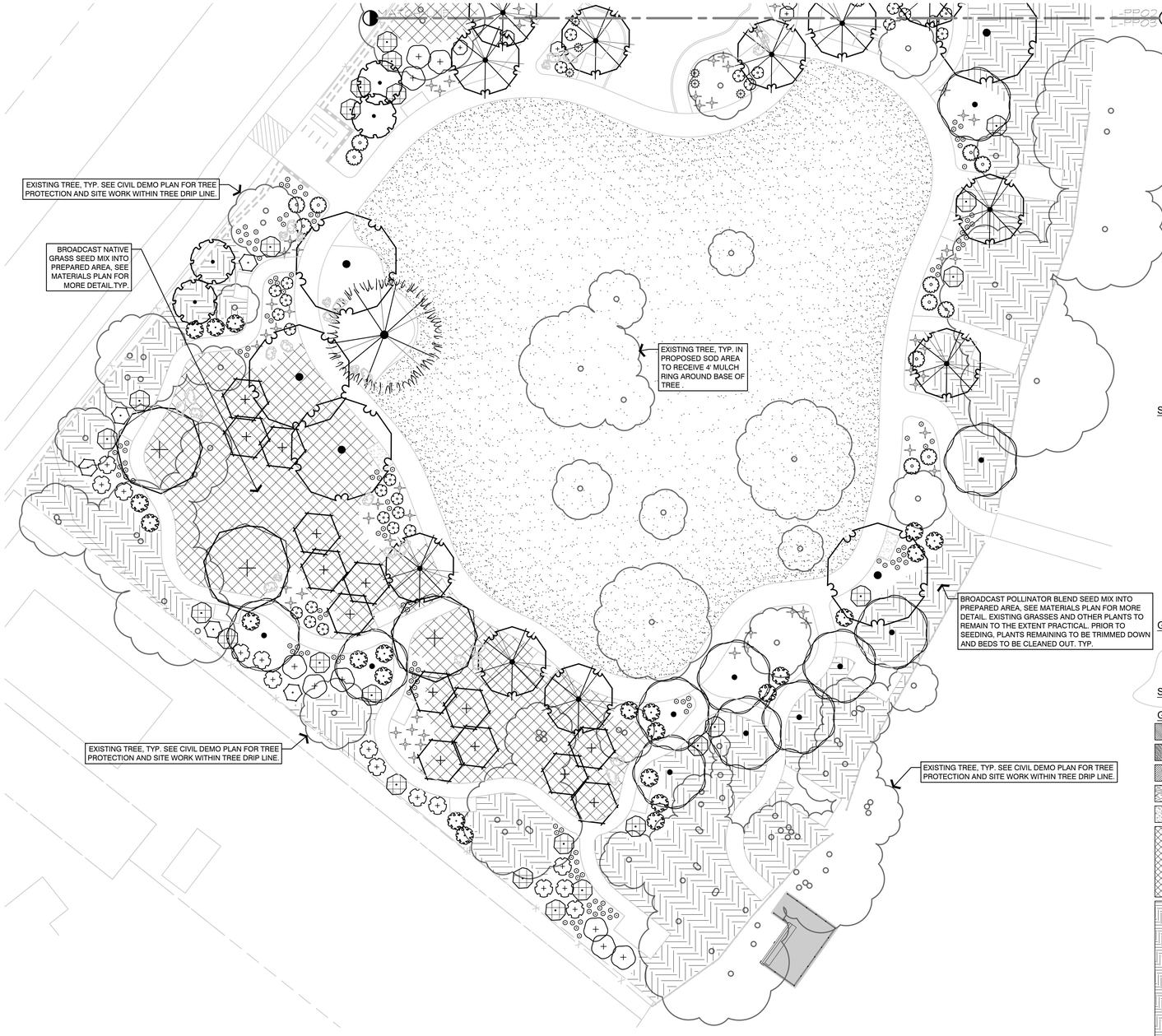
REV	DATE	DESCRIPTION

DESIGNED BY: NF
DRAWN: NF
CHECKED: NF/RS
ISSUE DATE: 02-17-25
PROJ #: ASSIST001

Sheet Name:
PLANTING PLAN NORTH

Sheet Number:
L-PP02

Know what's below. Call before you dig.



NOTE: BASE DRAWING COMPRISING EXISTING AND PROPOSED ELEMENTS OF THE PROJECT ARE PROVIDED BY ENGINEER. FOR GRAPHIC PURPOSES THE BASE DRAWINGS/INFORMATION IS SHOWN AS SCREENED/GRAYED OUT. PLEASE REFER THE THE CIVIL AND ARCHITECTURAL DRAWINGS FOR CLARIFICATION OF BASE INFORMATION.

NOTE: EXITING TREES SHOWN IN PLANTING PLAN ARE TO REMAIN AND BE PROTECTED DURING CONSTRUCTION TO THE EXTENT PRACTICAL. REFER TO THE CIVIL DEMOLITION PLAN FOR TREE PROTECTION MEASURES.

PLANT SCHEDULE

SYMBOL	CODE	BOTANICAL NAME	COMMON NAME	SIZE
TREES				
	ACE GRA	ACER GRANDIDENTATUM	BIGTOOTH MAPLE	2" CAL.
	ACE SNS	ACER NEGUNDO 'SENSATION'	SENSATION BOX ELDER	2" CAL.
	CEL OCC	CELTIS OCCIDENTALIS	COMMON HACKBERRY	2" CAL.
	JUN B15	JUNIPERUS SCOPULORUM 'BLUE ARROW'	BLUE ARROW JUNIPER	10 GAL.
	PIN PON	PINUS PONDEROSA	PONDEROSA PINE	8` HT.
	PLA WRI	PLATANUS WRIGHTII	ARIZONA SYCAMORE	2" CAL.
	PRU CHO	PRUNUS VIRGINIANA	CHOKECHERRY	2" CAL.
	QUE GAM	QUERCUS GAMBELII	GAMBEL OAK	10 GAL.
SHRUBS				
	AME UTA	AMELANCHIER UTAHENSIS	UTAH SERVICEBERRY	5 GAL.
	ARC PUN	ARCTOSTAPHYLOS PUNGENS	POINT LEAF MANZANITA	5 GAL.
	CHR RUB	CHRYSOTHAMNUS NAUSEOSUS	RUBBER RABBITBRUSH	5 GAL.
	EPH VIR	EPHEDRA VIRIDIS	MORMON TEA	5 GAL.
	HES PAR	HESPERALOE PARVIFLORA	RED YUCCA	5 GAL.
	MAH REP	MAHONIA REPENS	CREEPING MAHONIA	5 GAL.
	PUR MEX	PURSHIA MEXICANA	MEXICAN CLIFFROSE	5 GAL.
	RHU TRI	RHUS TRILOBATA	SKUNKBUSH SUMAC	5 GAL.
	ROS WOO	ROSA WOODSII	WOODS' ROSE	5 GAL.
	SAL DOR	SALVIA DORRII	DESERT SAGE	1 GAL.
	YUC UTA	YUCCA UTAHENSIS	UTAH YUCCA	5 GAL.
GRASSES				
	ARI PUR	ARISTIDA PURPUREA	PURPLE THREEAWN	1 GAL.
	FES ARI	FESTUCA ARIZONICA	ARIZONA FESCUE	1 GAL.
	ORY HYM	ORYZOPSIS HYMENOIDES	INDIAN RICEGRASS	1 GAL.
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SYMBOL	CODE	BOTANICAL NAME	COMMON NAME	SIZE	SPACING
GROUND COVERS					
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	PEN PEN	PENSTEMON EATONII	FIRECRACKER PENSTEMON	1 GAL.	24" o.c.
	TUR SOD	TURF SOD	DROUGHT TOLERANT FESCUE BLEND	SOD	
		GRANITE SEED - NATIVE CABIN GRASS MIX			
	BRO MAR	BROMUS MARGINATUS	MOUNTAIN BROME	SEED	20%
	ELY TRA	ELYMUS TRACHYCAULUS	SLENDER WHEATGRASS	SEED	20%
	FES ID2	FESTUCA IDAHOENSIS	IDAHO FESCUE	SEED	20%
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		GRANITE SEED - INTERMOUNTAIN POLLINATOR BLEND			
	ACH OCD	ACHILLEA MILLEFOLIUM OCCIDENTALIS	WESTERN YARROW	SEED	9%
	ASC SYR	ASCLEPIAS SYRIACA	COMMON MILKWEED	SEED	3%
	ASC TUB	ASCLEPIAS TUBEROSA	BUTTERFLY MILKWEED	SEED	4%
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	LOT COR	LOTUS CORNICULATUS	BIRDFOOT TREFOIL	SEED	6%
	LUP EPA	LUPINUS ARGENTEUS RUBRICAULIS	SILVERY LUPINE	SEED	3%
	MED SAT	MEDICAGO SATIVA	ALFALFA	SEED	9%
	MEL YEL	MELILOTUS OFFICINALIS	YELLOW SWEETCLOVER	SEED	6%
	ONO SVF	ONOBRYCHIS VICIIFOLIA	SAINFOIN	SEED	12%
	SOL VDN	SOLIDAGO CANADENSIS VAR. ELONGATA	CANADA GOLDENROD	SEED	3%
	TRI REP	TRIFOLIUM REPENS	WHITE CLOVER	SEED	9%

0 20 40 60 feet

SCALE: 1" = 20'

F&S Landscape
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DRAFT REVIEW NOT FOR CONSTRUCTION

SPRINGDALE RIVER PARK EXPANSION

GEORGE A. BARKER RIVER PARK
1615 ZION PARK BLVD.
SPRINGDALE, UT 84767

LANDSCAPE PLAN PROGRESS SET

REV	DATE	DESCRIPTION

DESIGNED BY: NF
DRAWN: NF
CHECKED: NF/RS
ISSUE DATE: 02-17-25
PROJ #: ASSIST001

Sheet Name:
PLANTING PLAN SOUTH

Sheet Number:
L-PP03

Know what's **below.**
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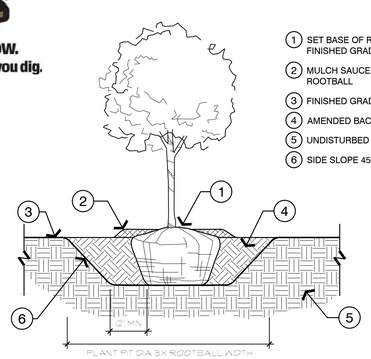
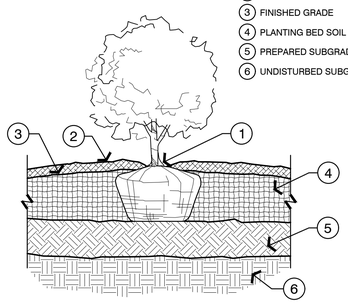


1. SET BASE OF ROOT FLARE 1"-2" ABOVE FINISHED GRADE
2. MULCH SAUCER - EXTEND 6" BEYOND ROOTBALL
3. FINISHED GRADE
4. AMENDED BACKFILL
5. UNDISTURBED SUBGRADE
6. SIDE SLOPE 45 DEGREE ANGLE

NOTE:
1. AFTER PLACEMENT, CUT AND REMOVE ALL LACING WIRE BASKETS FROM ROOTBALL. REMOVE BURLAP FROM SIDES OF ROOTBALL, RETAIN ON BOTTOM.
2. END WEED BARRIER FABRIC AND MULCH 4" FROM TREE TRUNK, MAINTAIN 8" DIA. SPACE AROUND TRUNK TO AVOID GIRDLING TRUNK WITH WEED FABRIC AND MULCH.

1 TREE PLANTING

1/2" = 1'-0"



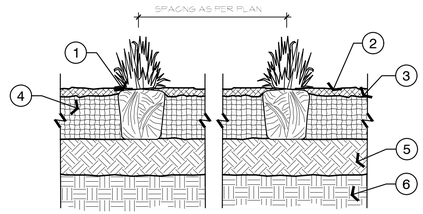
1. SET BASE ROOT FLARE 1"-2" ABOVE FINISHED GRAD
2. MULCH ENTIRE PLANTING BED PER SPEC.
3. FINISHED GRADE
4. PLANTING BED SOIL MIXTURE
5. PREPARED SUBGRADE
6. UNDISTURBED SUBGRADE

NOTE:
1. CONTAINER SHRUBS: CUT AND COMPLETELY REMOVE PLASTIC CONTAINER AT TIME OF PLANTING. GENTLY TEASE ROOTS AROUND ROOTBALL. DO NOT BREAK OR TWIST ROOTS.

2 TYPICAL SHRUB PLANTING

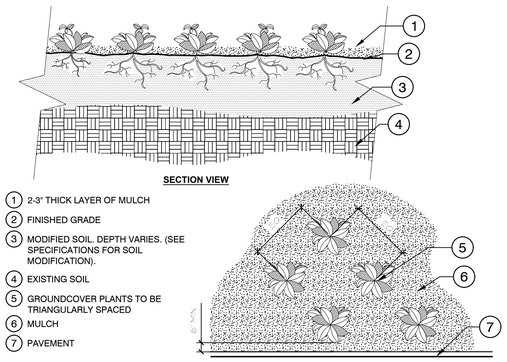
1 1/2" = 1'-0"

1. PLANT SHALL BEAR THE SAME RELATIONSHIP TO FINISHED GRADE AS IT BORE TO EXISTING GRADE IN THE NURSERY
2. MULCH, AS PER PLAN
3. FINSIH GRADE
4. PLANTING BED SOIL MIXTURE
5. AMENDED SUBGRADE
6. SUBGRADE



3 TYPICAL GRASS AND PERENNIAL PLANTING

1 1/2" = 1'-0"



1. 2-3" THICK LAYER OF MULCH
2. FINISHED GRADE
3. MODIFIED SOIL. DEPTH VARIES. (SEE SPECIFICATIONS FOR SOIL MODIFICATION).
4. EXISTING SOIL
5. GROUNDCOVER PLANTS TO BE TRIANGULARLY SPACED
6. MULCH
7. PAVEMENT

NOTES:
1- SEE PLANTING LEGEND FOR GROUNDCOVER SPECIES, SIZE, AND SPACING DIMENSION.
2- SMALL ROOTS (1/4" OR LESS) THAT GROW AROUND, UP, OR DOWN THE ROOT BALL PERIPHERY ARE CONSIDERED A NORMAL CONDITION IN CONTAINER PRODUCTION AND ARE ACCEPTABLE HOWEVER THEY SHOULD BE ELIMINATED AT THE TIME OF PLANTING. ROOTS ON THE PERIPHERY CAN BE REMOVED AT THE TIME OF PLANTING. (SEE ROOT BALL SHAVING CONTAINER DETAIL).
3- SETTLE SOIL AROUND ROOT BALL OF EACH GROUNDCOVER PRIOR TO MULCHING.

4 GROUNDCOVER

3/4" = 1'-0"

P-CO-SPR-01

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SPRINGDALE RIVER PARK EXPANSION

GEORGE A. BARKER RIVER PARK
1615 ZION PARK BLVD.
SPRINGDALE, UT 84767

LANDSCAPE PLAN PROGRESS SET

REV	DATE	DESCRIPTION

DESIGNED BY: NF
DRAWN: NF
CHECKED: NF/RS
ISSUE DATE: 02-17-25
PROJ #: ASSIST001

Sheet Name:
PLANTING PLAN DETAILS

Sheet Number:
L-PP04

GENERAL DEMO NOTES

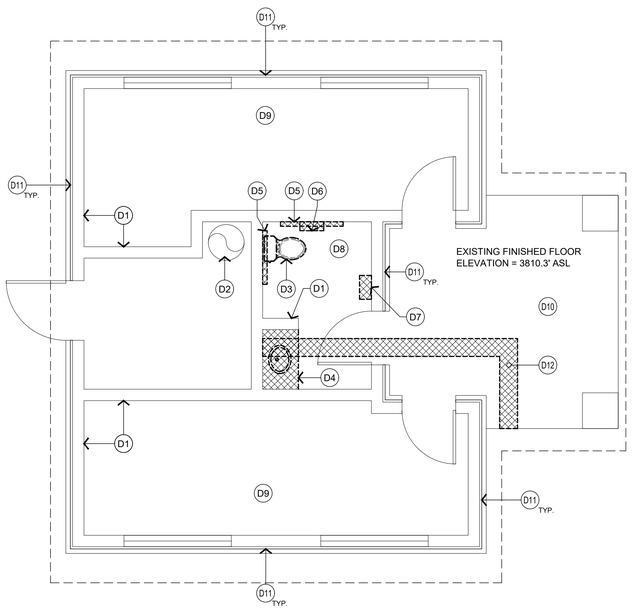
1. VERIFY ALL DIMENSIONS OF PROPOSED PLAN IN FIELD PRIOR TO COMMENCING WITH DEMOLITION; NOTIFY ARCHITECT OF ANY MECHANICAL OR STRUCTURAL CONFLICTS PRIOR TO PROCEEDING WITH WORK
2. DISPOSE OF ALL DEMOLISHED MATERIAL THAT IS NOT MARKED "TO BE SAVED" PROPERLY AT AN OFF-SITE WASTE FACILITY; RECYCLE ALL METAL & CONCRETE
3. OWNER RESERVES RIGHT OF FIRST REFUSAL TO ANY SALVAGEABLE FIXTURES, DOORS, OR EQUIPMENT
4. PROTECT ALL ITEMS NOT SLATED FOR DEMOLITION
5. REPAIR OR REPLACE "IN-KIND" ALL ITEMS DAMAGED OR AFFECTED BY DEMOLITION
6. PATCH ALL GAPS IN FLOOR, WALL, AND CEILING FINISHES RESULTING FROM DEMOLISHED ITEMS; MATCH ADJACENT FINISHES
7. REMOVE ALL ABANDONED PIPES AND MECHANICAL COMPONENTS; IF REMOVAL IS TECHNICALLY INFEASIBLE, CUT BACK & CAP BEHIND ADJACENT FINISHES
8. REMOVE ALL ABANDONED ELECTRICAL WIRES, OUTLETS, SWITCHES, ETC.
9. CONTRACTOR TO ENSURE ALL WALLS, DOORWAYS, AND POSTS ARE NON-LOAD BEARING BEFORE REMOVAL; IF LOAD BEARING, CONSULTATION WITH STRUCTURAL ENGINEER IS REQUIRED FOR REPLACEMENT OF STRUCTURAL COMPONENTS
10. CONTRACTOR TO INDEPENDENTLY TEST FOR LEAD & ASBESTOS; ANY AREAS CONTAINING LEAD AND/OR ASBESTOS SHALL BE PROPERLY ABATED IN COMPLIANCE WITH E.P.A. LAWS & REGULATIONS

DEMOLITION KEY NOTES

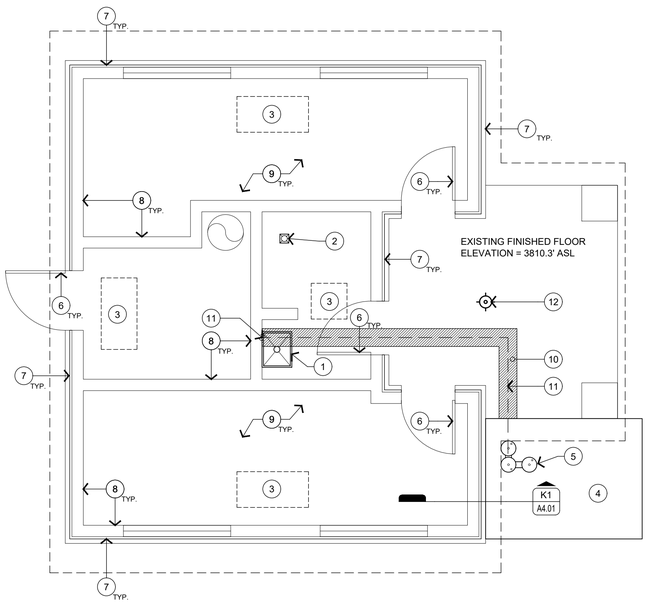
- (D1) EXISTING EXTERIOR / INTERIOR MASONRY WALL ASSEMBLY TO REMAIN
- (D2) EXISTING WATER HEATER TO REMAIN
- (D3) REMOVE EXISTING TOILET; REMOVE FLANGE AND INSTALL REDUCING BUSHING, TRAP, & DRAIN BODY FOR FLOOR DRAIN
- (D4) REMOVE EXISTING VANITY; PREPARE PLUMBING FOR NEW MOP SINK NOTED ON PROPOSED PLAN
- (D5) REMOVE EXISTING GRAB BARS; FILL HOLES w/ GROUT AND PAINT WALL TO MATCH EXISTING
- (D6) REMOVE EXISTING TOILET PAPER DISPENSER; REPAIR AND PAINT WALL TO MATCH EXISTING
- (D7) REMOVE EXISTING PAPER TOWEL DISPENSER; REPAIR AND PAINT WALL TO MATCH EXISTING
- (D8) PATCH AND REPAIR ALL HOLES FROM ABANDONED FIXTURES; PREP FLOOR FOR EPOXY FINISH PER MFR. REQUIREMENTS
- (D9) EXISTING FIXTURE, PARTITIONS, & TOILET ACCESSORIES @ MEN'S AND WOMEN'S RESTROOMS TO REMAIN; CLEAN & PREP FLOOR FOR EPOXY FINISH PER MFR. REQUIREMENTS
- (D10) EXISTING CONCRETE PATHWAY TO REMAIN
- (D11) SAND EXISTING WOOD SIDING & TRIM TO REMOVE ALL EXISTING FINISHES
- (D12) REMOVE PORTION OF CONCRETE SLAB FOR NEW PLUMBING SUPPLY LINE TO ADDED DRINKING FOUNTAIN

KEY NOTES

1. NEW FLOOR-MOUNTED MOP SINK; SEE SCHEDULE (MS-1)
2. NEW FLOOR DRAIN, TO REPLACE ABANDONED TOILET FLANGE; INSTALL 2" DRAIN, TRAP, AND REDUCING BUSHING TO CONNECT TO EXISTING TOILET DRAIN; SEE SCHEDULE (FD-1)
3. NEW CEILING MOUNTED ELECTRICAL HEAT PANEL; COORD WITH OWNER AND ARCHITECTURE; SEE SCHEDULE (CH-1)
4. NEW 4" CONCRETE SLAB OVER 4" COMPO\ACTED GRAVEL BASE; BELOW NEW FREE-STANDING DRINKING FOUNTAIN; MAX SLOPE 1:1/8" IN ANY DIRECTION
5. FREE STANDING OUTDOOR DRINKING BI-LEVEL FOUNTAIN WITH A DOG-BOWL / PET FOUNTAIN; SEE SCHEDULE (DF-1)
6. PATCH ANY HOLES @ EXISTING DOORS w/ METAL EPOXY; GRIND SMOOTH, PRIME AND PAINT
7. CLEAN WOOD SIDING AND WOOD TRIM AFTER SANDING;TREAT w/ WOOD BRIGHTENER; BRUSH APPLY STAIN SEALER FINISH
8. CLEAN AND LIGHTLY SAND ALL PAINTED INTERIOR WALLS; REMOVE ANY CHIPPED, PEALING, OR FLAKING PAINT; REPAINT; COORD. COLOR w/ OWNER
9. NEW EPOXY FLOOR; COORD w/ ARCHITECT & OWNER FOR COLOR
10. PATCH CONCRETE SLAB AFTER NEW PLUMBING HAS BEEN INSTALLED & INSPECTED
11. 5/8" Ø WATER LINE w/ SHUT OFF VALVE FROM EXISTING SINK LOCATION TO NEW DRINKING FOUNTAIN; COORDINATE WATER SUPPLY LINE BURIAL DEPTH w/ DRINKING FOUNTAIN INSTALLATION REQS.
12. NEW CEILING-MOUNTED LIGHT FIXTURE; SEE SCHEDULE (A)



K1 — A1.01 — Existing Condition & Demolision Plan
1/4" = 1'-0"
0' 1' 2' 4' 8'



K1 — A1.0-1 — Proposed Plan
1/4" = 1'-0"
0' 1' 2' 4' 8'

Springdale River Park Expansion

George A. Barker River Park
1615 Zion Park Blvd.
Springdale, UT 84767

Town of Springdale
435.772.3434

assist
COMMUNITY DESIGN CENTER
Tel: 801.355.7085 | TTY: 711 | Salt Lake City, UT 84111 | www.assistutah.org
918 East 500 South

STATE OF UTAH
JASON WHEELER
9484230-0301
LICENSED ARCHITECT

January 28, 2026

Revision	Date

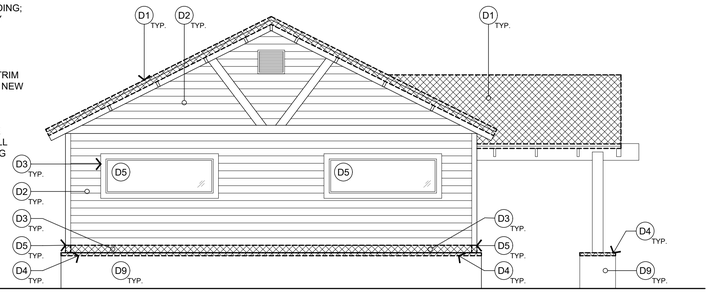
Project No:
Date: 01.28.2026

Existing Restroom Improvement Plans

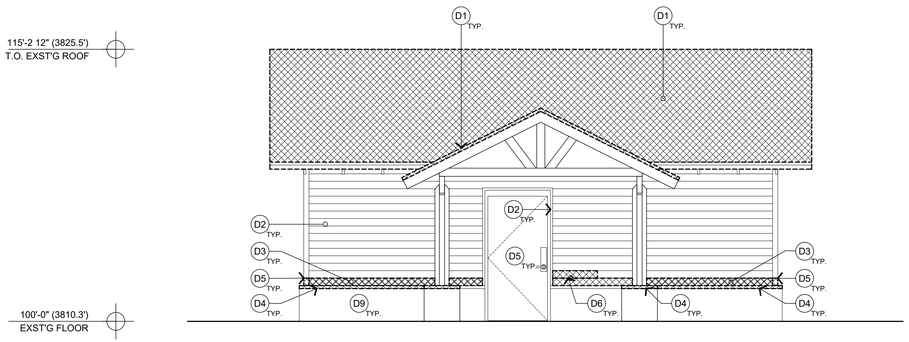
A1.01

DEMOLITION KEY NOTES

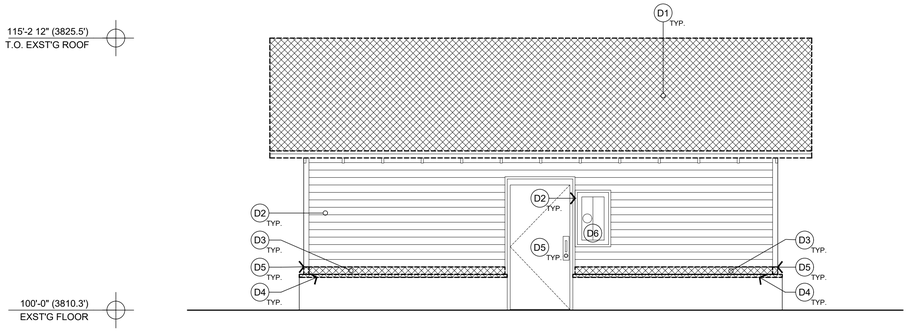
- (D1) REMOVE EXISTING ROOF SHINGLES, UNDERLAYMENT & FLASHING; REPLACE ANY DAMAGED PIECES OF ROOF SUBSTRATE w/ NEW MATERIAL PRIOR TO INSTALLATION OF NEW ROOFING
- (D2) SAND EXISTING WOOD SIDING & TRIM TO REMOVE ALL EXISTING FINISHES
- (D3) REMOVE BOTTOM COURSE OF SHIPLAP SIDING; SAVE FOR REINSTALLATION; REPLACE ANY PIECES DAMAGED DURING REMOVAL
- (D4) REMOVE EXISTING METAL FLASHING
- (D5) CUT BACK BOTTOM EDGE OF PERIMETER TRIM BOARDS TO ALLOW FOR INSTALLATION OF NEW SANDSTONE CAP
- (D6) REMOVE WOOD BACKING @ ABANDONED DRINKING FOUNTAIN LOCATION; CUT BACK PLUMBING BEHIND FINISHES & CAP; INSTALL WEATHER BARRIER & INTEGRATE w/ EXST'G
- (D7) EXISTING DOORS & WINDOWS TO REMAIN
- (D8) EXISTING ELECTRICAL PANEL TO REMAIN
- (D9) EXISTING SANDSTONE VENEER TO REMAIN



D1 Existing South Elevation (Noth Mirrored)
A2.01 — 1/4" = 1'-0"



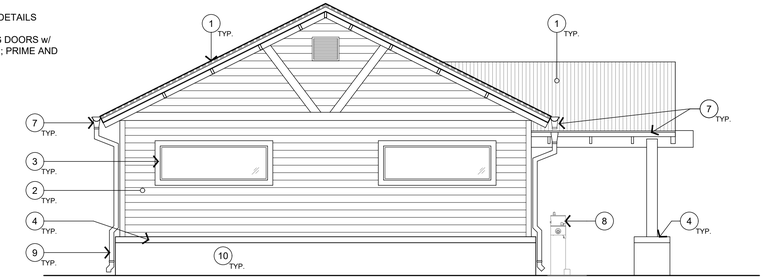
H1 Existing East Elevation
A2.01 — 1/4" = 1'-0"



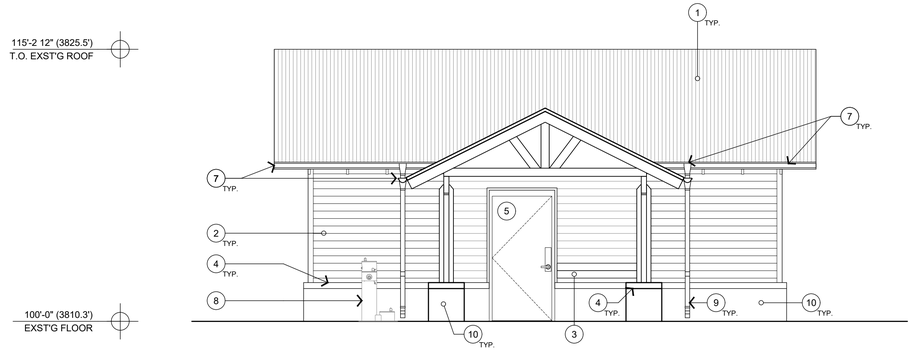
K1 Existing West Elevation
A2.01 — 1/4" = 1'-0"

KEY NOTES

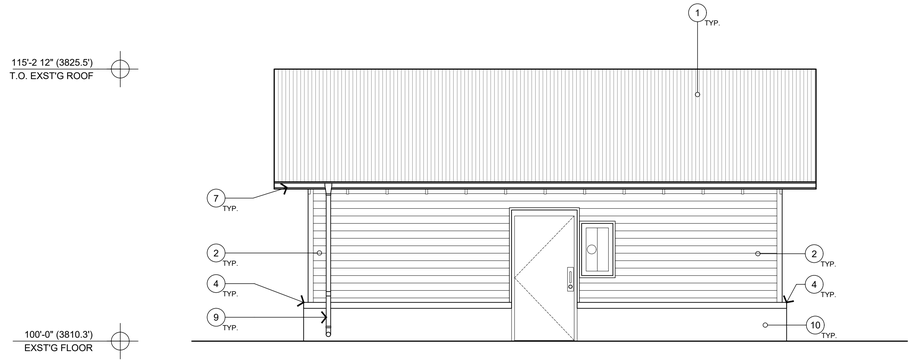
- (1) NEW ROOFING w/ ARCHITECTURAL GRADE SHINGLES
- (2) CLEAN WOOD SIDING AND WOOD TRIM AFTER SANDING; TREAT w/ WOOD BRIGHTENER; BRUSH APPLY STAIN SEALER FINISH
- (3) INSTALL NEW SHIPLAP SIDING TO MATCH EXISTING @ ABANDONED DRINKING FOUNTAIN LOCATION
- (4) NEW 4" SANDSTONE CAP; SEE DETAILS
- (5) PATCH ANY HOLES @ EXISTING DOORS w/ METAL EPOXY; GRIND SMOOTH; PRIME AND PAINT
- (7) NEW 6" COPPER HALF ROUND GUTTER; SEE WALL SECTION
- (8) FREE STANDING OUTDOOR DRINKING BI-LEVEL FOUNTAIN & INCLUDES A DOG-BOWL / PET FOUNTAIN
- (9) COPPER DOWNSPOUT; MATCH GUTTER
- (10) RE-POINT MORTAR ON SANDSTONE PORTION OF EXTERIOR WALLS; MORTAR TO COLOR-MATCH EXISTING



D6 Proposed South Elevation (North Mirrored)
A2.01 — 1/4" = 1'-0"



H6 Proposed East Elevation
A2.01 — 1/4" = 1'-0"



K6 Proposed West Elevation
A2.01 — 1/4" = 1'-0"

Springdale River Park Expansion

George A. Barker River Park
1615 Zion Park Blvd.
Springdale, UT 84767

Town of Springdale
435.772.3434

assist
COMMUNITY DESIGN CENTER
Tel: 801.355.7085 | TTY: 711
918 East 500 South | Salt Lake City, UT 84111 | www.assistutah.org

STATE OF UTAH
JASON WHEELER
9484230-0301
LICENSED ARCHITECT

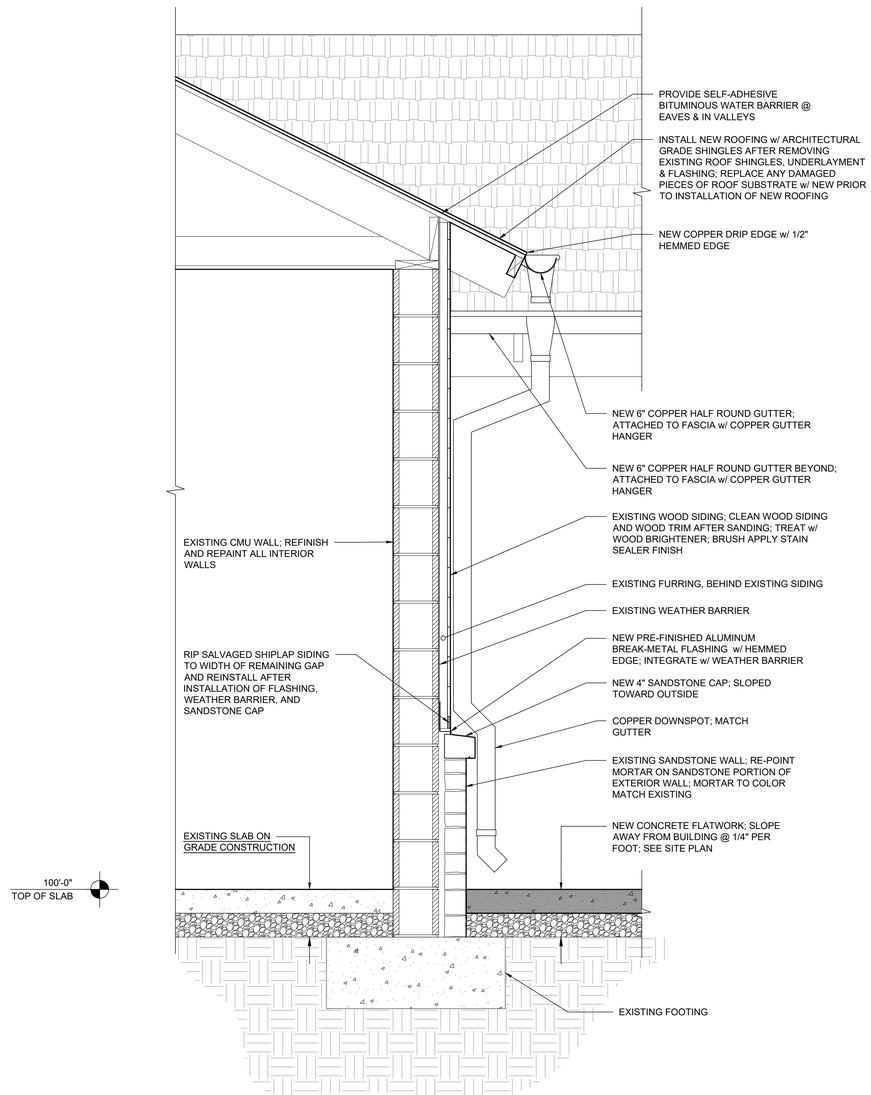
January 28, 2026

Revision Date

Project No:
Date: 01.28.2026

Existing Restroom Improvement Elevations

A2.01



K1 Wall Section
A4.01 1" = 1'-0"

Springdale River Park Expansion

George A. Barker River Park
1615 Zion Park Blvd.
Springdale, UT 84767

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STATE OF UTAH
JASON WHEELER
9484230-0301
LICENSED ARCHITECT

January 28, 2026

Revision Date

Project No:
Date: 01.28.2026

Wall Section

A4.01

GEOTECHNICAL ENGINEERING REPORT

Prepared for:

ASSIST Community Design Center
218 East 500 South
Salt Lake City, UT 84111
Attn: Sam Ball

September 13, 2024

Springdale River Park Expansion

Prepared by:

LANDMARK TESTING & ENGINEERING
795 EAST FACTORY DRIVE
ST. GEORGE, UT 84790

Landmark Project No: 240518

September 13, 2024

ASSIST Community Design Center
Sam Ball
218 East 500 South
Salt Lake City, Utah 84111

Subject: Geotechnical Engineering Report
Springdale River Park Expansion
Springdale, Utah
Landmark Project No.: 240518

As requested, Landmark Testing and Engineering (Landmark) has completed a geotechnical exploration for the proposed expansion of the George A. Barker Springdale River Park on Parcels S-155-1-A and S-150-D in Springdale, Utah. Geotechnical recommendations, along with field and laboratory data are presented in this report. The work has been performed in general accordance with approved Landmark proposal number YP5016 dated August 6, 2024.

Key elements of the proposed development include construction of the following: pavilion structure, restroom structure, play area, parking lot, gravel trails, paved walkways, expanded lawn area, picnic areas, and a river overlook platform.

Geotechnical field exploration consisted of six (6) borings, two proximate to structures proposed on site, two in the expanded parking area, and two in the expansion area of the park proposed to the south of the existing park. Borings extended to a maximum depth of 11.5 feet. Penetration testing and sleeved split-spoon soil sampling was done in intervals of roughly 2.5 feet.

Pavilion and restroom structures may be supported by conventional spread footings and concrete floor slab bearing on at least 1 foot of structurally placed imported granular fill material. Excavation and recompaction, as detailed in Section 5.0 of this report will be required.

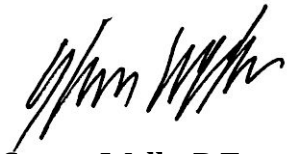
Preferred construction methods for the river overlook platform have not been provided. We recommend that this element be founded on deep foundation helical anchors as shallow foundations would be prone to erosion of the river bank. Helical pile recommendations are provided in Section 6.0.

Pavement design for the parking area and trail has been provided in Section 9.0.

Landmark has great interest in providing materials testing and special inspection services during the construction phase of this project. If you advise us of the appropriate time to discuss these engineering services, we will be pleased to meet with you at your convenience.

Please feel free to contact our office at (435) 986-0566 if you have any questions.

Sincerely,
LANDMARK TESTING AND ENGINEERING



Steven Wells, P.E.
Geotechnical Manager

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1.0 INTRODUCTION

This report presents the results of Landmark Testing & Engineering's (Landmark) geotechnical exploration for the expansion of Springdale River Park located at 1615 Zion Park Boulevard in Springdale, Utah. Figure A-1 is a Vicinity Map showing the project location relative to surrounding features. Figure A-2 is a Site Map showing the proposed project layout and the approximate locations of the borings completed for this exploration.

This exploration was completed to assist in developing opinions and recommendations concerning site earthwork, trail, and foundation design.

2.0 PROPOSED CONSTRUCTION

We understand that the proposed construction will consist of expanding the park to the southwest of the existing park as well as improving some components of the existing park area. Key elements of the proposed development include construction of the following: pavilion structure, restroom structure, play area, parking lot, gravel trails, paved walkways, expanded lawn area, picnic areas, and a river overlook platform.

It is our understanding that the restroom and pavilion structures will be founded on conventional spread footings with concrete floor slabs. Static structural loads are expected to be between 1000 and 1500 plf.

Construction intentions for the river overlook platform are not known. It may be possible to cantilever the platform from the shore, or alternatively to found the "floating" side of the dock on helical anchors.

Traffic volumes and loads were not provided to Landmark. We assume that parking and drive aisles will receive light traffic loads, as such a traffic index (T.I.) of 5.0 has been used in pavement designs provided herein.

Any significant changes to the anticipated development should be reviewed by Landmark to evaluate the continued applicability of the recommendations contained in this report.

3.0 SITE SETTING

3.1 SURFACE CONDITIONS

The project area consists of two Parcels, S-155-1-A is the already established George A. Barker Springdale River Park which contains concrete paved walking paths, restroom structure, hardscapes with benches and picnic areas, as well as grass and landscape trees and shrubbery. This park will be expanded to Parcel S-150-D to the southwest. This lot is undeveloped and is primarily sparse desert grasses and stunted trees.

The Virgin River borders the project area to the east. The topography on the site is relatively flat with the total change in elevation across the project being less than 5 feet in total.

3.2 GEOLOGIC SETTING

According to the Utah Geological Survey,[1] the project site is mapped primarily as located on:

> **Qa: River and stream deposits (Holocene) -** Stratified, moderately to well-sorted gravel, sand, silt, and minor clay deposited in river and stream channels and flood plains; includes local small alluvial-fan and colluvial deposits, stream-terrace deposits less than about 10 feet (<3 m) above modern base level, and higher-level stream-terrace deposits too small to map separately; typically 10 to 25 feet (3-8 m) thick.

The eastern corner of the project area is mapped as located on:

> **Qafy: Younger alluvial-fan deposits (Holocene) -** Poorly to moderately sorted, non-stratified, subangular to subrounded, boulder- to clay-size sediment deposited at the mouths of streams and washes; clast composition ranges widely and reflects rock types exposed in upstream drainage basins; forms both active depositional surfaces (Qaf1 equivalent) and low-level inactive surfaces incised by small streams (Qaf2 equivalent) undivided here; deposited principally as debris flows and debris floods, but colluvium locally constitutes a significant part of the deposits; small, isolated alluvial fans are typically less than a few tens of feet thick, but large, coalesced fans, as in the New Harmony basin, are probably as much as 200 feet (60 m) thick.

Soil conditions encountered on site consisted of soils interpreted as fill which was underlain by soils which coincide with geologic mapping of the area.

3.3 GEOLOGIC HAZARDS

The project area lies within a physiographic transition zone between the Colorado Plateau to the east and the Basin and Range Province to the west. Southwestern Utah is located on a structural block proximate to the southern segment of the Intermountain Seismic belt, which is characterized by high-angle normal faults that tend to step down to the west. These faults in combination with the arid depositional climate make this area geotechnically and geologically challenging.

The UGS has performed an assessment of geologic hazards[2] which contains a summary of possible hazards that may be present at the project location. Landmark has provided a summary of these hazards as well as a response for each. The UGS[3] Hazard Map Report is provided in Appendix C.

Fault Rupture

A well constrained trace of the Hurricane Fault is mapped by the United States Geologic Society (USGS) approximately 14 miles west of the project site. The Kolob Terrace Fault Complex is mapped roughly 17 miles to the north of the project.[4] The Kolob Terrace Fault Complex was the

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1 Utah Geological Survey (UGS), Interactive Geologic Map Portal, Accessed September 12, 2024, https://geology.utah.gov/apps/intgeomap

2 St. George-Hurricane Metropolitan Area Geologic-Hazard Study, Knudsen, Tyler R., Utah Geologic Survey Special Study 127.

3 Utah Geologic Hazards Portal, Retrieved September 12, 2024, from Utah Geological Survey, https://geology.utah.gov/apps/jay/tests/hazards.

4 Black, B.D., Hecker, S., Hylland, M.D., Christenson, G.E., and McDonald, G.N., 2003, Quaternary fault and fold database and map of Utah: Utah Geological Survey Map 193DM, scale 1:500,000.

epicenter of the magnitude (M) 4.5 earthquake in July 2024. These fault zones have been shown to displace Quaternary depositions and are considered active.

While we do not believe that there is a risk of surface fault rupture on site, seismic accelerations associated with potential rupture of these or other faults in the Intermountain Seismic Belt should be considered in design of the project. The probability, proximity, a magnitude of potential ruptures near the project are considered in the American Society of Civil Engineers (ASCE) 7-16 parameters provided in Section 3.4.

Liquefaction

Liquefaction is the sudden loss of shear strength in the soil due to the build-up of excess pore water pressure.[5] This can occur when the soil is subjected to intense shaking such as during a seismic event. The soils that are most susceptible to liquefaction are loose, saturated sandy soils with a low fines content (material passing the #200 sieve). The UGS indicates that young alluvial fan deposits have a very high susceptibility for liquefaction.

Soils on site consisted of low fines silty sand or poorly graded sands which, when saturated, can be prone to liquefaction. No groundwater was encountered at the time and locations observed; however, it is likely that soils deeper than the borings performed on site are saturated and may liquefy in the event of an earthquake. Liquefaction was observed in poorly graded sands along the Virgin River in the 1992 earthquake.

The quantification of the factors of safety against liquefaction is beyond the scope of this report.

Expansive Soils

Expansive soils are soils that are prone to volume changes with a change in water content in the soil. They can occur when sedimentary rock with a particular minerology erode and leave fine-grained silt and clay in their place. These types of soils are one of the most prevalent causes of damage to buildings and construction in the Unites States[6]. The UGS Hazard Report has mapped the site as having a high susceptibility for volumetric change of greater than 3 to 4 percent expansion.

In this area, expansive soils can range in color from very light grey to blue and purple. When wetted these clays can be rolled very thin in the hand, and when dry they are very stiff and brittle. Additionally, significant surficial cracking is a sign of underlaying shrinking and swelling.

Expansive soils were not found in the locations of the borings performed, and we did not see signs of shrinking or swelling on the surface of the site. However, it is possible for expansive soils to exist in areas beyond our exploration. As such contractors working on site should be aware of soil conditions, and if clays are encountered, Landmark should be contacted for evaluation of the material.

Collapsible Soils

5 Coduto, Donald P. (1999), Geotechnical Engineering: Principles and Practices, Prentice Hall, Upper Saddle River, NJ

6 Colorado Geological Survey (2023), Expansive Soil and Rock, https://coloradogeologicalsurvey.org/hazards/expansive-soil-rock

Collapsible soils have considerable strength when in a dry, natural state, but when wetted they settle significantly due to hydro compaction. These soils occur in arid climates and are generally dry, low-density silty soils with high void spaces and air gaps between the soil grains. These voids often present themselves as pinholes or micro-pores that can be observed by the naked eye. The UGS has mapped this area as "Collapsible Soil 1" indicating that there is potential for collapse percentages greater than 3 percent.

Consolidation testing was performed on samples collected from the site. Samples showed low potential for collapse. The values determined in the lab are within allowable tolerance for potential settlement of low-risk structures. For earthwork recommendations refer to Section 5.0.

Piping and Erosion

According to the UGS Hazards Report, "Piping and erosion can cause significant damage to roads, canals, earth-fill dams, buildings, bridges, culverts, and farmland. Piping, also referred to as tunnel erosion, is the subsurface erosion of soil by groundwater that moves through permeable, non-clay layers in soils and exits at a slope." The site is mapped as having soil which is susceptible to this geologic hazard.

Care should be given to management of stormwater on site as outlined in Section 10.0. Erosion of exposed soils is likely to occur, especially where turbulent water is allowed to contact the soil. The client should expect some maintenance of piped soils. We do not expect piping to pose a risk to proposed structures on site.

3.4 SEISMICITY

Seismicity at the site was determined using the ASCE 7 Hazard Tool[7]. Seismic accelerations provided have been determined in accordance with ASCE/SEI 7-16. The following values are presented to assist with seismic design:

- Latitude = 37.176460, Longitude = -113.009009
- Site Class = D- Stiff Soil based on ASCE 7 as referenced in 2021 IBC

Period (sec)	Sa (g)	Site Class
0.2	S_S = 0.482	B/C
1.0	S_1 = 0.158	B/C
0.2	S_{DS} = 0.454	D
1.0	S_{D1} = 0.241	D

As per Section 20.1 of ASCE 7-16, "The soil shall be classified in accordance with Table 20.3-1 and Section 20.3 based on the upper 100 feet of the site profile." However, Section 20.1 continues, "Where site specific data are not available to a depth of 100 feet, appropriate soil properties are permitted to be estimated by the registered design professional preparing the soil exploration report

7 American Society of Civil Engineers, Online Hazard Tool, Accessed September 12, 2024 https://ascehazardtool.org/

based on known geologic conditions." Based on our engineering experience in the area, mapped geology and the soils encountered in the test pits, it is the opinion of Landmark Testing and Engineering that the soils on site classify as Site Class D-Stiff Soil.

4.0 EXPLORATION

4.1 FIELD EXPLORATION

To investigate the subsurface conditions, six borings were performed to a maximum depth of 11.5 feet. The borings were drilled with a CME-55 drill rig utilizing 8.0-inch O.D. hollow-stem augers. Samples were obtained with a 2.5- inch O.D., split barrel, sampler driven with a 140-lb auto hammer dropping 30 inches. Depending on subsurface conditions, bag or tube samples of soil were obtained from the borings. Blow counts shown on the attached log have not been corrected and represent field values.

Landmark geologist Micheal Meyers, G.I.T., conducted the field exploration under full time observation. A log of the subsurface conditions was prepared, samples were collected and sealed for transport, and relevant site photographs were taken.

Soil conditions consisted of a variety of fine-grained soils ranging from lean clay to poorly graded fine sands. The majority of the soil encountered was classified as silty sand in the field. In general soils were loose to medium dense in place.

No groundwater was observed. Soil and groundwater conditions are presented only for the locations and times observed. Boring logs are attached as Figures A-3 through A-8 with the Unified Soil Classification System sheet attached as Figure A-9.

4.2 LABORATORY TESTING

Soil samples from the test pits were taken to our St. George, Utah laboratory for testing. Samples collected by hand tool were sent to Utah State University (UTU) Analytical Laboratories. Tests performed on the samples included:

- Moisture content and unit weight
- Sieve analysis and Atterberg Limits for soil classification
- Water-Soluble Sulfate testing to determine corrosivity potential
- One dimensional consolidation testing to determine collapse/swell potential
- Agricultural Evaluation and Fertilizer Recommendations (UTU Lab)

Three samples were selected for moisture content testing and soil classification according to the United Soil Classification System (USCS). The samples underwent mechanical sieve gradation and plasticity analysis according to Atterberg Limits methods. A summary of classification results are as follows (Note that "NP indicates sample was determined to be nonplastic either in the field or in the lab in accordance with Atterberg Limit methods):

Location	Depth (ft.)	Moisture (%)	Gravel (%)	Sand (%)	Fines (%)	Liquid Limit	Plasticity Index	USCS Symbol
B-2	11.0	3.8	37	60	3	NP	NP	SP
B-3	3.5	15.8	1	62	37	24	9	SC

B-6	6.0	8.6	0	63	37	NP	NP	SM

Consolidation testing was performed on two samples collected during the geotechnical exploration. This testing was done by initially loading a sample to a given pressure, and then saturating the soil with water. The deformation in the sample is measured and recorded. A summary of consolidation testing is provided as follows:

Location	Depth (ft.)	Moisture (%)	Dry Density (pcf)	Wetting Pressure (pcf)	Collapse (%)
B-1	11.0	5.1	93.7	1000	1.5
B-2	2.5	2.3	94.4	1000	0.7

These results indicate low potential for collapsible in the samples tested. Recommendations regarding collapsible soils are presented in Sections 5.0 and 6.0.

One sample was tested for water-soluble sulfate content. These sulfates are known to be corrosive to concrete and metal, and special accommodations should be made for corrosive soils according to the American Concrete Institute. A summary of sulfate test results is provided as follows:

Location	Depth (ft.)	Sulfate Content (%)	Exposure Class
B-1	3.5	0.11	S1

Proctor testing was not performed. If the development requires used of on site soils as structural fill, a sample should be collected prior to density testing being required.

Landmark has not evaluated the testing performed by UTU. Those results are attached in Appendix B for convenience.

The results of the laboratory tests have been summarized and attached as Table B-1. Individual lab reports are also attached in Appendix B along with the data provided by UTU.

4.3 ANALYSIS AND CONCLUSIONS

Based on the geotechnical exploration, soils on site consist primarily of fine-grained soils which are variable but are primarily silty sand. This soil did exhibit a low potential for collapse when tested in the laboratory. In addition, we believe that soils beneath the extent of our borings are likely saturated and are prone to liquefaction in the event of an earthquake. There is a history of liquefaction in the alluvial Virgin River deposits.

Analysis of key elements of the proposed development are present as follows:

Restroom and Pavilion Structures

The restroom and pavilion structures foundation and floor slabs maybe be constructed on one foot of imported granular soil placed as structural fill as outlined in Section 5.2. This will require overexcavation and recompaction of subgrade to a firm and unyielding condition as outlined in Section 5.0.

River Overlook Platform

The desired founding methods for the river overlook platform are not known. Landmark recommends establishing the entire platform on deep foundation helical anchors. Spread footings will be susceptible to erosion and scour of the bank and creek bed soils. Anchors should be installed a minimum of 5 feet below the limits of scour associated with the desired lifespan of the structure as determined by a licensed professional Civil Engineer. Parameters for use in design of the helical anchors is provided in Section 6.0

Paved Areas (Walking Path and Parking Area)

We anticipate that in the paved areas, soft to medium dense soils will be encountered. We have provided a recommended asphaltic concrete and concrete pavement section for the parking lot and the walking path in Section 9.0. Based on the near surface blow counts, we have assumed a California Bearing Ratio (CBR) of 6 for the subgrade soils, and a Traffic Index (T.I.) of 5.0 has been assume for traffic volumes.

General recommendations for the earthwork and the foundation system are outlined in Sections 5.0 and 6.0 of the report.

5.0 SITE GRADING AND EARTHWORK

5.1 GENERAL GRADING

Site preparation should initially consist of grubbing and removal of vegetation in areas of structures. Stripping is expected to be 3 to 6 inches to remove root mats and organic material from the area. Where vegetation is removed, roots and organic matter should be removed as well. Organic soils should not be used in structural areas and should only be limited to landscaped areas of the project.

A complete grading plan has not been developed; however, we anticipate that overall grades will be relatively level with localized cuts or fills of less than 2 feet.

Landmark does not determine lines or grades. It is the earthwork contractor's responsibility to ensure that soil preparation is performed at the correct depth and location for the proposed structures on site.

Restroom and Pavilion Structures

For restroom and pavilion structures proposed on site, Landmark recommends that within the footings, floor slabs, and 2 feet beyond horizontally in all directions, existing soils should be removed sufficiently to establish a minimum of 1 foot of imported granular fill underlying all concrete incorporated into the structure. This will allow for a firm, level, and uniform working surface. It will also provide increased bearing capacity as described in Section 6.0 as well as some resilience against saturation of bearing soils.

Once the overexcavation is complete, the contractor should scarify (till) 8 to 12 inches of soil at the bottom of the excavation and moisture condition the soils to within 2 percent of option moisture as determined by ASTM D-1557 Modified Proctor. This material should then be compacted to a firm and unyielding condition. Landmark should be called to verify the overexcavation and recompaction prior to installation of structural fill.

Landmark does not determine lines or grades. It is the earthwork contractor's responsibility to ensure that the building pad preparation is performed at the correct depth and location for the proposed structures on site.

River Overlook Platform

Due to expected erosion, rescension and scour of bank and river bed soils upon which the river outlook will be founded, we recommend deep foundation solutions upon which to establish the river overlook platform. Helical anchors seem to be the best option as no shoring is required, they penetrate alluvial gravels that would cause refusal of driven piles. Additionally, they can be installed by reaching equipment out beyond the waterline from the shore without casings or shoring being required.

Minimal earthwork is required where deep foundations are being used. The area of the installation should be graded sufficiently flat as to allow the specialty contractor to work confidently. It is possible that keying in a construction pad will be required. Consideration should be given to placing 12 inches of rip rap, road base, or pit run on a pad upon which to operate and install the anchors.

Paved Areas

The walking path and parking area should be excavated sufficiently to install the required aggregate base course and asphaltic concrete pavement section. Subgrade soils should be moisture conditioned and recompacted to a firm and unyielding condition prior to the installation of aggregate base course material. Pavement should be constructed according to Springdale requirements and the recommendations provided in Section 9.0.

5.2 FILL PLACEMENT AND COMPACTION

All fill to be placed for support of structures and pavement should be considered structural fill. On-site soils are suitable for use as structural fill.

Imported, granular fill, should be well-graded, non-expansive, and free of organics and all deleterious materials. The material used for structural fill underlying the abutments is critical to limiting risk of settlement of the bridge. Therefore, Landmark would like to approve the material prior to use. Soils used for imported, granular fill should meet the following specifications at minimum and preferably would classify as gravel.

GRADATION	PERCENT PASSING
3- inch	100
1.5-inch	80-100
No. 200 sieve	10-25
ATTERBERG LIMITS	
Liquid Limit	30 or less
Plasticity Index	9 or less

Material not meeting the above requirements may be suitable for use as structural fill at the

discretion of the geotechnical engineer. Samples of structural fill should be submitted for testing prior to transporting to the site.

Any on-site soils used as structural fill or imported; granular fill should be compacted to the following specifications.

FILL PLACEMENT AND COMPACTION	
Maximum lift thickness	8-inch (loose)
Minimum compaction	95% ASTM D-1557
Compacted Moisture Content	within 2% of optimum

Compaction of structural fill should be completed with equipment suitable for the conditions encountered in the field such that compaction requirements are met, including those areas that may be inaccessible to large rolling compactors. All structural fill should be evenly spread on a horizontal plane in eight-inch loose lifts. Each eight-inch lift of structural fill material placed at the site should be tested for compliance with the required relative compaction and moisture content prior to proceeding with additional lifts.

It is likely that on site soils will not be density testable by nuclear densometer gauge due to too much oversized material being present. Density should be determined by assessing the moisture condition, compactive effort, and in place response to loading on site by Landmark personnel.

5.3 CUT AND FILL SLOPES

It is recommended that permanent cut or fill slopes be maintained at a slope of two horizontal to one vertical (2H:1V) or flatter unless structurally retained. Poorly graded sands should be sloped at 3H:1V or flatter.

Grading of both cut and fill slopes should be such that surface water is directed away from the slopes and not concentrated on slopes or in unprotected channels. Construction procedures should ensure adequate compaction of slope faces. All excavations should conform to OSHA standards.

5.4 CONCRETE FLATWORK

The concrete walking paths, picnic slabs, and other hardscapes should be supported on soils which have been compacted to structural fill standards. The concrete flatwork should meet all applicable municipality standards. Any sidewalks installed along public roadways should be established on a minimum of 6 inches of approved aggregate road base material which has been installed as structural fill.

6.0 FOUNDATION & CONSTRUCTION CONSIDERATIONS

6.1 SHALLOW FOUNDATIONS

The proposed structures may be supported on conventional spread or continuous footings established on suitable in place soil or structural fill as previously described in Section 5.0. Foundation excavations should be visually observed and tested by qualified personnel prior to placement of reinforcing steel or concrete. Additional foundation recommendations are subsequently presented.

DESCRIPTION	VALUE
Foundation Type	Continuous or spread footings
Bearing Material	Imported Granular Fill
Allowable Bearing Capacity	2,500 psf on Imported Granular Fill
Minimum embedment depth below finished grade	24 inches for frost and confinement
Minimum footing width	12 inches (continuous) for single-story 18-inches for two stories 24-inches (isolated spread)
Total estimated settlement	1-inch
Total differential settlement	less than 3/4 inch over 10 lineal feet

The allowable bearing capacity is based upon dead load plus long-term live load. A one-third increase in allowable bearing capacity for short duration loads such as wind or seismic loads is permitted with the alternative load combinations given in Section 1605.3.2 of the IBC.

6.2 DEEP FOUNDATION HELICAL ANCHORS

Helical anchors should consist of 8-10-12 helical anchors, extending into competent native soil. We estimate allowable vertical compressive capacities of 8-10-12 CHANCE™ anchors to be 20 kips each. Helical anchors from other manufacturers may also be used, provided they are designed to have allowable vertical compressive capacity of 20 kips. Anchors should be installed a minimum of 5 feet below the scour depth as determined by a Civil Engineer. We anticipate total anchor lengths on the order of 15 feet to 20 feet. Anchor spacing should be no more than 7 feet along the length of the platform.

Although not observed in borings conducted for the geotechnical report, the presence of cobbles or boulders may limit the depth achievable during helical anchor installation. At least one of the vertical anchors should be tested to verify pull-out resistance. Installation of the anchors, and the pull-out tests, should be monitored by Landmark.

The total number and location of helical anchors should be determined by a Structural Engineer. In addition, brackets, grade beams, and other steel elements of the design should be done in accordance with manufacturer's specifications and design input provided by others. The installation of the piers should be done under full-time observation by Landmark staff.

7.0 FLOOR SLABS

It is recommended that concrete floor slabs be constructed on a pad that has been prepared as previously indicated. A minimum of 4-inches of relatively free-draining material should be used beneath the slab in order to help distribute floor loads, break the rise of capillary water, and aid in the concrete curing process. Alternatively, 6 inches of road base may be used in place of the free draining-material.

Concrete slabs should be designed using rebar reinforcement and frequent crack control joints to help control normal shrinkage and stress cracking. Concrete placement and curing should meet

ACI[8] requirements including following hot or cold weather placement recommendations, when appropriate.

8.0 LATERAL EARTH PRESSURES

Lateral loads imposed on the abutments and structure footings may be resisted by the development of passive earth pressures against the sides and the supporting soils. Lateral earth pressure values are presented in the following table. The following values are for the silty sand prevalent on site and are assuming an effective friction angle (ϕ) of 32º and a unit weight (γ) of 105 pcf.

Case Evaluated	Soil Type	Value
Active	On Site Silty Sand	32 psf/ft
		48 psf/ft (with seismic)
At-Rest	On Site Silty Sand	49 psf/ft
Passive	On Site Silty Sand	342 psf/ft
		297 psf/ft (with seismic)
Seismic Coefficient	IBC 1610.1.1	0.182
Coefficient of friction (ϕ=32°)	On Site Silty Sand	0.35

The lateral earth pressures presented do not include any safety factors. The pressures also assume horizontal backfill and that the backfill is in a drained condition with no build-up of hydrostatic pressure. The additional effects of sloping backfill, surcharge, structural loads and groundwater conditions should be included in calculating lateral earth pressures. Backfill should be placed in accordance with the requirements of structural fill except that backfill in landscape and areas that will not be subject to structural loadings may be reduced to 90 percent of the maximum dry density as determined by ASTM D-1557.

9.0 PAVEMENT DESIGN RECOMMENDATIONS

9.1 ASPHALT PAVEMENT

Design of the pavement sections are based on the procedures outlined in the 1993 Guidelines for Design of Pavement Structures by the American Association of State Highway and Transportation Officials (AASHTO). A Traffic Index (T.I) of 5.0 was used for the parking area. A CBR value of 6 was used based on the soil encountered in our exploration.

For pavement design, the following design parameters have been assumed:

Pavement Design Life	20 years
Subgrade CBR	6
Structural Layer Coefficients	Asphalt = 0.42
	Road Base = 0.12
	Improved Subgrade = 0.8

8 American Concrete Institute

Based on design parameters, the following pavement sections are provided.

Location	Asphalt Thickness (inches)	Base Course (inches)	Improved Subgrade
Parking Area (T.I = 5.0)	2.5	8.0	10.0
Pathway	2.5 (voidless)	6.0	6.0

Recompacted on-site soils should be compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D-1557 and base course soils should be compacted to a minimum of 95 percent of the maximum dry density (ASTM D-1557). Asphalt should be compacted to at least 96 percent of the Marshall maximum density. Asphaltic concrete and base should be tested prior to site delivery and during placement for conformance with project specifications.

10.0 MOISTURE CONTROL

This soils report provides recommendations for site preparation and foundation design. Inadequate surface drainage or failure to control moisture will result in excessive differential movement of slabs, walkways, porches, or patios and structural damage, regardless of the site preparation. The following moisture control measures are strongly recommended:

(1) Once the finish floor elevation has been established, the site grades should be constructed and maintained to drain surface and roof runoff away from the building foundation at a slope of 5 percent for at least 10 feet beyond the structure. The ground surface should be graded to drain away from the building in all directions. Water should not be allowed to pond adjacent to foundations or on-site.

(2) Grass should not be placed within 5 feet of the foundation. Grass, if planted, should have a minimum slope of 5% away from the foundation.

(3) Xeriscape (landscaping that eliminates the need for supplemental irrigation of plants) is recommended within 10 feet of the building foundation. Bubblers, although more efficient than sprinkler irrigation, still have a significant potential of introducing excessive water into the ground and saturating foundation soils. Bubblers are not recommended in the 10 feet buffer zone area. As an alternative, sealed bottom planter boxes may be used.

(4) Inadequate compaction of utility trench backfill provides a conduit for water migration. All utility trenches within the building footprint and extending 5 feet beyond the footprint should be backfilled with structural fill similar to that approved for the foundations. Backfill adjacent to structures should be compacted to at least 90 percent of the maximum dry density as determined by ASTM D-1557 and the minimum slope requirements should be followed. Backfill beneath structures should be compacted to at least 95 percent of the maximum dry density.

(5) Grading should be such that surface water is directed away from all cut and fill slopes and collected only in channels protected against erosion. Water should not be allowed to pond on-site.

(6) Unless roof runoff falls on impervious surfaces such as asphalt or concrete that are sloped away from the building for a distance of 10 feet, roof runoff should be collected and discharged well outside of the foundation backfill limits.

It should be emphasized that final grading and landscaping generally occurs after construction of the structure and observation of these features is outside of normal geotechnical inspection and observation. The owner/contractor is responsible to ensure that these surface drainage and moisture control recommendations are followed throughout the life of the structure.

11.0 SOIL CORROSIVITY

A soil sample taken from B-1 at 3.5 feet bgs was tested for corrosivity. The sample contained 0.11% soluble sulfate which is considered moderately corrosive according to ACI 318. We recommend that concrete mixes used on the project be designed in accordance with ACI 318 Table 19.3.1.1 for Sulfate Exposure Class S1. We recommend that buried pipes be plastic (PVC or HDPE) instead of metal, where possible.

12.0 FOUNDATION REVIEW AND TESTING

This report has been prepared to assist in project design and construction. Variations from the conditions portrayed in the exploratory explorations may occur which are sometimes sufficient to require modifications to the design. In order to incorporate recommendations provided into actual field conditions and to confirm that the project specifications are implemented, we recommend that observation and testing be performed during construction to monitor over-excavation, grading, and preparation of soils upon which foundations elements or structural loads may be established.

13.0 LIMITATIONS

The exploratory data presented in this report were collected to provide geotechnical design recommendations for this project and subsurface site descriptions represent conditions observed at the time and at the locations explored. The explorations may not be indicative of subsurface conditions beyond the exploration location and conditions may change with passage of time. If subsurface conditions are encountered that are significantly different than those reported herein, Landmark should be contacted immediately for the continued applicability of the recommendations. In the event changes to the project are made that differ from those presented in this report, Landmark should be made aware of the changes. Landmark will provide written verification that the recommendations and conclusions remain valid or that modifications are required.

This report has been prepared to assist in project design and construction. We respectfully request the opportunity to review the final design drawings and specifications in order to determine whether the assumptions and recommendations presented herein are applicable to the anticipated designs.

This report is not intended to be used as the sole bid document. Any information concerning the environmental conditions of the site is beyond the scope of this geotechnical study. This geotechnical report has been prepared to meet the specific needs of our client and may not be appropriate to satisfy the needs of other users.

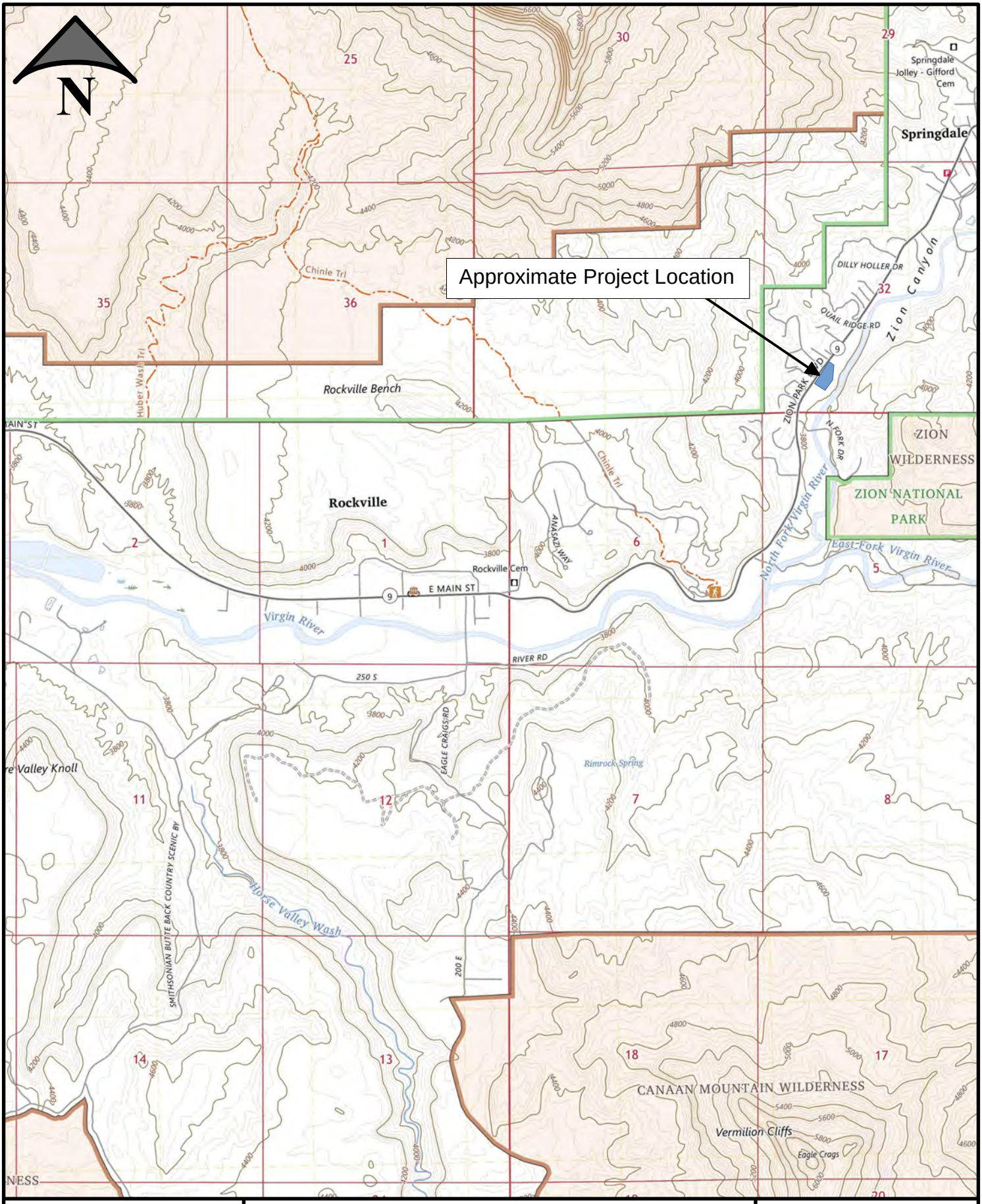
Site conditions and standards of practice change, therefore, we should be notified to review and update the report and its recommendations if construction is not commenced within 3 years of the date it was issued.

We appreciate this opportunity to be of service.

LANDMARK TESTING & ENGINEERING

Chad S. Hardman, P.E.
Professional Engineer

Reviewed by:
Kent Nelson, P.E.
Professional Engineer

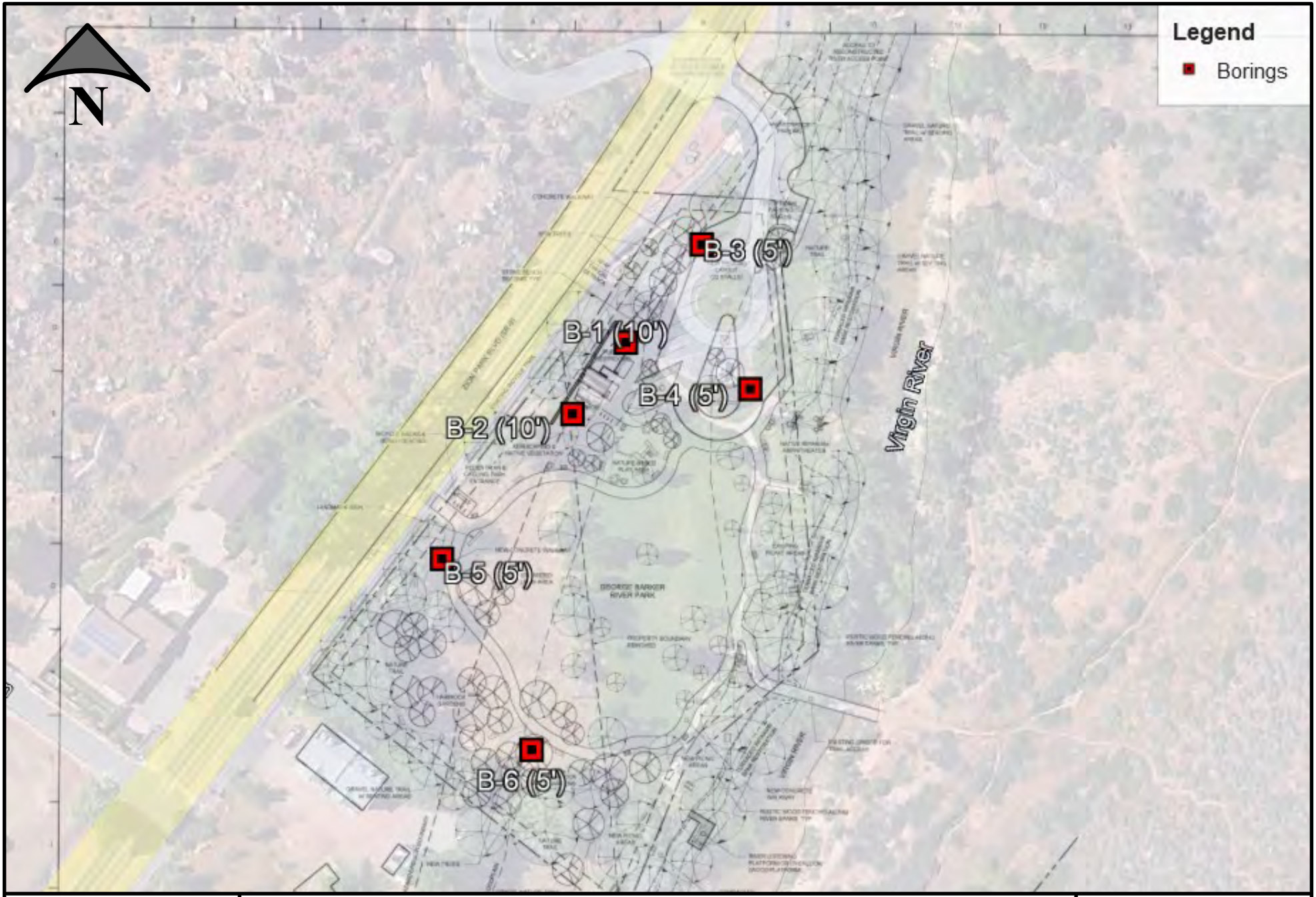


LANDMARK TESTING & ENGINEERING

Vicinity Map

Landmark Project No 240518

Figure A-1



LANDMARK TESTING & ENGINEERING

Site Map

Landmark Project No 240518

Figure A-2

BORING NUMBER B-1

START DATE: 2024-08-13
LOGGED BY: Michael Meyers
REVIEWED BY: Chad Hardman
NOTES:

DRILLING COMPANY: Geotechnical Drilling Services
DRILL RIG: CME-55
LATITUDE/LONGITUDE: 37.17682 -113.00898
GROUNDWATER: _____ feet _____ feet

Depth (ft)	Soil Symbol	Samples No.	Samples Symbols	3.0-inch Modified California	Lithologic Description	Dry Density (pcf)	Moisture (%)	Atterberg Limits LL (%)	Atterberg Limits PI (%)	Gravel	Sand	#200 Fines	Consolidation	Water-Soluble Sulfate (%)	Modified Proctor	Unconfined Compression
					Ground Surface											
0			M	19	**FILL: Silty SAND (SM)** Medium dense, slightly moist, fine to medium grained, light brown to brown, fine roots down to 2 feet, unusual color mixes									0.11		
					3.5 ft Red											
5			M	37	5 ft Light brown to brown											
					7 ft **NATIVE: Silty SAND (SM)**											
			M	11	Loose, slightly moist to moist, fine to medium grained, light brown											
10			M	13		93.7	5.1						1.5% C @ 1.0 ksf			
					11.5 ft B-1 Terminated at 11.5'											
15																

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LANDMARK TESTING & ENGINEERING

PROJECT NAME: Springdale River Park Expansion
CLIENT: ASSIST Community Design Center
Project No.: 240518
Project Location: Springdale, Utah

Figure A-3

BORING NUMBER B-2

START DATE: 2024-08-13
LOGGED BY: Michael Meyers
REVIEWED BY: Chad Hardman
NOTES:

DRILLING COMPANY: Geotechnical Drilling Services
DRILL RIG: CME-55
LATITUDE/LONGITUDE: 37.17664 -113.00906
GROUNDWATER: _____ feet _____ feet

Depth (ft)	Soil Symbol	Samples No.	Samples Symbols	3.0-inch Modified California	Lithologic Description	Dry Density (pcf)	Moisture (%)	Atterberg Limits LL (%)	Atterberg Limits PI (%)	Gravel	Sand	#200 Fines	Consolidation	Water-Soluble Sulfate (%)	Modified Proctor	Unconfined Compression
					Ground Surface											
0					**FILL: Lean CLAY (CL)** Soft, moist, fine to medium dense, roots, brown, medium easy drilling 0.5 ft											
			M	15	**Silty SAND (SM)** Loose, slightly moist, fine to medium grained, light brown	94.4	2.3						0.7% C @ 1.0 ksf			
5					5 ft											
			M	21	**NATIVE: Silty SAND (SM)** Medium dense, slightly moist, fine to medium grained, with sublong to subrounded gravels, light brown, easy drilling											
				42	8 ft											
			M		**Poorly Graded SAND (SP)** Medium dense, slightly moist, fine to medium grained, light brown, rare gravels, liquifiable soil type											
10					10 ft											
			M	32	Moist, with abundant gravel		3.8	0	0	37	59	3.1				
					11.5 ft											
15					B-2 Terminated at 11.5'											

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LANDMARK TESTING & ENGINEERING

PROJECT NAME: Springdale River Park Expansion
CLIENT: ASSIST Community Design Center
Project No.: 240518
Project Location: Springdale, Utah

Figure A-4

BORING NUMBER B-3

START DATE: 2024-08-13
LOGGED BY: Michael Meyers
REVIEWED BY: Chad Hardman
NOTES:

DRILLING COMPANY: Geotechnical Drilling Services
DRILL RIG: CME-55
LATITUDE/LONGITUDE: 37.17702 -113.00880
GROUNDWATER: _____ feet _____ feet

Depth (ft)	Soil Symbol	Samples No.	Samples Symbols	3.0-inch Modified California	Lithologic Description	Dry Density (pcf)	Moisture (%)	Atterberg Limits LL (%)	Atterberg Limits PI (%)	Gravel	Sand	#200 Fines	Consolidation	Water-Soluble Sulfate (%)	Modified Proctor	Unconfined Compression
					Ground Surface											
0					**TOPSOIL: Lean CLAY (CL)** Soft, moist, fine grained, roots, brown 0.5 ft											
				8	**FILL: Silty SAND (SM)** Loose, slightly moist to moist, fine to medium grained, roots and pinholes down to 3 feet, brown 3 ft											
			M		**Clayey SAND (SC)** Soft, moist, fine to medium grained, brown 4.5 ft		15.8	24	9	1	62	37				
5				38	**NATIVE: Silty SAND (SM)** Medium dense, slightly moist, fine to medium grained, with subround to rounded gravels, light brown, with river deposits 6.5 ft											
			M		B-3 Terminated at 6.5'											
10																
15																

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LANDMARK TESTING & ENGINEERING

PROJECT NAME: Springdale River Park Expansion
CLIENT: ASSIST Community Design Center
Project No.: 240518
Project Location: Springdale, Utah

Figure A-5

BORING NUMBER B-4

START DATE: 2024-08-13
LOGGED BY: Michael Meyers
REVIEWED BY: Chad Hardman
NOTES:

DRILLING COMPANY: Geotechnical Drilling Services
DRILL RIG: CME-55
LATITUDE/LONGITUDE: 37.17673 -113.00870
GROUNDWATER: _____ feet _____ feet

Depth (ft)	Soil Symbol	Samples No.	Samples Symbols	3.0-inch Modified California	Lithologic Description	Dry Density (pcf)	Moisture (%)	Atterberg Limits LL (%)	Atterberg Limits PI (%)	Gravel	Sand	#200 Fines	Consolidation	Water-Soluble Sulfate (%)	Modified Proctor	Unconfined Compression
					Ground Surface											
0					**TOPSOIL: Silty SAND (SM)** Loose to medium dense, moist, fine to medium grained, roots, dark brown 0.5 ft											
			M	11	**FILL: Silty SAND (SM)** Medium dense, slightly moist, fine to medium grained, light brown to brown, odor, medium easy drilling											
					4 ft											
5					**NATIVE: Silty SAND (SM)** Medium dense, slightly moist, fine to coarse grained, light brown, with river deposits											
			M	39												
					6.5 ft											
10					B-4 Terminated at 6.5'											
15																

PROJECT NAME: Springdale River Park Expansion
CLIENT: ASSIST Community Design Center
Project No.: 240518
Project Location: Springdale, Utah

Figure A-6

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BORING NUMBER B-5

START DATE: 2024-08-13
LOGGED BY: Michael Meyers
REVIEWED BY: Chad Hardman
NOTES:

DRILLING COMPANY: Geotechnical Drilling Services
DRILL RIG: CME-55
LATITUDE/LONGITUDE: 37.17643 -113.00940
GROUNDWATER: _____ feet _____ feet

Depth (ft)	Soil Symbol	Samples No.	Samples Symbols	3.0-inch Modified California	Lithologic Description	Dry Density (pcf)	Moisture (%)	Atterberg Limits LL (%)	Atterberg Limits PI (%)	Gravel	Sand	#200 Fines	Consolidation	Water-Soluble Sulfate (%)	Modified Proctor	Unconfined Compression
					Ground Surface											
0			M	15	**NATIVE: Silty SAND (SM)** Loose, slightly moist, fine to medium grained, thin clay lenses, fine roots down to 3 feet, light brown to tan to reddish brown											
					4 ft											
5			M	31	Medium dense, reddish brown											
					6.5 ft											
10					B-5 Terminated at 6.5'											
15																

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LANDMARK TESTING & ENGINEERING

PROJECT NAME: Springdale River Park Expansion
CLIENT: ASSIST Community Design Center
Project No.: 240518
Project Location: Springdale, Utah

Figure A-7

BORING NUMBER B-6

START DATE: 2024-08-13
LOGGED BY: Michael Meyers
REVIEWED BY: Chad Hardman
NOTES:

DRILLING COMPANY: Geotechnical Drilling Services
DRILL RIG: CME-55
LATITUDE/LONGITUDE: 37.17601 -113.00919
GROUNDWATER: _____ feet _____ feet

Depth (ft)	Soil Symbol	Samples No.	Samples Symbols	3.0-inch Modified California	Lithologic Description	Dry Density (pcf)	Moisture (%)	Atterberg Limits LL (%)	Atterberg Limits PI (%)	Gravel	Sand	#200 Fines	Consolidation	Water-Soluble Sulfate (%)	Modified Proctor	Unconfined Compression
					Ground Surface											
0					**NATIVE: Silty SAND (SM)** Loose, dry to slightly moist, fine to medium grained, fine roots down to 3 feet, tan											
					2 ft											
				23	**Lean CLAY (CL)** Very stiff, slightly moist, fine grained, pinholes down to 6 feet, brown											
			M													
5				24												
			M		6 ft		8.6	0	0	0	63	37				
					Silty SAND (SM) Medium dense, slightly moist, fine to medium grained, light brown to brown 6.5 ft											
					B-6 Terminated at 6.5'											
10																
15																

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LANDMARK TESTING & ENGINEERING

PROJECT NAME: Springdale River Park Expansion
CLIENT: ASSIST Community Design Center
Project No.: 240518
Project Location: Springdale, Utah

Figure A-8

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS (More than 50% of soil Retained on No. 200 sieve size)	GRAVELS More than 1/2 of coarse fraction > No.4 sieve size	GW	Well graded gravels or gravel-sand mixtures little or no fines.
		GP	Poorly graded gravels or gravel-sand mixtures little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS More than 1/2 of coarse fraction < No.4 sieve size	SW	Well graded sands or gravelly sand mixtures little or no fines.
		SP	Poorly graded sands or gravelly sand mixtures little or no fines.
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (Less than 50% of soil Retained on No. 200 sieve size)	SILTS & CLAYS Liquid Limit < 50	ML	Inorganic silts and very fine sands, rock flour, silty fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		OL	Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS Liquid Limit > 50	MH	Inorganic silts, micaceous of diatomaceous fine sand or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

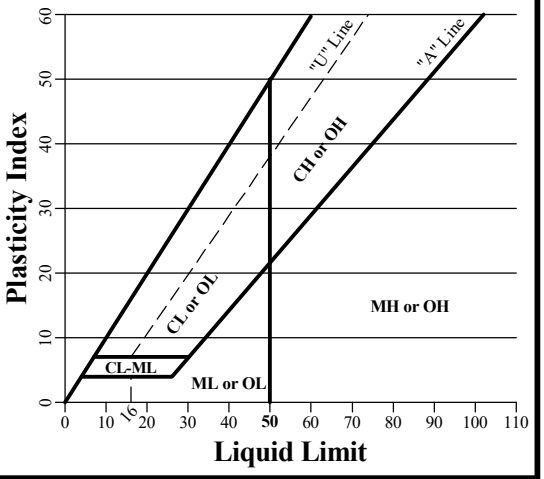
GRAIN SIZE CHART

CLASSIFICATION	Range of Grain Size	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	**Above 12"**	**Above 305**
COBBLES	**12" to 3"**	**305 to 76.2**
GRAVEL	**3" to No. 4**	**76.2 to 4.76**
Coarse	3" to 3/4"	76.2 to 19.1
Fine	3/4" to No. 4	19.1 to 4.76
SAND	**No. 4 to No. 200**	**4.76 to 0.074**
Coarse	No. 4 to No. 10	4.76 to 2.00
Medium	No. 10 to No. 40	2.00 to 0.42
Fine	No. 40 to No. 200	0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

SAMPLES

- Relatively Undisturbed Sample
- Block Sample
- Bag Sample
- Auger Cuttings
- B — Bucket Sample
- Core
- No Recovery

PLASTICITY CURVE



Landmark Testing & Engineering
795 Factory Drive
St. George, UT 84790
Telephone: 435-986-0566
Website: www.landmarktesting.com

Figure A-9

LANDMARK TESTING & ENGINEERING

SUMMARY OF LABORATORY TEST RESULTS

Client: ASSIST Community Design Center
218 East 500 South
Salt Lake City, UT 84111

Date of Report: 9/11/2024

Project: Springdale River Park Expansion

Project #: 240518

Location: Springdale, Utah

Boring / Test Pit Number	Depth Below Ground Surface (ft)	Moisture Content (%)	In-Place Dry Desnity (pcf)	Mechanical Gradation			Atterberg Limits		Swell-Consolidation Swell/Collapse @ Wetting Load (S/C @ ksf)	Modified Proctor / CBR			Percent Finer Than 0.02 mm (%)	Unconfined Compressive Strength (psf)	Sooluble Sulfate Content (%)	USCS Group Symbol	AASHTO Soil Classification
				Gravel (%)	Sand (%)	Fines (%)	Liquid Limit	Plasticity Index		Maximum Dry Density (pcf)	Optimum Moisture Content (%)	CBR Value					
B1	3.5														0.11		
B1	11.0	5.1	93.7						1.5% C @ 1.0 ksf								
B2	2.5	2.3	94.4						0.7% C @ 1.0 ksf								
B2	11.0	3.8		37.0	59.0	3.1	NP	NP								SP	A-1-b
B3	3.5	15.8		1.0	62.0	37.0	24	9								SC	A-4(0)
B6	6.0	8.6		0.0	63.0	37.0	NP	NP								SM	A-4(0)

TABLE B-1

SOIL CLASSIFICATION REPORT

Client: ASSIST Community Design Center
218 East 500 South
Salt Lake City, UT 84111

Date of Report: 8/28/2024
Reviewed By: Z. Girsberger
Lab#: 24SG5201

Project: Springdale River Park Expansion **Project #:** 240518
Location: Springdale **Sampled By:** M. Meyers **Date:** 8/14/2024
Type of Sample: Brown Poorly Graded Sand with Gravel **Tested By:** K. Barnett **Date:** 8/27/2024
Location of Sample: Boring 2 at 11.0 **Authorized By:** Client **Date:** 8/14/2024

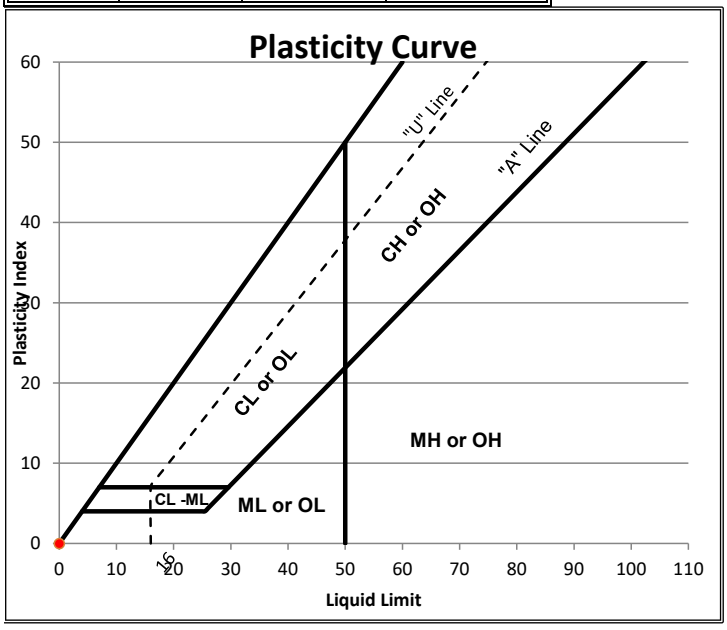
Sieve Analysis , ASTM C136 and C117

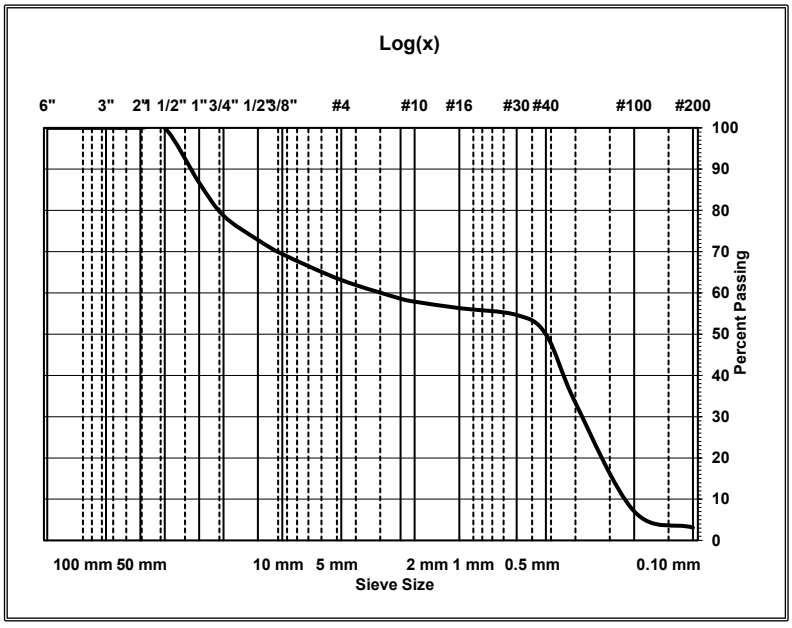
Sieve Size		% Passing Cumulative	Specification
150 mm	6"		
75 mm	3"		
50 mm	2"		
37.5 mm	1-1/2"	100	
25 mm	1"	87	
19 mm	3/4"	79	
12.5 mm	1/2"	73	
9.5 mm	3/8"	69	
4.75 mm	#4	63	
2.00 mm	#10	58	
1.18 mm	#16	56	
425 µm	#40	50	
300 µm	#50	33	
75 µm	#200	3.1	

Test	Result	Specification	Test Standard
Natural Moisture Content, %	3.8		ASTM D 2216
Liquid Limit	NP		ASTM D 4318
Plasticity Index	NP		ASTM D 4318
Unified Classification System	SP		ASTM D 2487
AASHTO Classification System	A-1-b		AASHTO M145

% Cobble > 3"	% Gravel < 3" - #4	% Sand < #4 - #200	% Silt-Clay < #200
0.0	37.0	59.9	3.1

Diameter D_{60}	Diameter D_{30}	Diameter D_{10}	Coefficient of Uniformity, C_U	Coefficient of Concavity, C_C
3.0972	0.2808	0.1668	18.568	0.153





SOIL CLASSIFICATION REPORT

Client: ASSIST Community Design Center
218 East 500 South
Salt Lake City, UT 84111

Date of Report: 9/3/2024
Reviewed By: Z. Girsberger
Lab#: 24SG5203

Project: Springdale River Park Expansion **Project #:** 240518
Location: Springdale **Sampled By:** M. Meyers **Date:** 8/14/2024
Type of Sample: Brown Clayey Sand **Tested By:** A. Pay **Date:** 8/26/2024
Location of Sample: Boring 3 at 3.5 **Authorized By:** Client **Date:** 8/14/2024

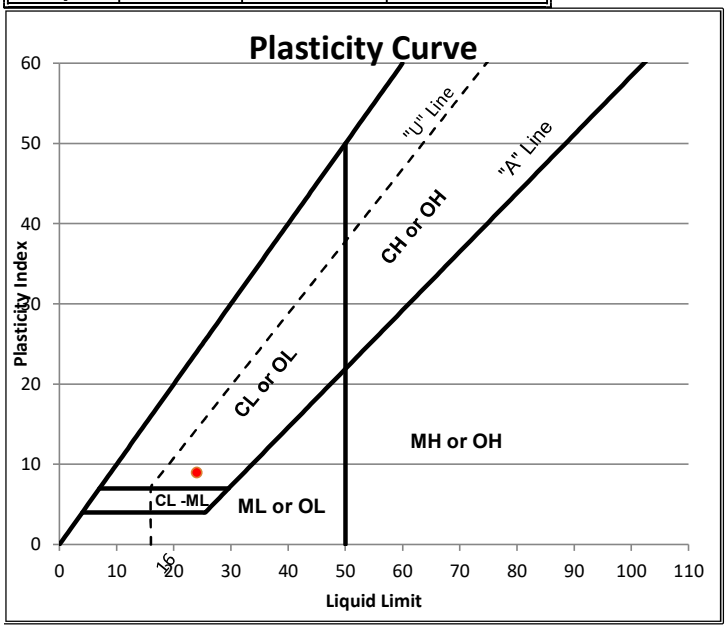
Sieve Analysis , ASTM C136 and C117

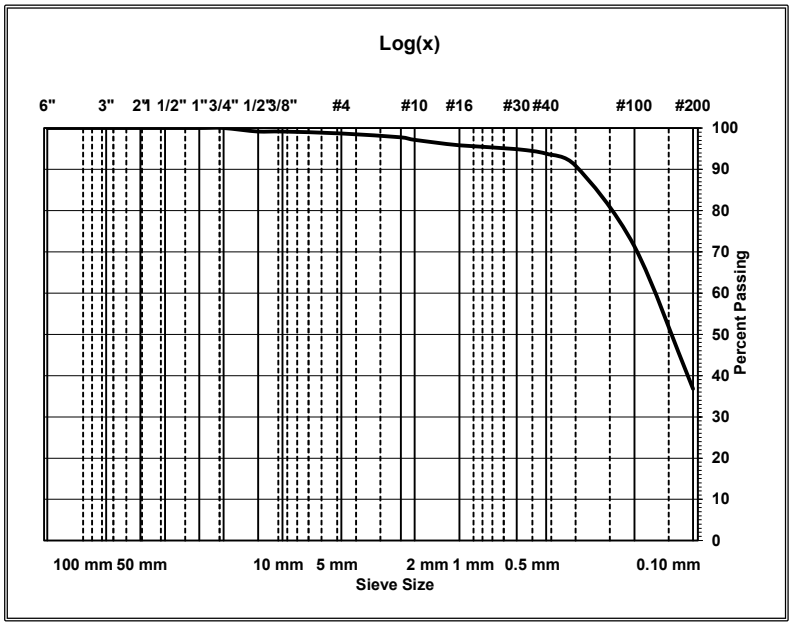
Sieve Size		% Passing Cumulative	Specification
150 mm	6"		
75 mm	3"		
50 mm	2"		
37.5 mm	1-1/2"		
25 mm	1"		
19 mm	3/4"	100	
12.5 mm	1/2"	99	
9.5 mm	3/8"	99	
4.75 mm	#4	99	
2.00 mm	#10	97	
1.18 mm	#16	96	
425 µm	#40	94	
300 µm	#50	91	
75 µm	#200	36.8	

Test	Result	Specification	Test Standard
Natural Moisture Content, %	15.8		ASTM D 2216
Liquid Limit	24		ASTM D 4318
Plasticity Index	9		ASTM D 4318
Unified Classification System	SC		ASTM D 2487
AASHTO Classification System	A-4(0)		AASHTO M145

% Cobble > 3"	% Gravel < 3" - #4	% Sand < #4 - #200	% Silt-Clay < #200
0.0	1.0	62.2	36.8

Diameter D_{60}	Diameter D_{30}	Diameter D_{10}	Coefficient of Uniformity, C_U	Coefficient of Concavity, C_C





LANDMARK TESTING & ENGINEERING

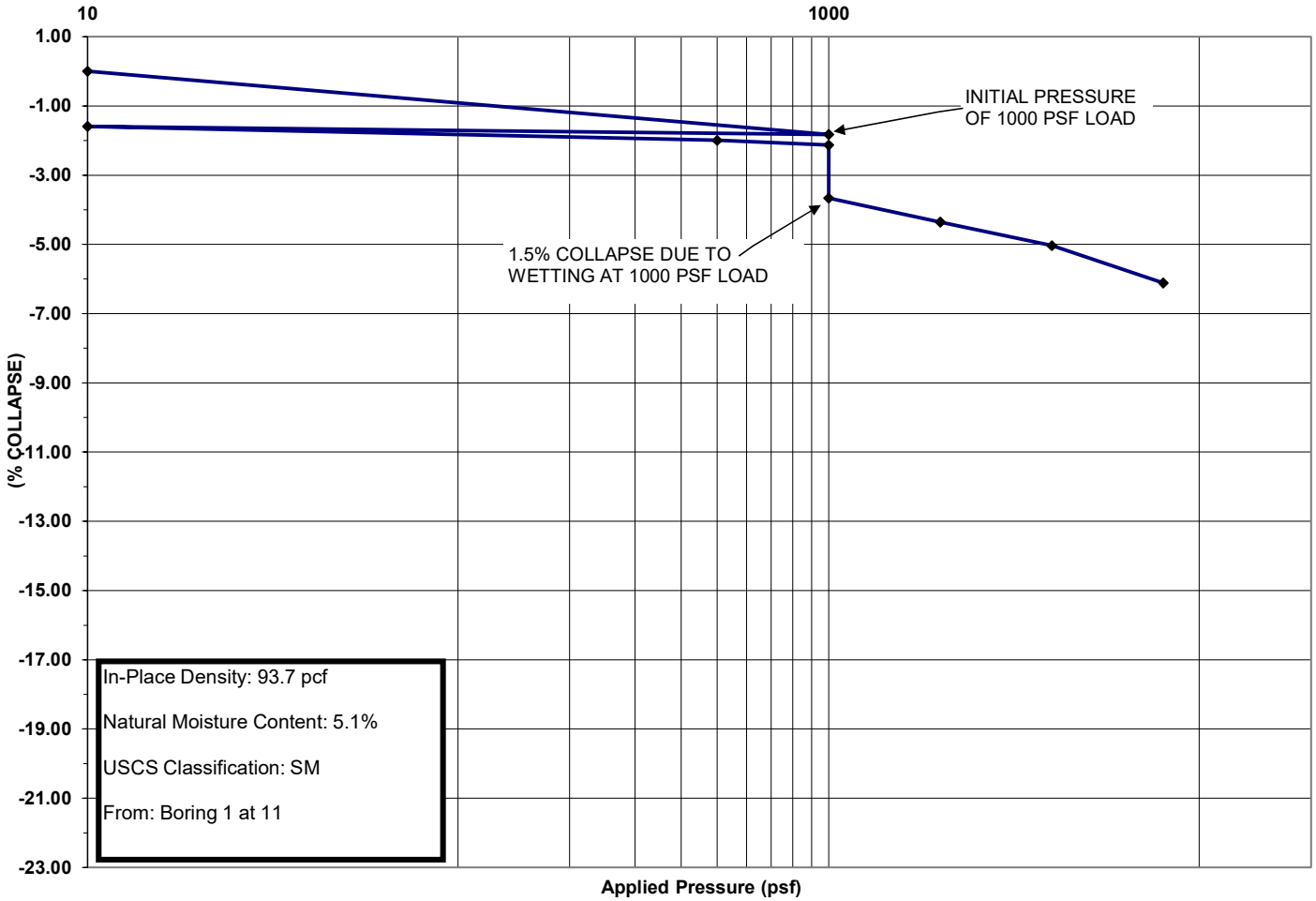
CONSOLIDATION REPORT

Client: ASSIST Community Design Center
218 East 500 South
Salt Lake City, UT 84111

Date of Report: 8/23/2024
Reviewed By: Z. Girsberger
Lab#: 24SG5199

Project: Springdale River Park Expansion **Project #:** 240518
Location: Springdale **Sampled By:** M. Meyers **Date:** 8/14/2024
Type of Sample: SM **Tested By:** B. Holdaway **Date:** 8/19/2024
Location of Sample: Boring 1 at 11 **Authorized By:** Client **Date:** 8/14/2024

COLLAPSE/SWELL CURVE



LANDMARK TESTING & ENGINEERING

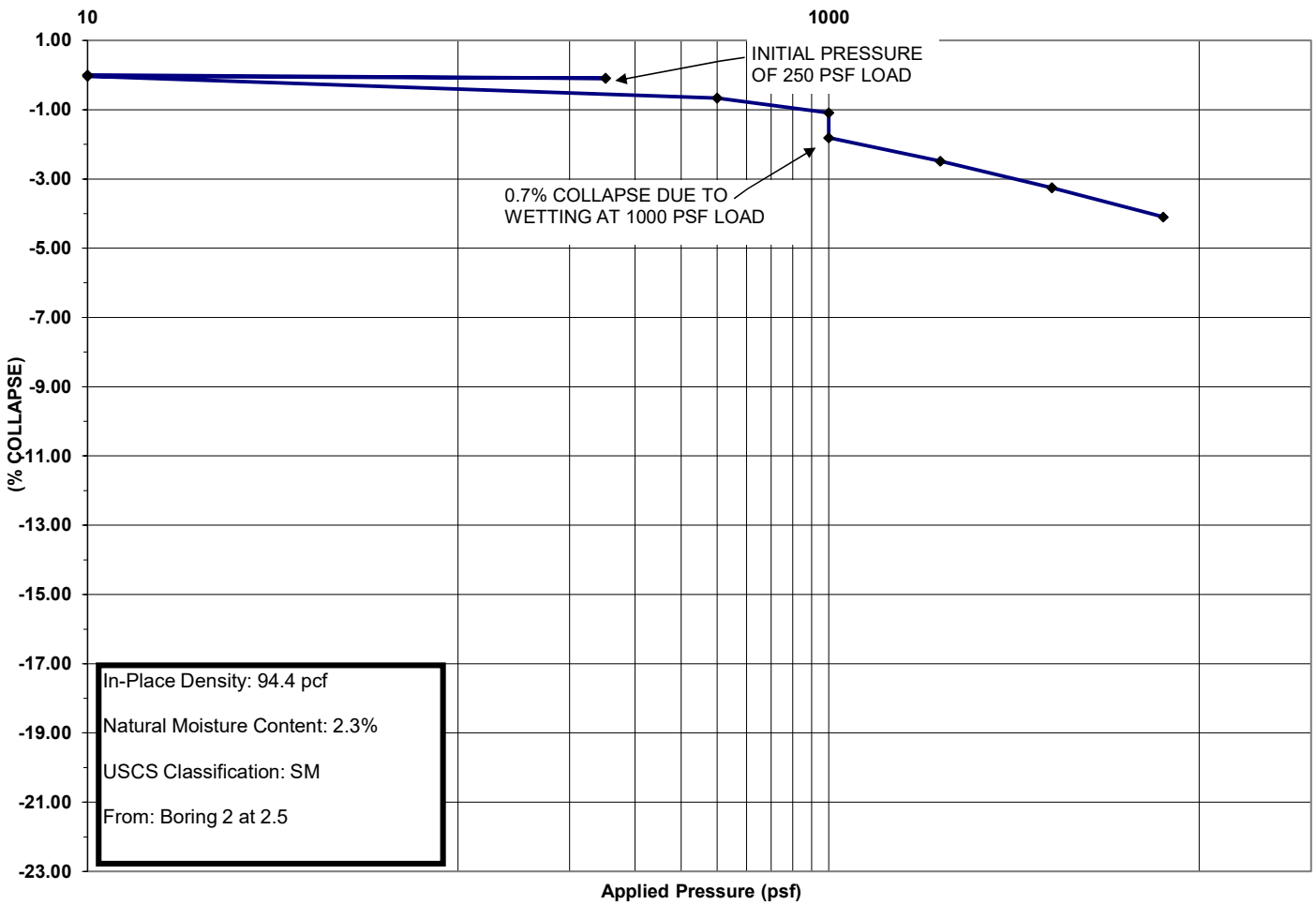
CONSOLIDATION REPORT

Client: ASSIST Community Design Center
218 East 500 South
Salt Lake City, UT 84111

Date of Report: 8/23/2024
Reviewed By: Z. Girsberger
Lab#: 24SG5200

Project: Springdale River Park Expansion **Project #:** 240518
Location: Springdale **Sampled By:** M. Meyers **Date:** 8/14/2024
Type of Sample: SM **Tested By:** B. Holdaway **Date:** 8/19/2024
Location of Sample: Boring 2 at 2.5 **Authorized By:** Client **Date:** 8/14/2024

COLLAPSE/SWELL CURVE



LANDMARK TESTING & ENGINEERING

WATER-SOLUBLE SULFATE IN SOIL

Client: ASSIST Community Design Center
218 East 500 South
Salt Lake City, UT 84111

Date of Report: 8/28/2024
Reviewed By: Z. Girsberger
Lab#: 24SG5198

Project: Springdale River Park Expansion **Project #:** 240518
Location: Springdale **Sampled By:** M. Meyers **Date:** 8/14/2024
Type of Sample: Brown Silty Sand **Tested By:** A. Pay **Date:** 8/27/2024
Location of Sample: Boring 1 at 3.5 **Authorized By:** Client **Date:** 8/14/2024

Test	Result %	Exposure Class	Test Standard
Percent Water-Soluble Sulfate in Soil	0.11	S1	ASTM C1580

Soil Test Report
and
Fertilizer Recommendations

USU Analytical Labs
Utah State University
Logan, Utah 84322-9400
(435) 797-2217
(435) 797-2117 (FAX)
www.usual.usu.edu

Date Received: 8/22/2024
Date Completed: 8/29/2024

Name: Chad Hardman
Address: 795 E Factory Dr. Suite B

St. George UT 84790

Phone: 435-986-0566
County: Washington

Lab Number: 2401-1719
Identification: 240518
Crop to be Grown: Lawn

Grower's Comments:
Project 240518

Acres in Field:

Soil Test Results			Interpretations	Guidelines
Texture		Sandy Clay Loam		
pH		7.6	Normal	
Salinity - ECe	dS/m	1.05	Normal	
Phosphorus - P	mg/kg	35.2	High	0 lbs P2O5/1000 sq ft
Potassium - K	mg/kg	355	Adequate	0 lbs K2O/1000 sq ft
Nitrate-Nitrogen - N	mg/kg	32.3		0 lbs N/1000sq ft*
Zinc - Zn	mg/kg	2.17	Adequate	0 oz Zinc/1000 sq ft
Iron - Fe	mg/kg	6.11	Adequate	
Copper - Cu	mg/kg	0.59	Adequate	
Manganese - Mn	mg/kg	6.19	Adequate	
Sulfate-Sulfur - S	mg/kg	12.7	Adequate	0 lbs Sulfur/1000 sq ft
Organic Matter	%	3.7		
SAR				

Notes
*SEE LAWN AND GARDEN GUIDES
FOR MORE INFORMATION ABOUT UNDERSTANDING YOUR REPORT SEE:
https://digitalcommons.usu.edu/extension_curgarden/14/

For further assistance, please see your County Agent -- Ben Scow - 435-301-7740
For further information and publications of interest, see the
USU Analytical Lab webpage or Utah State University Extension

Methods Used by USUAL: pH + EC (salinity) + SAR by saturated paste; P + K by Olsen sodium bicarbonate extract – K by AA, P by ascorbic acid/molybdate blue colorimetric; NO3-N by CaOH extract + cadmium reduction; Zn, Fe, Cu, Mn by DTPA + ICP; SO4-S by CaHPO4 + ICP; OM by Walkley-Black
Results only reflect the sample received and may not be indicative of actual field conditions.

Appendix C

Utah Geological Survey

GEOLOGIC HAZARDS MAPPING AND DATA CUSTOM REPORT

Report generated on 9/12/2024 at 9:25:55 AM

This report contains geologic hazard information and data from the Utah Geological Survey (UGS) and other sources for the area of interest shown on the map below and can be used to identify mapped geologic hazards in an area, understand what the hazards are, and learn potential ways to mitigate them. This report is not a substitute for site-specific geologic hazards and geotechnical engineering investigations by a qualified, Utah-licensed consultant. These investigations provide valuable information on the site geologic conditions that may affect or be affected by development, as well as the type and susceptibility of geologic hazards at a site and recommend solutions to mitigate the effects and costs of the hazards, both at the time of construction and over the life of the development. See your local city or county building department for details on these investigations and UGS Circular 122 (https://ugspub.nr.utah.gov/publications/circular/c-122.pdf). Since 1850, at least 5797 deaths and an undetermined financial cost have been attributed to geologic hazards in Utah. Damages resulting from many geologic hazards are often not covered by property or other insurance. In almost all cases, it is more cost effective to investigate and characterize potential hazards and implement appropriate mitigation, rather than rely on additional maintenance over the life of a project and/or incur costly construction change orders and other financial costs.

100 m
500 ft

Scale 1:6,414

Although this product represents the work of professional scientists, the Utah Department of Natural Resources, Utah Geological Survey, makes no warranty, expressed or implied, regarding its suitability for a particular use, and does not guarantee accuracy or completeness of the data. The Utah Department of Natural Resources, Utah Geological Survey, shall not be liable under any circumstances for any direct, indirect, special, incidental, or consequential damages with respect to claims by users of this product. The Utah Geological Survey does not endorse any products or manufacturers. Reference to any specific commercial product, process, service, or company by trade name, trademark, or otherwise, does not imply endorsement or recommendation by the Utah Geological Survey.

Report Summary

Geologic hazards affect Utah, negatively impacting life safety, health, property, and the state's economy. These hazards are those geologic conditions that present a risk to life or of substantial loss or damage of real property, and are generally within five categories: landslide, earthquake (seismic), flooding, problem soil and rock, and volcanic hazards. Although many geologic hazards are not life threatening, they are often costly when not recognized and properly accommodated and mitigated in project planning and design, and may result in additional, significant construction and/or future maintenance costs and injury or death. However, we can live and deal with geologic hazards by understanding what they are, where they exist, how large or difficult they are, and how to effectively mitigate them. Detailed geologic hazard mapping is available for limited areas and for specific hazards in Utah and additional mapping is ongoing. This report represents geologic hazard data extracted from the Utah Geologic Hazards Database of current geologic hazard mapping by the UGS for part of Utah and from other sources at the date and time indicated on the cover page. For each of the major geologic hazard categories (earthquake, landslide, flooding, and problem soil and rock) mapped in Utah, a summary page is available that describes the hazard category and the individual types of hazards within that category. Following the summary page, are detailed pages for each mapped hazard type that contain a brief description of that hazard type, a map of your area of interest and the mapped hazard susceptibility, a brief discussion on the susceptibility rankings and their meaning, and a list of references and other information on that hazard type. The absence of data does not imply that no geologic hazard or hazards exist. Additional geologic hazard mapping is on-going and will be added to the database as it is finalized.

Table 1 lists the mapped geologic hazards, the mapped hazard relative susceptibility, and the corresponding report page(s) with information on that hazard in your area of interest.

Mapped Geologic Hazards	**Hazard Category**
Liquefaction Susceptibility	Very High
Ground Shaking	Strong/Very Strong
Flood and Debris-Flow Hazard	High priority
Collapsible Soil Susceptibility	Collapsible Soil 1
Expansive Soil and Rock Susceptibility	High
Expansive Soil and Rock Susceptibility	Moderate
Expansive Soil and Rock Susceptibility	Low
Piping and Erosion Susceptibility	Soil Susceptible

The database is updated when new geologic hazard mapping is published by the UGS, most commonly in urban areas using 7.5-minute map quadrangles as comprehensive geologic hazard map sets. If mapping is not

available for your area of interest at the time this report was created, check the website for updates or contact the UGS at (801) 537-3300 or https://geology.utah.gov/about-us/ask-a-geologist

EARTHQUAKE HAZARD

Utah has experienced sixteen earthquakes greater than magnitude (M) 5.5 since pioneer settlement in 1847, and geologic investigations of Utah's faults indicate a long geologic history of repeated large earthquakes of M 6.5 and greater prior to settlement. Although Utah is not on a boundary between tectonic plates where most of the world's earthquakes occur, it is in the tectonically extending western part of the North American plate. Thus, earthquakes in Utah are indirectly caused by interactions with the Pacific plate along the plate margin on the west coast of the United States. Also, many small earthquakes in east-central Utah are induced by underground coal mining. Large, damaging earthquakes in Utah are likely to occur in the Intermountain Seismic Belt (ISB) that generally extends north-south through the center of the state, essentially following Interstate 15, where there are many hazardous faults capable of producing earthquakes. However, areas outside the ISB also experience earthquakes. Moderate to large earthquakes (generally M 6 and greater) can kill and injure many people and cause substantial damage to buildings, roads, bridges, and utilities. The Utah Earthquakes (1850 to 2016) and Quaternary Fault Map (https://ugspub.nr.utah.gov/publications/maps/m-277.pdf) shows earthquakes known to have occurred within and surrounding Utah and mapped Quaternary faults (those with movement in the past 2.6 million years) considered to be earthquake sources.

Earthquake hazards include:

Earthquake Ground Shaking – the sudden motion or trembling of the Earth as stored elastic energy is released by fracture (breaking) and movement of rocks along a fault.

Surface Fault Rupture – displacement(s) of the ground surface along a tectonic fault during an earthquake that results in a steep slope known as a scarp.

Liquefaction – a sudden, large decrease in strength of a saturated sandy soil caused by a temporary increase in soil water pressure during an earthquake and subsequent collapse of soil structure, resulting in sand boils, differential foundation settlement, and localized flooding.

Tsunamis – a series of waves in the ocean or a lake caused by the displacement of a large volume of water, such as from underwater fault rupture or landsliding into the water.

Seiches – an oscillating wave in an enclosed body of water, such as a lake, river, canal, or tank, induced by earthquakes or other energy sources.

Tectonic Deformation – the lowering and tilting of a valley floor on the down-dropped side of a fault during an earthquake that commonly causes localized flooding and gravity-flow utility failure.

Earthquake – **Triggered Landslides and Rockfall** – landslides and rockfall triggered by earthquake ground shaking.

Quick Clays – typically, marine-type clays that significantly lose strength when subjected to earthquake ground shaking.

The UGS has mapped surface-fault-rupture and liquefaction earthquake hazards for selected areas, and the U.S. Geological Survey has mapped expected earthquake ground shaking in Utah. The other earthquake hazard types have not yet been mapped in Utah. More information on earthquake hazards are available at https://geology.utah.gov/hazards/earthquakes-faults and https://ussc.utah.gov. The following Earthquake Hazards pages describe the individual mapped earthquake hazards for your area of interest.

EARTHQUAKE HAZARD

Liquefaction Susceptibility

Generally, earthquakes greater than about M 5 can cause liquefaction—a sudden, large decrease in the strength of sandy soils caused by a temporary increase in soil water pressure during earthquakes. Liquefaction can result in soil collapse, sand boils, differential building foundation settlement, lateral spread landslides, and localized, shallow flooding. The map below shows where liquefaction susceptibility may exist for your area of interest and the mapped relative susceptibility in terms of very high, high, moderate, low, very low, and not susceptible. Due to limited information, some areas are mapped as susceptible or unknown. The map does not integrate earthquake ground shaking which is required to determine the liquefaction potential (potential is equal to susceptibility plus opportunity) in susceptible soils or the probability (likelihood) of liquefaction.

How to Use This Map

The liquefaction susceptibility mapping is intended for general planning purposes to indicate where liquefaction susceptibility may be present and to assist in designing liquefaction-hazard investigations. Your area of interest has an area mapped as having liquefaction susceptibility. The susceptibility of liquefaction susceptibility and the description of the liquefaction susceptibility categories identified in your area of interest are listed above. This means that some form of liquefaction is likely to occur during an earthquake if the conditions to produce liquefaction are present at the site, including strong enough ground shaking, sandy soils, and shallow groundwater at or above 50 feet. Areas with no mapped liquefaction susceptibility either do not have the conditions for liquefaction present or there was not enough data to determine the subsurface and groundwater conditions. Groundwater levels fluctuate seasonally and can change after development. Due to scale and data restrictions, a site-specific assessment should be conducted in areas with no mapped liquefaction susceptibility. In areas with mapped liquefaction susceptibility hazard, a site-specific investigation is highly recommended. The 2018 International Building Code (IBC) and International Residential Code (IRC), adopted statewide, require a geotechnical investigation where liquefiable soils may be present beneath a building. Specifically, the IBC requires the investigation to evaluate liquefaction hazard, including the total and differential settlement, and surface displacement from lateral spreading and/or lateral flow.

More Information

Although these areas are not regulated on a state-level many cities and counties throughout Utah have adopted development ordinances requiring a comprehensive, site-specific liquefaction investigation. Site-specific investigations are necessary to accurately characterize the site-specific liquefaction susceptibility and determine appropriate building requirements. The UGS offers guidelines for these investigations and recommends they are conducted as part of the development permitting process. Contact your local city or

county building department for requirements, and a Utah-licensed engineering geology consultant for investigations.

Additional informational resources are listed below:

UGS: Liquefaction.

Very high liquefaction susceptibility, includes highly susceptible geologic units consisting of well-sorted sand, silty sand, and gravel along modern stream drainages, young alluvial terraces, and lacustrine deposits where the depth to groundwater is less than or equal to 10 feet.

References

Liquefaction Hazards in Utah (UGS Public Information Series 100): https://ugspub.nr.utah.gov/publications/public_information/pi-100.pdf.

Geologic Hazards of the State Route 9 Corridor, La Verkin to Springdale, Washington County, Utah (UGS Special Study 148) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-148/ss-148.pdf and Map, Plate 9– Liquefaction Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-148/ss-148pl9.pdf.

Geologic Hazards of the Zion National Park Geologic-Hazard Study Area, Washington and Kane Counties, Utah (UGS Special Study 133) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-133/ss-133.pdf and Map, Plate 5– Liquefaction Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-133/ss-133pl5.pdf.

Geologic Hazards and Adverse Construction Conditions, St. George-Hurricane Metropolitan Area, Washington County, Utah (UGS Special Study 127) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-127/ss-127.pdf and Map, Plate 2– Liquefaction Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-127/ss-127pl2.pdf.

Geologic Hazards of the Tickville Spring Quadrangle, Salt Lake and Utah Counties, Utah (UGS Special Study 163) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-163/ss-163.pdf and Map, Plate 2– Liquefaction Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-163/ss-163-2.pdf.

Geologic Hazards of the Magna Quadrangle, Salt Lake County, Utah (UGS Special Study 137) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-137/ss-137.pdf and Map, Plate 1– Liquefaction Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-137/ss-137_Plate1.pdf.

Geologic Hazards of the Copperton Quadrangle, Salt Lake County, Utah (UGS Special Study 152) Report and Maps: https://ugspub.nr.utah.gov/publications/special_studies/ss-152/ss-152.pdf.

Geologic Hazards of the Bullfrog and Wahweap High-Use Areas of Glen Canyon National Recreation Area, San Juan, Kane, and Garfield Counties, Utah, and Coconino County, Arizona (UGS Special Study 166) Report and Maps: https://doi.org/10.34191/SS-166.

EARTHQUAKE HAZARD

Ground Shaking

Ground shaking is the primary hazard resulting from earthquakes. Based on data from the UGS, the University of Utah Seismograph Stations, and other agencies, the U.S. Geological Survey periodically creates seismic hazard maps of the entire U.S. These maps are used by engineers and architects in designing buildings to meet the seismic requirements of the 2018 International Building Code (IBC) and International Residential Code (IRC), adopted statewide in Utah. Unless the building is specially designed, such as a critical facility (police and fire stations, emergency operations centers, etc.), building “to the code” means that the building is not expected to collapse during an earthquake of a magnitude for which it was designed. However, the building may dangerous and uninhabitable, due to significant structural damage and must then be replaced.

The map below shows the level of ground shaking (peak horizontal acceleration with a 2 percent probability of exceedance in 50 years) (in percent of the standard acceleration due to gravity or one g,) expected during a large earthquake in the vicinity of your area of interest. This map is at a reduced scale (zoomed out) compared to the other maps in this report, due to the low resolution of the source data and mapping.

How to Use This Map

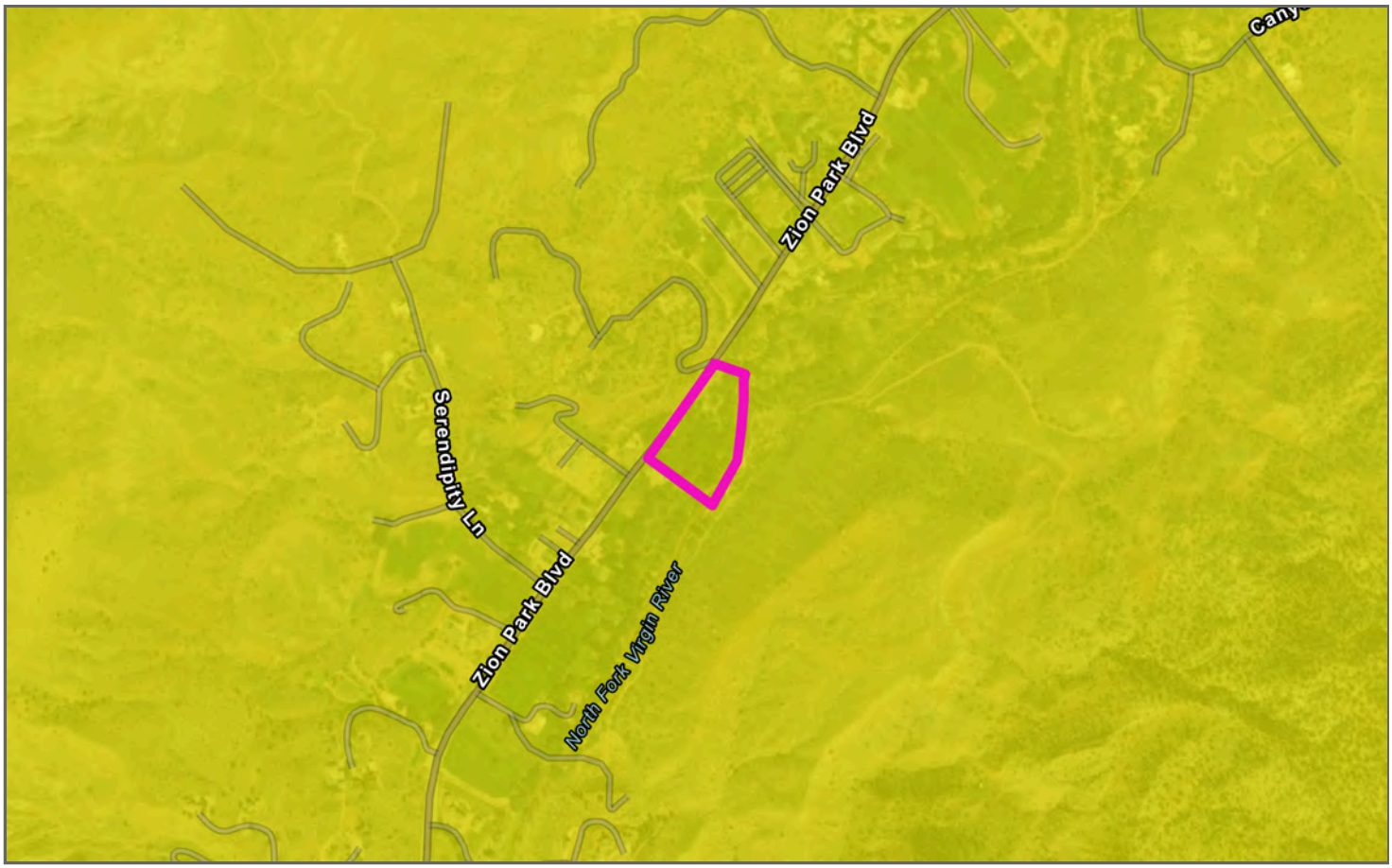
Your area of interest has an area with an expected ground shaking with a potential for damage. See the Ground Shaking Maps linked in the More Information section for technical information related to ground shaking categories. Typical homeowner's insurance excludes damages from earthquakes.

More Information

Ground shaking is the most widespread and typically the most damaging hazard associated with an earthquake. Strong ground shaking can last for several seconds to minutes and can be more or less intense depending on local soil and rock conditions. This map can be used by professionals to identify peak horizontal acceleration with a 2 percent probability of exceedance in 50 years. Damaging ground shaking can occur during earthquakes generated by an unspecified fault or at a distance from an identified fault.

Additional informational resources are listed below:

UGS: Earthquake Scenario and Probabilistic Ground Shaking Maps for the Salt Lake City, Utah Metropolitan Area.



Strong/Very Strong

References

Seismic Hazard Maps and Site-Specific Data (U.S. Geological Survey): https://earthquake.usgs.gov/hazards/hazmaps.

FLOODING HAZARD

Flooding is the overflow of water onto lands that are normally dry and is the most commonly occurring natural hazard in Utah. Damage from flooding includes inundation of land and property, erosion, deposition of sediment and debris, and the force of the water itself, which can damage property and take lives. Historically, flooding is the most prevalent, costly, and destructive (on an annual basis) hazard in Utah. Since 1850, at least 101 people in Utah have died from flooding.

Flooding hazards include:

River, Lake, or Sheet Flooding – overflow of water from excessive river/stream flow, water in lakes, and thin flow across generally flat to gently sloping ground.

Debris Flows – fast-moving flow-type landslides composed of a slurry of rock, mud, organic matter, and water that move down drainage-basin channels onto alluvial fans.

Shallow Groundwater – shallow groundwater can flood basements and other underground facilities, damage buried utility lines, and destabilize excavations.

Dam and Canal Failure – an unintentional release of water due to the failure of a water-retention or conveyance structure (dam or canal) that may occur with little warning.

Seiches – an oscillating wave in a lake or tank induced by earthquakes and other energy sources.

Tsunamis – a series of waves in the ocean or a lake caused by the displacement of a large volume of water, such as from underwater fault rupture or landsliding into the water.

The Federal Emergency Management Agency (FEMA) has mapped flood hazards for selected areas in Utah (https://msc.fema.gov) and these maps are the official maps for flood insurance and related activities. However, the FEMA maps do not show flooding from debris flows, alluvial fans, and shallow groundwater, and may be out-of-date. The UGS has mapped river, lake, or sheet; debris flows; and shallow groundwater flooding hazards for selected areas in Utah using geologic-based methods, and the Utah Division of Water Rights has mapped dam failure flooding for selected dams in Utah (https://maps.waterrights.utah.gov/EsriMap/map.asp?layersToAdd=Dams). Canal failure, seiches, and tsunami flooding hazards remain unmapped in Utah. The following Flooding Hazards pages describe the individual mapped flooding hazards for your area of interest.

FLOODING HAZARD

Flood and Debris-Flow Hazard

Active alluvial fan landforms delineated by JE Fuller/Hydrology & Geomorphology, Inc. under contract with AECOM Technical Services, Inc. for the Utah Division of Emergency Management as part of the Utah statewide Risk MAP program. The landforms mapped do not represent Federal Emergency Management Agency regulatory alluvial fan floodplains. The purpose of the delineations was to identify landforms that could potentially require additional, more detailed analyses to determine the actual flood risk. The landform delineation limits from this study should be considered approximate.

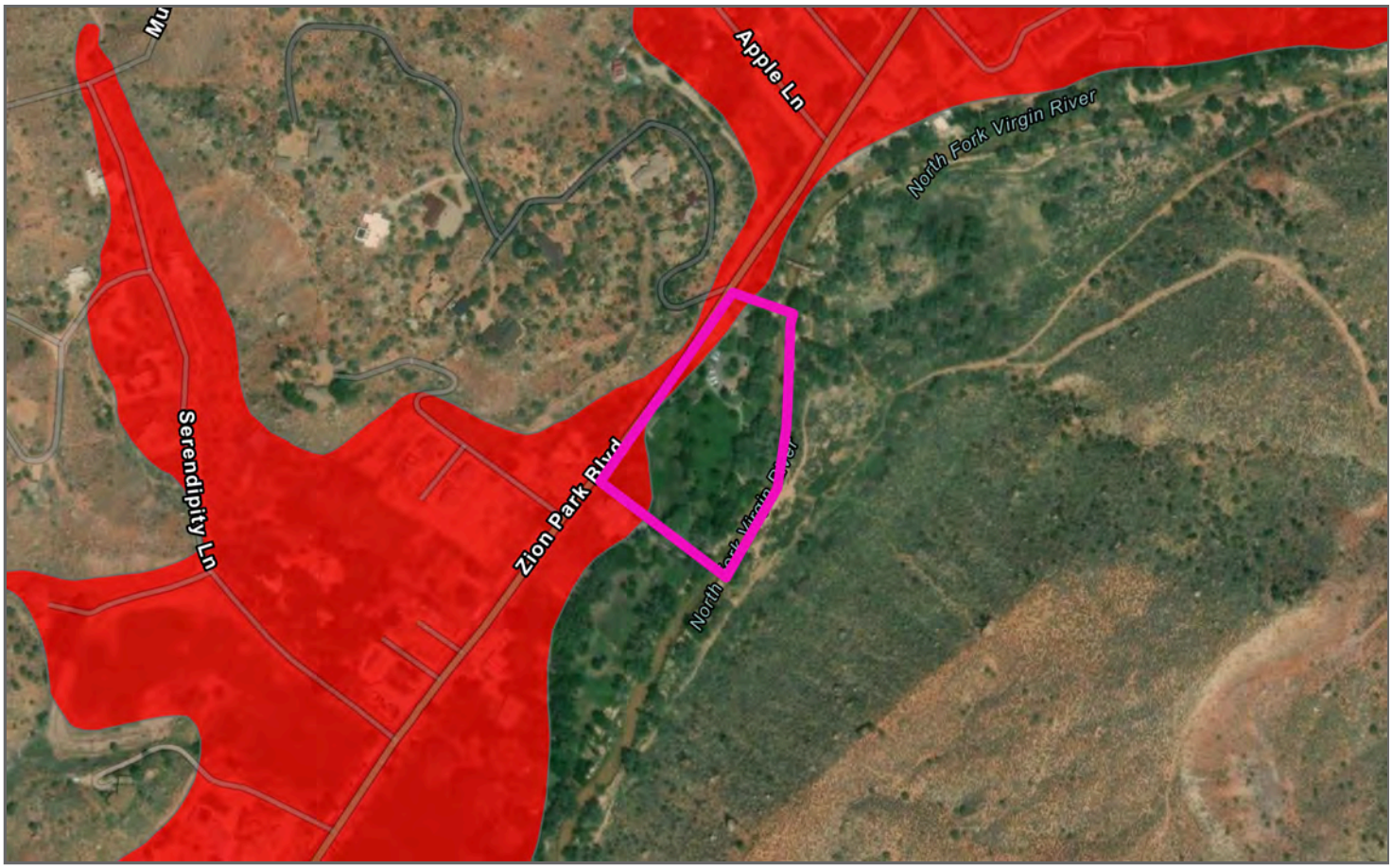
How to Use This Map

The alluvial fan mapping is intended for general planning purposes to identify active alluvial fan landforms throughout the state that pose a potential flood risk to current or potential future development areas. Your area of interest has an area identified as an active alluvial fan. This means that some form of alluvial fan flooding is present. Areas with no mapped alluvial fan may be outside of the study area and still experience flooding.

More Information

Although these areas are not regulated on a state-level, many cities and counties throughout Utah have adopted development ordinances requiring a comprehensive, site-specific slope investigation, which could include alluvial fan flooding. Site-specific investigations are necessary to accurately characterize the site-specific erosion hazard and determine appropriate building requirements. The UGS offers guidelines for these investigations and recommends they are conducted as part of the development permitting process. Contact your local city or county building department for requirements, and a Utah-licensed engineering geology consultant for investigations.

Additional informational resources on this special investigation can be found by contacting the Utah Geological Survey Office or on the UGS website: Utah Geological Survey.



100 m
500 ft

Scale 1:6,414

Alluvial-fan landforms determined by J.E. Fuller Hydrology & Geomorphology, Inc., to pose a high potential risk to existing infrastructure and/or population areas.

References

None

PROBLEM SOIL/ROCK HAZARD

Problem soil and rock can cause extensive damage to structures and foundations. Problem soil and rock may also damage pavements after construction, resulting in high maintenance and/or replacement costs, along with increased legal and financial liability from pavement separation and/or gaps causing tripping hazards. In addition, future maintenance may disrupt business activities, resulting in increased costs and/or lost revenue. Except for radon gas, Utah's most deadly geologic hazard which has caused at least 5630 deaths since 1973, no deaths have been reported in Utah from other problem soil and rock hazards; however, they have caused an undetermined, but very significant, amount of infrastructure damage and resulting economic impact.

Problem soil and rock hazards include:

Caliche – a calcareous material that can accumulate in the shallow subsurface of soils in arid and semiarid climates that can be very difficult to excavate.

Collapsible Soils – soils that have considerable strength when in a dry, natural state, but that significantly settle due to hydrocompaction (reduction of air space within the soil) when wetted.

Corrosive Soil and Rock – soil and rock that is corrosive to exposed metals and/or concrete.

Expansive Soil and Rock – soil and rock with high clay content that swells when wetted and shrinks when dried.

Karst Landscape – formed from the dissolution of limestone, dolomite, and gypsum rocks that can create features, such as caves, sinkholes, and breccia pipes (rubble-filled vertical tubes that form and project to the surface as overlying rock collapse into buried karst caverns).

Land Subsidence and Earth Fissures – sinking of the ground surface caused by groundwater mining and underground mine subsidence or collapse. Subsidence often causes earth fissures which are permanent, linear tension crack(s) in the ground that extend upward from the groundwater table.

Piping and Erosion – piping is the subsurface erosion of soil or rock by groundwater flow that form narrow voids. Piping can remove support of overlying soil and rock, resulting in collapse. Erosion is the process of material being moved by wind, water, and other processes and can occur at or below the ground surface.

Radon Gas – an odorless, tasteless, and clear radioactive gas resulting from the natural decay of uranium that occurs in nearly all rock and soil, and when concentrated, such as in a building or other confined space can lead to lung cancer.

Salt Tectonics – salt formations at depth below the ground surface may deform, causing deformation and cracks at the ground surface.

Shallow Bedrock – rock at shallow depths that may be encountered in construction and other excavations.

Soluble Soil and Rock – soil and rock that may be dissolved by water, causing ground subsidence.

Wind-Blown Sand – geologically young, active or partially stabilized, deposits characterized by a well-sorted, loose, sandy soil texture with little to no clay.

The UGS has mapped problem soil and rock hazards for selected areas in Utah. The following problem soil and rock hazards pages describe the individual mapped problem soil and rock hazards for your area of interest.

PROBLEM SOIL/ROCK HAZARD

Collapsible Soil Susceptibility

Collapsible soils have considerable strength when in a dry, natural state, but significantly settle due to hydrocompaction when wetted. Typically, they are associated with young alluvial fans, debris flows, and loess (wind-blown silts), where soil structure creates a significant amount of air space within the soil and includes certain rock units that weather in-place to soil. Collapsible soils may cause extensive damage to building foundations, asphalt and concrete slabs and pavements, and buried utilities and other infrastructure if not identified, investigated, and mitigated prior to the construction of buildings, pavements, and utilities. Often, these soils can be mitigated by over excavating and recompacting or removal of the collapse susceptible soils. The map below shows where collapsible soil and/or rock may be present for your area of interest and the relative susceptibility in terms of high, susceptible, bedrock, or not mapped.

How to Use This Map

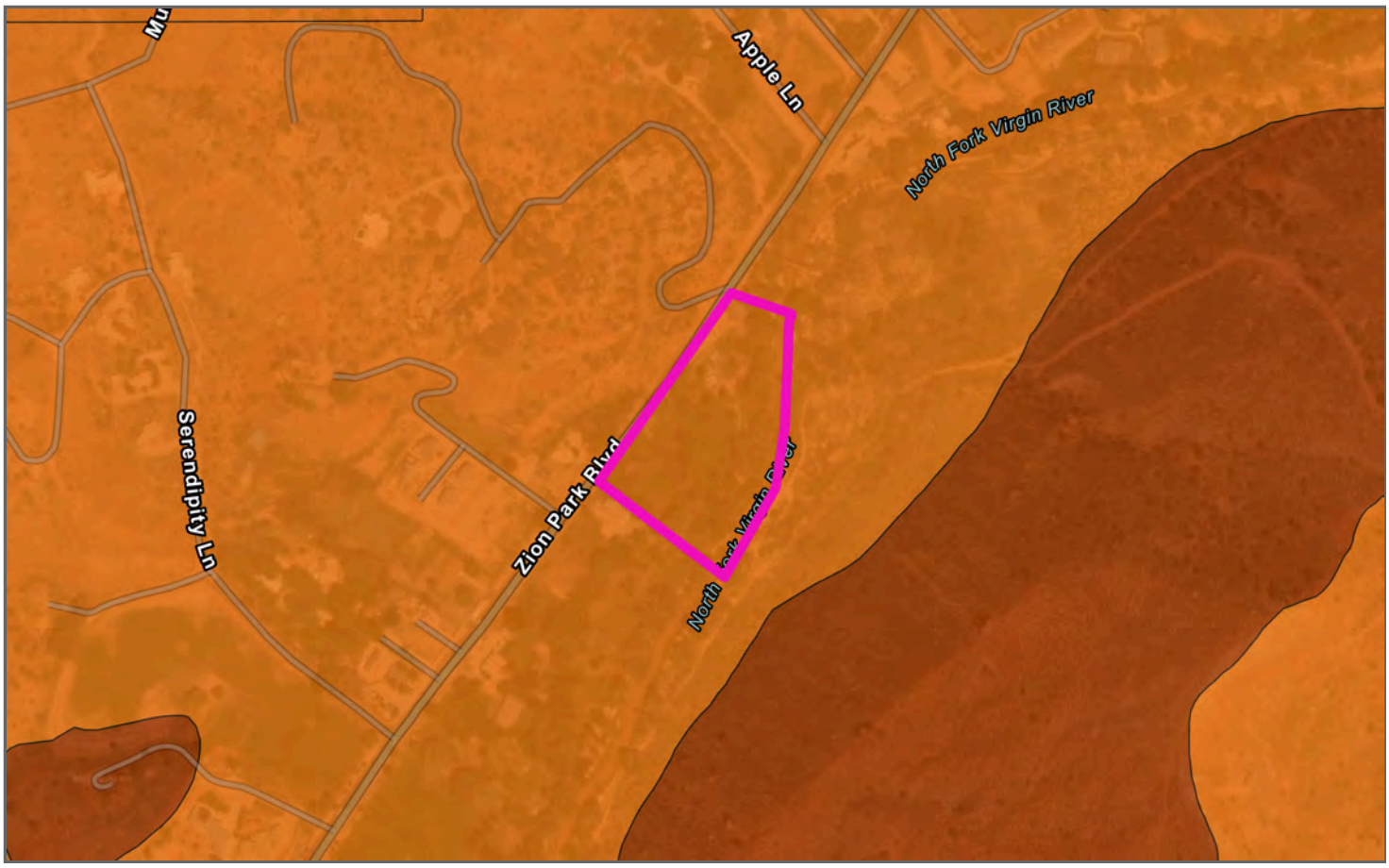
The collapsible soil susceptibility mapping is intended for general planning purposes to indicate where collapsible soils may be present and to assist in designing geotechnical and geologic-hazard investigations. Your area of interest has an area mapped as having collapsible soil susceptibility. The susceptibility of collapsible soil susceptibility and the description of the susceptibility categories identified in your area of interest are listed above. When not mitigated, these soils can cause considerable damage to buildings, foundations, concrete and asphalt pavements, and underground utilities. A geotechnical investigation that specifically addresses collapsible soils is highly recommended to determine if these soils are present. The 2018 International Building Code (IBC) and International Residential Code (IRC), adopted statewide, require a geotechnical investigation where compressible soils may be present beneath a building.

More Information

Although these areas are not regulated on a state-level, many cities and counties throughout Utah have adopted development ordinances requiring a comprehensive, site-specific geotechnical and geologic-hazard investigation. Site-specific investigations are necessary to accurately characterize the site-specific collapsible soil susceptibility and determine appropriate building requirements. The UGS offers guidelines for these investigations and recommends they are conducted as part of the development permitting process. Contact your local city or county building department for requirements, and a Utah-licensed engineering geology consultant for investigations.

Additional informational resources are listed below:

UGS: Problem Soil and Rock Hazards.



Collapsible Soil 1 - Unconsolidated geologic units with reported collapse values greater than or equal to 3 percent. Collapsible soils are unlikely in areas continually subjected to saturation or flooding.

References

Geologic Hazards of the State Route 9 Corridor, La Verkin to Springdale, Washington County, Utah (UGS Special Study 148) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-148/ss-148.pdf and Map, Plate 4– Collapsible Soil Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-148/ss-148pl4.pdf.

Geologic Hazards of the Zion National Park Geologic-Hazard Study Area, Washington and Kane Counties, Utah (UGS Special Study 133) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-133/ss-133.pdf and Map, Plate 6– Collapsible Soil Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-133/ss-133pl6.pdf.

Geologic Hazards and Adverse Construction Conditions, St. George-Hurricane Metropolitan Area, Washington County, Utah (UGS Special Study 127) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-

127/ss-127.pdf and Map, Plate 7– Collapsible Soil Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-127/ss-127pl7.pdf.

Geologic Hazards of the Tickville Spring Quadrangle, Salt Lake and Utah Counties, Utah (UGS Special Study 163) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-163/ss-163.pdf and Map, Plate 8– Collapsible Soil Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-163/ss-163-8.pdf.

Geologic Hazards of the Magna Quadrangle, Salt Lake County, Utah (UGS Special Study 137) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-137/ss-137.pdfand Map, Plate 7– Collapsible Soil Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-137/ss-137_Plate7.pdf.

Geologic Hazards of the Copperton Quadrangle, Salt Lake County, Utah (UGS Special Study 152) Report and Maps: https://ugspub.nr.utah.gov/publications/special_studies/ss-152/ss-152.pdf.

Geologic Hazards of the Moab Quadrangle, Grand County, Utah (UGS Special Study 162) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-162/ss-162txt.pdf and Map, Plate 7– Collapsible Soil Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-162/ss-162pl7.pdf.

Geologic Hazards of the Bullfrog and Wahweap High-Use Areas of Glen Canyon National Recreation Area, San Juan, Kane, and Garfield Counties, Utah, and Coconino County, Arizona (UGS Contract Deliverable) Report and Maps: https://doi.org/10.34191/SS-166.

PROBLEM SOIL/ROCK HAZARD

Expansive Soil and Rock Susceptibility

Expansive soil and rock swells as it gets wet and shrinks as it dries out. These changes in volume can cause cracked foundations and other structural damage to buildings, asphalt and concrete pavements, and underground utilities, heaving and cracking of canals and road surfaces, and the failure of septic disposal systems. Expansive soil and rock contains a significant percentage of clay minerals that can absorb water directly into their crystal structure when wetted. Often, these soils and rocks can be mitigated by over excavating and replacing with non-expansive, engineered fill materials that are properly placed and compacted. These soils and rocks should be identified, investigated, and mitigated prior to the construction of buildings, pavements, and utilities.

The map below shows where expansive soil and rock susceptibility has been mapped for your area of interest and the relative susceptibility in terms of high, moderate, low, not susceptible, or not mapped categories.

How to Use This Map

The expansive soil and rock susceptibility mapping is intended for general planning purposes to indicate where expansive soil and rock may occur and to assist in designing expansive soil and rock susceptibility investigations. Your area of interest has an area mapped as having locations of expansive soil and rock susceptibility. The susceptibility of expansive soil and rock susceptibility and the description of categories identified in your area of interest are listed above. Soil and rock that expands when wet and shrinks as it dries is likely present at the site. These soils and rocks can cause considerable damage to buildings, concrete and asphalt pavements, and underground utilities and damages are often costly to repair. A geotechnical investigation that specifically addresses expansive soils and rock is highly recommended to determine if these soils and rocks are present. The 2018 International Building Code (IBC) and International Residential Code (IRC), adopted statewide, require a geotechnical investigation where expansive soils and rocks may be present beneath a building. Areas with no mapped expansive soil and rock susceptibility may not have had enough data to determine the hazard, or limitations of scale.

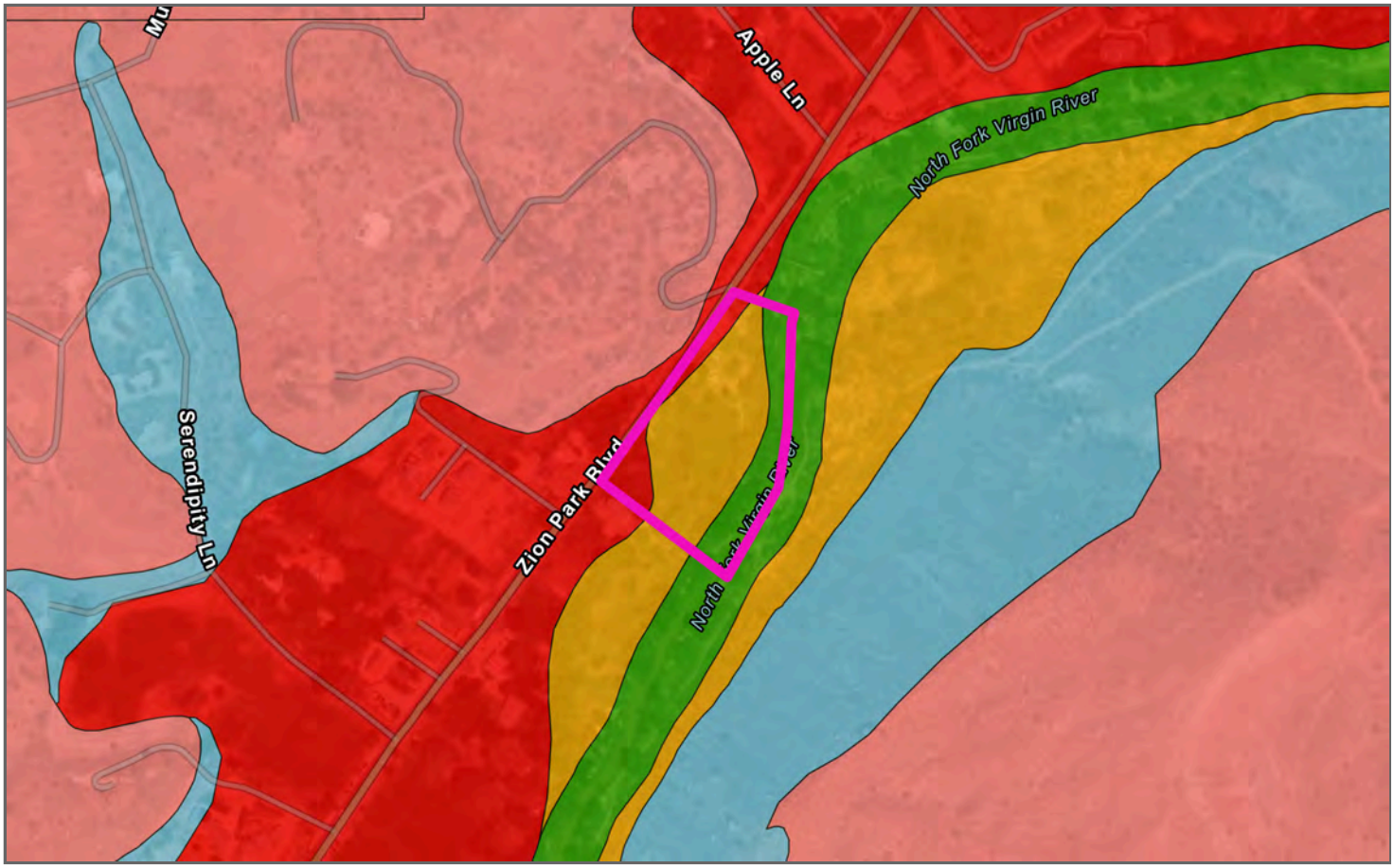
More Information

Although these areas are not regulated on a state-level, many cities and counties throughout Utah have adopted development ordinances requiring a comprehensive, site-specific geotechnical and geologic-hazard investigation. Site-specific investigations are necessary to accurately characterize the site-specific expansive

soil and rock susceptibility and determine appropriate building requirements. The UGS offers guidelines for these investigations and recommends they are conducted as part of the development permitting process. Contact your local city or county building department for requirements, and a Utah-licensed engineering geology consultant for investigations.

Additional informational resources are listed below:

UGS: Problem Soil and Rock Hazards.



Soils classified by the Natural Resources Conservation Service as having a high susceptibility for volumetric change; and/or have a liquid limit (LL) greater than or equal to 35 to 45, a plasticity index (PI) greater than or equal to 15 to 20, and a swell/collapse test (SCT) value of greater than or equal to 3 to 4 percent swell; and/or a linear extensibility potential greater than 6 percent. Soils are clay rich or weather to clay.

Soils classified by the Natural Resources Conservation Service as having moderate susceptibility for volumetric change; and/or have a liquid limit [LL] from 20 to 55, a plasticity index [PI] from non-plastic [NP] to 35, and swell/collapse (SCT) value of 2 to 3 percent; and/or a linear extensibility potential of 3 to 6 percent. These values overlap at their upper ends with soils in the high susceptibility category. Chen

(1988) recognized that while PI is an indicator of expansive potential, other factors also exert an influence, and therefore reported a range of PI values when categorizing soil's capacity to shrink or swell.

- Soils classified by the Natural Resources Conservation Service as having low susceptibility for volumetric change; and/or have a liquid limit [LL] from 0 to 40, a plasticity index [PI] from non-plastic [NP] to 15, and a swell/collapse (SCT) value of 0 to 2 percent; and/or a linear extensibility potential of less than 3 percent. These values overlap at their upper ends with soils in the moderate susceptibility category. However, the low category includes soils with highly variable potential for volumetric change that do not fit easily into the moderate or high categories.

References

Geologic Hazards of the State Route 9 Corridor, La Verkin to Springdale, Washington County, Utah (UGS Special Study 148) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-148/ss-148.pdf and Map, Plate 5– Expansive Soil and Rock Hazard: https://ugspub.nr.utah.gov/publications/special_studies/ss-148/ss-148pl5.pdf.

Geologic Hazards of the Zion National Park Geologic-Hazard Study Area, Washington and Kane Counties, Utah (UGS Special Study 133) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-133/ss-133.pdf and Map, Plate 7– Expansive Soil and Rock: https://ugspub.nr.utah.gov/publications/special_studies/ss-133/ss-133pl7.pdf.

Geologic Hazards and Adverse Construction Conditions, St. George-Hurricane Metropolitan Area, Washington County, Utah (UGS Special Study 127) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-127/ss-127.pdf and Map, Plate 6– Expansive Soil and Rock Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-127/ss-127pl6.pdf.

Geologic Hazards of the Tickville Spring Quadrangle, Salt Lake and Utah Counties, Utah (UGS Special Study 163) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-163/ss-163.pdf and Map, Plate 9– Expansive Soil and Rock Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-163/ss-163-9.pdf.

Geologic Hazards of the Magna Quadrangle, Salt Lake County, Utah (UGS Special Study 137) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-137/ss-137.pdf and Map, Plate 8– Expansive Soil and Rock Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-137/ss-137_Plate8.pdf.

Geologic Hazards of the Copperton Quadrangle, Salt Lake County, Utah (UGS Special Study 152) Report and Maps: https://ugspub.nr.utah.gov/publications/special_studies/ss-152/ss-152.pdf.

Geologic Hazards of the Moab Quadrangle, Grand County, Utah (UGS Special Study 162) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-162/ss-162txt.pdf and Map, Plate 8– Expansive Soil and Rock Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-162/ss-162pl8.pdf.

Geologic Hazards of the Bullfrog and Wahweap High-Use Areas of Glen Canyon National Recreation Area, San Juan, Kane, and Garfield Counties, Utah, and Coconino County, Arizona (UGS Special Study 166) Report and Maps: https://doi.org/10.34191/SS-166.

PROBLEM SOIL/ROCK HAZARD

Piping and Erosion Susceptibility

Piping and erosion can cause significant damage to roads, canals, earth-fill dams, buildings, bridges, culverts, and farmland. Piping, also referred to as tunnel erosion, is the subsurface erosion of soil by groundwater that moves through permeable, non-clay layers in soils and exits at a slope. Fine-grained sand, silt, and clay particles are removed by the subsurface flow of water, creating void space. An exit point at a slope may not always be obvious. Silt and clay carried in water can travel with the subsurface groundwater flow for long distances, enter the regional groundwater regime, and exit as seeps and springs or into streams and rivers. Rapid erosion may occur when susceptible materials are exposed to running water or wind. Monsoonal storms typically bring intense rainfall and high winds. Heavy rain can quickly erode silts and clays. Slope runoff that becomes channelized can form gullies and erode steep banks of streams and rivers. Erosional gullies can also contribute to the piping hazard. The map below shows mapped piping and erosion susceptibility for your area of interest in relative terms of high, susceptible, or not mapped.

How to Use This Map

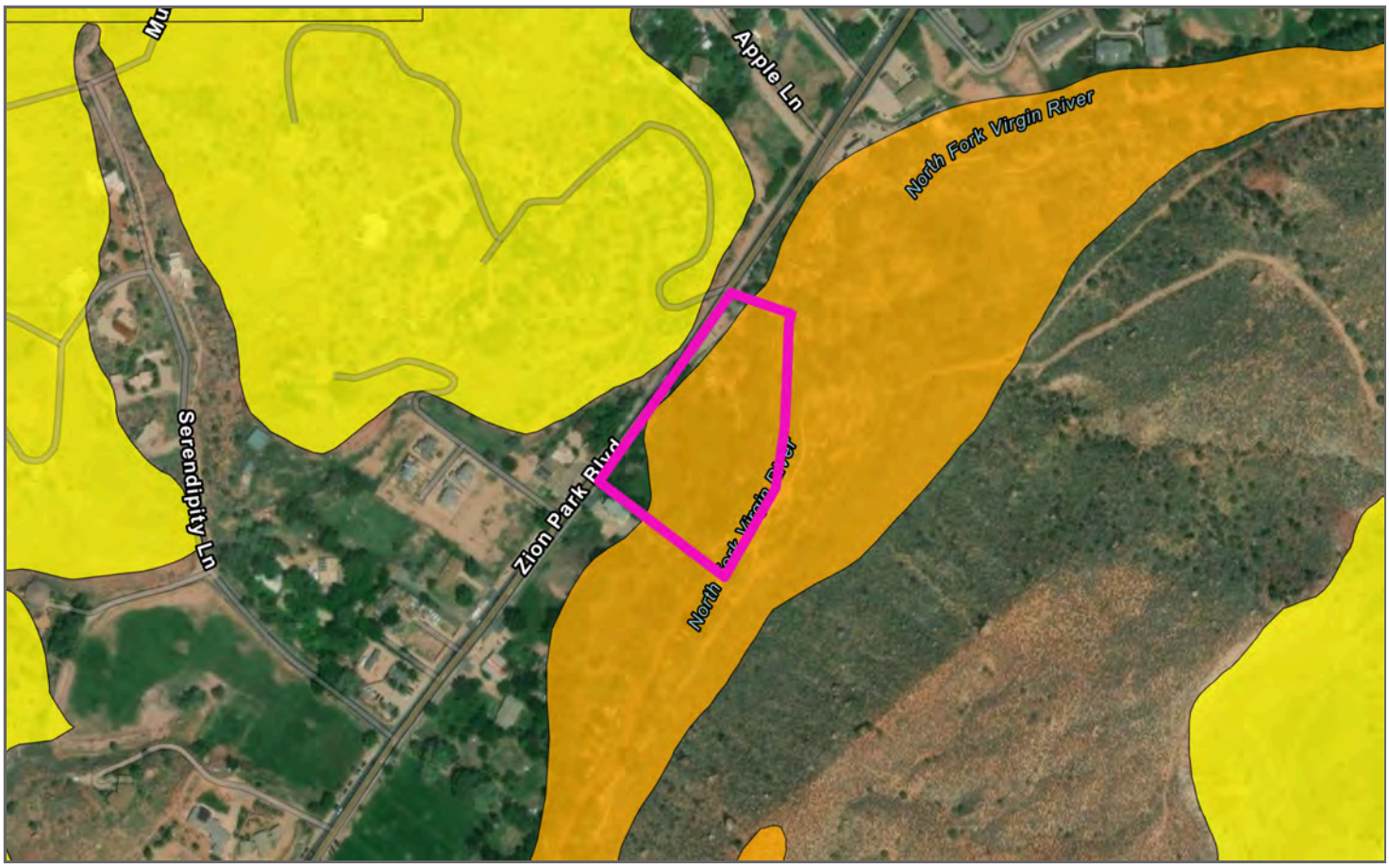
The piping and erosion susceptibility mapping is intended for general planning purposes to indicate where piping and erosion susceptibility may be present and to assist in designing piping and erosion-hazard investigations. Your area of interest has an area mapped as having piping and erosion susceptibility. The description of the piping and erosion susceptibility categories identified in your area of interest are listed above. A geotechnical investigation that specifically addresses piping and erosion is highly recommended to determine if these features are present. The 2018 International Building Code (IBC) and International Residential Code (IRC), adopted statewide, require a geotechnical investigation to evaluate unsuitable soils and rocks that may be present beneath a building.

More Information

Although these areas are not regulated on a state-level, many cities and counties throughout Utah have adopted development ordinances requiring a comprehensive, site-specific geotechnical and geologic-hazard investigation. Site-specific investigations are necessary to accurately characterize the site-specific piping and erosion susceptibility and determine appropriate building requirements. The UGS offers guidelines for these investigations and recommends they are conducted as part of the development permitting process. Contact your local city or county building department for requirements, and a Utah-licensed engineering geology consultant for investigations.

Additional informational resources are listed below:

UGS: [Problem Soil and Rock Hazards](#).



Soil susceptible to piping and erosion. Typically, fine-grained, non-cohesive, loose to poorly consolidated sand and silt deposits, landslide deposits and some very poorly consolidated siltstone and claystone. For piping to develop, a free face and percolating groundwater are required. The loose, non-cohesive nature of erodible soils makes them highly susceptible to the effects of water and wind erosion, especially when disturbed from their natural conditions.

References

Geologic Hazards of the State Route 9 Corridor, La Verkin to Springdale, Washington County, Utah (UGS Special Study 148) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-148/ss-148.pdf and Map, Plate 7– Piping, Erosion, and Wind-Blown Sand Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-148/ss-148pl7.pdf.

Geologic Hazards of the Zion National Park Geologic-Hazard Study Area, Washington and Kane Counties, Utah (UGS Special Study 133) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-133/ss-133.pdf and Map, Plate 9– Piping and Erosion Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-133/ss-133pl9.pdf.

Geologic Hazards and Adverse Construction Conditions, St. George-Hurricane Metropolitan Area, Washington County, Utah (UGS Special Study 127) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-127/ss-127.pdf and Map, Plate 13– Piping and Erosion Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-127/ss-127pl13.pdf.

Geologic Hazards of the Moab Quadrangle, Grand County, Utah (UGS Special Study 162) Report: https://ugspub.nr.utah.gov/publications/special_studies/ss-162/ss-162txt.pdf and Map, Plate 11– Piping and Erosion Susceptibility: https://ugspub.nr.utah.gov/publications/special_studies/ss-162/ss-162pl11.pdf.

Geologic Hazards of the Bullfrog and Wahweap High-Use Areas of Glen Canyon National Recreation Area, San Juan, Kane, and Garfield Counties, Utah, and Coconino County, Arizona (UGS Special Study 166) Report and Maps: https://doi.org/10.34191/SS-166.

OTHER GEOLOGIC HAZARD RESOURCES

Utah Geological Survey

For information on geologic hazards, contact the UGS online at https://geology.utah.gov/about-us/ask-a-geologist/ or by telephone at (801) 537-3300 and for southern Utah at (435) 865-9036.

The Guidelines for Investigating Geologic Hazards and Preparing Engineering-Geology Reports with a Suggested Approach to Geologic-Hazard Ordinances in Utah (UGS Circular 122, https://ugspub.nr.utah.gov/publications/circular/c-122.pdf) provides geologic and geotechnical consultants, local government officials, and land owners with comprehensive information on how to conduct appropriate and effective investigations of various geologic hazards before building and infrastructure design and construction. These guidelines were developed to reduce the life safety risk and overall cost of geologic hazards to Utahans and have been adopted by numerous cities and counties in Utah. The UGS strongly recommends that all development incorporate these guidelines in their planning, design, and construction.

The UGS GeoData Archive (https://geodata.geology.utah.gov) contains Utah geologic related scanned documents, consultant geologic and geotechnical reports, photographs, and other digital materials from our files and those gathered from other agencies or organizations. Most of the items in the archive have not been formally published and are not available elsewhere.

The UGS Utah Aerial Imagery Collection (https://geodata.geology.utah.gov) contains aerial photography (air photos) across Utah and dating from 1935 to 2005, about half of the collection dates before 1960.

The Utah Geologic Map Portal (https://geology.utah.gov/apps/intgeomap/) contains geologic maps that show the mapped ground surface soil and rock types across the state.

Building Codes (the IBC and IRC with amendments are adopted statewide by Utah law)

State of Utah Adopted Building Codes in Law: https://le.utah.gov/xcode/Title15A/15A.html.

2018 International Building Code (IBC): https://codes.iccsafe.org/content/IBC2018/toc.

2018 International Residential Code (IRC) for One- and Two-Family Dwellings: https://codes.iccsafe.org/content/IRC2015/toc.

Professional Licensing

When selecting a geologist or engineer consultant and a construction contractor, make sure they are licensed to practice in Utah using the Utah Division of Occupational & Professional Licensing website at https://secure.utah.gov/llv/search/index.html. For more information, see https://dopl.utah.gov/.

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

Memorandum

To: **The Planning Commission**
From: **Niall Connolly**
Date: **February 13, 2026**
Re: **Erosion Hazard Permit for the River Park Expansion Project**

Introduction

The River Park expansion project is discussed in detail in the Design Development Review (DDR) staff report. Most of the river park is within one of the erosion hazard zones (high and moderate risk), and therefore so are some of the proposed improvements. Section 10-13E of the Town Code sets out the Town's regulations for the Erosion Hazard Zone.

Figure 1. Aerial view of the River Park, showing the high and moderate erosion hazard zones in red and yellow respectively

An erosion hazard permit is required for any "land disturbance" within the erosion hazard zone. The definition of land disturbance is provided in 10-13E-5, and includes "earthwork such as filling, grading, excavation or contouring land". By this definition, an erosion hazard permit is required in this case.

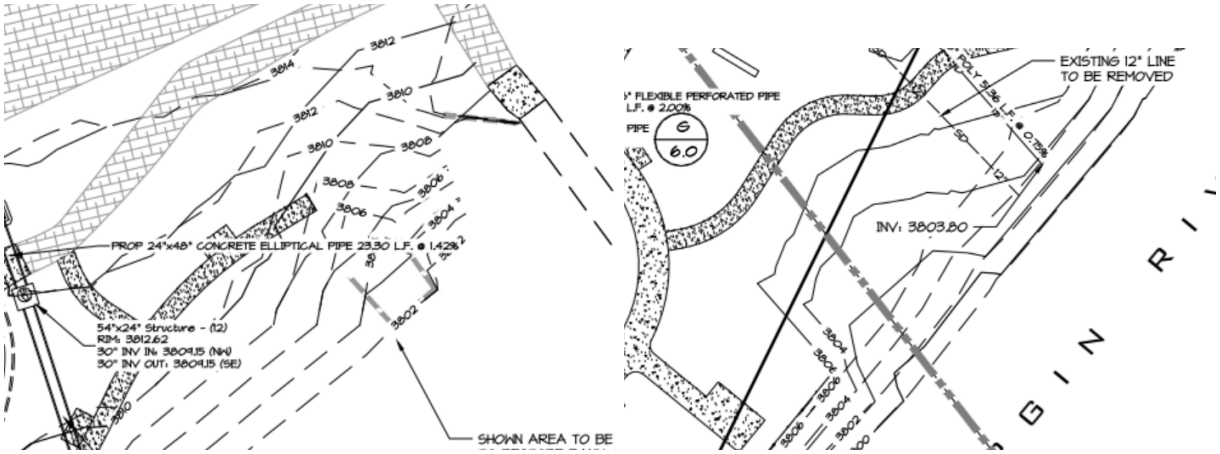


Figure 2. Examples of the proposed re-grading (existing contours are shown in broken lines and proposed contours are shown in solid lines)

Erosion Hazard Study

An erosion hazard study, prepared by Rosenberg Engineers, has been submitted with the application. The erosion hazard study includes an assessment of more significant development at the park than is actually proposed at this time. The improvements listed in the study include new restrooms, a river viewing platform, and pavilion. These improvements are *not* proposed for the park at this time.

The erosion study finds that the proposed improvements (including the presently proposed improvements as well as the potential future phase improvements) will not result in an increase in the base flood elevation, or result in an increased risk of erosion on, or off site. The study discusses the potential risk of erosion to a new restroom building, and explores two options for addressing this risk. Firstly, a traditional erosion protection solution involving a section of riprap along the river bank. The second option is to simply deepen the building footings to a depth of 5' below the finished floor elevation. The study recommends the second option, because it would involve significantly less disturbance to the park and its riparian zone. In any event, a new restroom building is not proposed, and therefore no such erosion mitigation is needed in conjunction with the presently proposed improvements. If a new restroom building is proposed in the future the recommended erosion hazard mitigation would need to be implemented.

No erosion protection improvements are proposed as part of the river park expansion project as presently proposed.

Floodplain Development Permit

For the Commission's information - a separate floodplain development permit is required for this project. An application has been submitted for this permit. These permits are staff reviewed, and Planning Commission approval is not part of that process.

Planning Commission Action

The Planning Commission should review the proposed Erosion Hazard Permit application to determine if it complies with the applicable standards in the Town Ordinance. Staff recommends the Commission specifically consider the following:

- Does the proposal meet the standards for Erosion Hazard Permits, as set out in Section 10-13E of the Town Code?

Sample Motion Language

The Planning Commission may refer to the following sample language when making a motion on the application:

The Planning Commission approves/ denies the proposed Erosion Hazard Permit, associated with the expansion of the George A Barker River Park, as discussed at the Commission meeting on February 18th, 2026. The motion is based on the following findings:

[LIST FINDINGS]

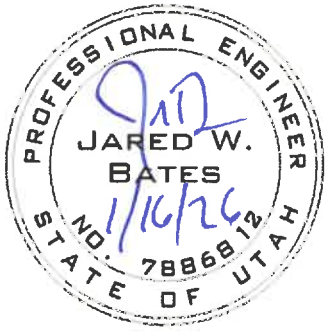
EROSION HAZARD ASSESSMENT

Springdale River Park Expansion
Springdale, Utah

Prepared For:

Assist Inc. Community Design Center
218 East 500 South
Salt Lake City, UT 84111
(801) 355-7085

Rosenberg Associates
Project No: 6650-24-005
January 16, 2026



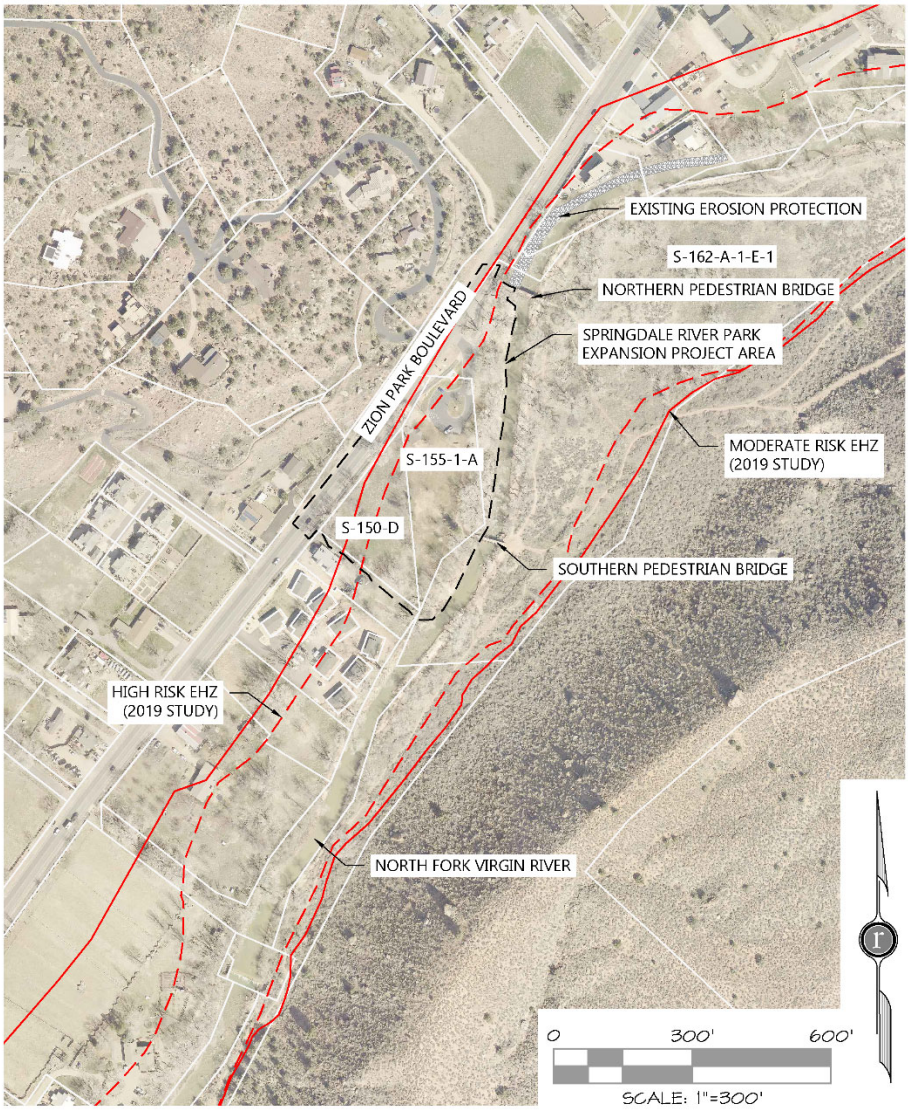
ROSENBERG ASSOCIATES™
CIVIL ENGINEERS LAND SURVEYORS

1.0 INTRODUCTION

1.1 PROJECT OVERVIEW & LOCATION

The expansion of George Barker River Park is proposed along the right (west) overbank of the North Fork of the Virgin River within Parcels S-155-1-A, S-150-D and S-162-A-1-E-1. The expanded river park encompasses a 4.2 acre area in Springdale, UT, located within Section 32, Township 41 South, Range 10 West, Salt Lake Base and Meridian. The proposed river park expansion includes the installation of a new restroom facility, covered pavilion area, river viewing platform, parking lot improvements, utility improvements, a nature-based play area, walking paths, detention basins, and other public amenities. The project area is bounded by Zion Park Boulevard to the northwest, the North Fork of the Virgin River to the southeast, and private land owned by others to the south and north. A copy of the proposed site plan is included in the Appendix. Refer to *Figure 1 – Vicinity Map.*

Figure 1 – Vicinity Map



The Erosion Hazard Zone (EHZ) consists of areas adjacent to the river channel likely to suffer flood related damage by a typical series of flood events over a 60 year period, plus the erosion caused by a single 100 year flood event. The EHZ also includes areas prone to natural channel movement due to geomorphic processes such as meander migration or channel avulsion. It is important to recognize an EHZ is not a "no build" zone, but it serves notice to landowners of the inherent risk that should be addressed through engineering design, insurance, appropriate land uses or avoidance. The Town of Springdale requires an Erosion Hazard Assessment be completed as part of any proposed development or building permits issued on properties impacted by the established Erosion Hazard Zone (EHZ).

Based on the Springdale River Park Expansion Site Plan, the proposed park improvements are partially located within the HREHZ (High Risk Erosion Hazard Zone), and MREHZ (Moderate Risk Erosion Hazard Zone) as defined by the *Draft Erosion Hazard Delineation* (Reference 1). The purpose of this document is to assess the erosion hazard risks associated with the North Fork of the Virgin River adjacent to the proposed development, present recommendations to mitigate the risk of lateral erosion damage to proposed structures and ensure proposed improvements associated with the project do not increase the risk of erosion to adjacent properties.

2.0 SITE INVESTIGATION

2.1 SITE CONDITIONS

The study reach of the North Fork of the Virgin River begins at a major bend, just upstream of the pedestrian bridge north of George Barker River Park and extends downstream approximately 1,300 feet. Rock rip-rap erosion protection was recently installed along the right (west) overbank of the river along the upstream portion of the study reach, as part of the Zion Park Boulevard Erosion Protection Project. During installation of this erosion protection, mature cottonwoods were left undisturbed along the active floodplain/low terrace boundary, and willow pole plantings were placed at the toe of the rip-rap. The slope of the installed erosion protection varies from a 2:1 to a 1.5:1 slope. Recontouring took place along the left (east) overbank, with willows installed along the overbank zone. This erosion protection ties into the right (west) abutment of the pedestrian bridge just north of the river park. The low flow channel of the river through this portion of the study reach consists of a wide, sandy bed with occasional cobbles and boulders.

Adjacent to the proposed improvements, the low flow channel consists of a wide, sandy bed, with a higher proportion of cobbles and boulders when compared to the upstream section. Along the right (west) overbank, the steep active floodplain is moderately vegetated with mature cottonwoods, coyote willows, and mule fat, with a general lack of vegetation in areas where social trails have been established. A few of the cottonwoods along the water's edge have been undercut due to past high flow events, leaving the roots exposed. A small vertical cutbank has formed adjacent to one of the picnic areas within the park, likely due to foot traffic, which either prevented vegetation from establishing, or negatively affected existing vegetation. The low terrace has been previously mass graded to varying extents to accommodate the river park. Mature trees installed as part of the landscaping for the park are present, with a general lack of shrubs in the understory. Along the left (east) overbank, the steep active floodplain is

also moderately vegetated with mature cottonwoods, coyote willows, and mule fat. The mature cottonwoods and numerous large boulders keyed into the bank along both sides of the river have provided resistance to erosion and are likely partially responsible for preventing large scale vertical cutbanks from forming previously. A pedestrian bridge with concrete abutments is located near the downstream end of the study reach, which provides additional stability to the location of the main channel.

Figure 2 – November 11, 2024. Image of George Barker Springdale River Park, looking south from the edge of the parking lot. The North Fork of the Virgin River is located behind the mature cottonwoods on the left side of the image. These cottonwoods provide some erosion protection for the park. The proposed improvements are partially located within the HREHZ and MREHZ.

Figure 3 – November 11, 2024. Looking upstream from the downstream edge of the park along the right (west) low terrace. The proposed improved restroom facility and covered pavilion are to be located near the current restroom (red building on the left side of the image).

Figure 4 – November 11, 2024. Image of the undeveloped area south of the existing river park, where the expansion is proposed to take place. The low terrace is vegetated with a few mature cottonwoods and herbaceous vegetation in the understory.

Figure 5 – November 11, 2024. Looking downstream from the pedestrian bridge north of the river park. Recent disturbance from the erosion protection installed along the right (west) overbank is visible in the front of the image. The moderately vegetated, steep and narrow floodplains are visible on either side of the river through this portion of the study reach.

Figure 6 – November 11, 2024. Looking upstream along the right (west) overbank of the North Fork of the Virgin River adjacent to the existing river park. Work associated with the proposed park expansion will not disturb the overbank area, allowing the existing vegetation to continue to provide some erosion protection.

Figure 7 – November 11, 2024. Looking downstream along the right (west) overbank of the North Fork of the Virgin River. The lack of vegetation in the understory within some section of the active floodplain can likely be attributed to erosion occurring during high flow events and foot traffic from park visitors.

Figure 8 – November 11, 2024. Small (1-2') vertical cutbank located along the right (west) overbank of the North Fork of the Virgin River, approximately 50 feet upstream of the southern pedestrian bridge.

Figure 8 – November 11, 2024. Looking downstream from the southern pedestrian bridge. The active floodplain along both overbanks is well vegetated with cottonwoods in varying life stages, coyote willows, mule fat, and herbaceous vegetation.

2.3 GEOLOGY AND SOILS INFORMATION

The NRCS has classified soils within most of the project area as NaC – Naplene silt loam, 2 to 6 percent slopes (Reference 2). The NaC soil unit is a relatively loose, silty loam associated with alluvial fans and valleys. These soils generally have a minimum distance to lithic bedrock of 80". These soil units within the project area have a high potential for erosion and scour damage due to their composition and location.

An investigation of the regional and local geology of the study reach was performed using geologic mapping data obtained from the Utah Geologic Survey (UGS) database. The geology of the stream bed and banks can greatly influence the erosivity of the floodplain, in turn affecting the lateral erosion distances expected during a flood. The spatial extent of the geologic units within the river systems can provide information of where the river has been in the past. The proposed project area is located within the Qath and Qafc geologic units, which are described as follows in the Geologic Map of the St. George and East Part of the Clover Mountains (Reference 3).

Qat: Old river and stream alluvium (Holocene to middle Pleistocene): Stratified, moderately to well-sorted alluvial gravel, sand, silt, and minor clay that forms level to gently sloping terraces above modern drainages; locally divisible into six or more distinct terrace levels based on elevation above modern drainages, but undivided here due to map scale; deposited in stream channel and floodplain environments and may include colluvium and alluvial fans too small to map separately; commonly forms a sand-and-gravel veneer 10 to 30 feet (3–9 m) thick over an eroded bedrock surface.

Qafy: Younger fan alluvium (Holocene) – Poorly to moderately sorted, non-stratified, subangular to subrounded, boulder to clay-size sediment deposited at the mouths of streams and washes; clast composition ranges widely and reflects rock types exposed in upstream drainage basins; forms both active depositional surfaces (Qaf1 equivalent) and low-level inactive surfaces incised by small streams (Qaf2 equivalent) undivided here; deposited principally as debris flows and debris floods, but colluvium locally constitutes a significant part of the deposits; small, isolated alluvial fans are typically less than a few tens of feet thick, but large, coalesced fans, as in the New Harmony basin, are probably as much as 200 feet (60 m) thick.

The fine-grained alluvial material of units Qat and Qafy is associated with modern, active channel processes and is highly erosive. The USGS map material description is consistent with the finding in the NRCS soil survey and the site investigation.

2.4 EFFECTIVE FLOODPLAIN INFORMATION

A majority the project area is located within Zone AE, defined as areas inside the 1% annual chance floodplain according to FEMA Flood Insurance Rate Map (FIRM), panel 49053C 0895G, dated April 2, 2009 (Reference 4). A portion of the project area, including the proposed restroom facility and covered pavilion are located within Zone X, defined as areas outside the 1% annual chance floodplain. A FIRMette of panel 0895G and a floodplain exhibit with the project area boundary are included in the Appendix.

2.5 FLOODPLAIN ANALYSIS

To determine the impacts of placing fill within the project area as part of the proposed improvements, a HEC-RAS hydraulic model was prepared based on existing and proposed conditions and compared with the regulatory model of the North Fork of the Virgin River along the study reach. The existing conditions hydraulic model was prepared with geometric data derived from 2017 Washinton County LiDAR topography, 2024 field survey data, and 2009 Washington County FIS (Reference 5) regulatory flow information. The proposed conditions hydraulic model was developed by adjusting the elevations along the right (west) overbank based on proposed site improvements. Table 1 below provides a comparison between effective, existing, and proposed water surface elevations.

Table 1 *100 Year Water Surface Elevations*				
Station	***Effective 100 Year Water Surface Elevation***	***Existing 100 Year Water Surface Elevation***	***Proposed 100 Year Water Surface Elevation***	***Difference (Proposed – Existing)***
7+600.735 (FEMA Q)	3816.05′	3816.10′	3816.10′	0.00′
7+402.373 (FEMA P)	3815.16′	3815.43′	3815.43′	0.00′
7+296.517	3812.32′	3814.09′	3814.09′	0.00′
7+276.270 (FEMA O)	3811.69′	3811.08′	3811.06′	-0.02′
7+146.536 (FEMA N)	3811.44′	3810.71′	3810.67′	-0.04′
6+886.104 (FEMA M)	3809.31′	3809.25′	3809.14′	-0.11′
6+752.393	3809.02′	3808.88′	3808.69′	-0.19′
6+735.798 (FEMA L)	3808.97′	3808.00′	3807.98′	-0.02′
6+535.399 (FEMA K)	3807.34′	3806.83′	3806.83′	0.00′

As shown in Table 1 above, the proposed improvements do not change the 100-year water surface elevations more than one foot within the property limits, meeting the requirements of Ordinance 2020-04. Based on the hydraulic analysis, the proposed improvements do not impact water surface elevations at properties adjacent to the project area. See the Floodplain Exhibit, the Proposed Erosion Protection Exhibit, and the hydraulic calculations included in the Appendix for additional information.

3.0 RIVER MEANDER & SCOUR ANALYSIS

3.1 HISTORICAL AERIAL PHOTO ANALYSIS

Historic aerial photos from 1973 to 2024 of the study reach were reviewed to establish the location of the North Fork of the Virgin River active channel and determine meander patterns and trends over the extended recent time period, including the impacts of the significant flood events in 2005 and 2010. The results of the analysis indicate that throughout most of the reach, the location of the active channel has remained relatively stable throughout the study period. The lack of lateral movement of the North Fork of the Virgin River is likely due to the presence of mature cottonwoods alone the water's edge, the active floodplain, and active floodplain/ low terrace transition zone. The presence of the two pedestrian bridges also likely plays a role in stabilizing this reach of the river.

3.2 SCOUR ANALYSIS

Scour depths were calculated based on the Virgin River 100-year flood event. 100-year flood water surface elevations, flow depths, and flow velocities were based on the proposed conditions HEC-RAS model of the study reach.

Total estimated scour depth along the study reach was based on the Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual, which uses a sum of long term degradation, bend scour, and (1/2) anti-dune scour (Reference 5). Table 3 lists the individual components and total scour value calculated along the channel.

Table 3 - Total Scour Depths	
½ Anti-Dune Scour	0.68 ft
Bend Scour	0.36 ft
Long Term Degradation	1.00 ft
Total Scour	***2.04 ft***

3.3 ANALYSIS OF EROSION HAZARD RISK

The proposed improvements are partially located within the HREHZ, and are along a relatively straight, stable reach of the North Fork of the Virgin River. The existing erosion protection along the right (west) overbank, upstream of the northern pedestrian bridge, provides lateral stability to this section of river, and will limit channel migration to the west. The two pedestrian bridges also contribute to the lateral stability of the river through the proposed project area. The mature cottonwoods located within the active floodplain and terrace along the right (west) overbank provide natural stabilization, limiting lateral migration of the channel and minimizing the effect of scour. Although there is evidence of some scour by the exposed root structure of several of the larger cottonwoods, many of the trees remain healthy and stable. The presence of the roots structure has likely prevented the formation of vertical cutbanks adjacent to the site. However, if the trend of erosion continues, it can be assumed that the cottonwoods along the toe of the bank will continue to be undercut and likely will collapse into the river, removing bank protection and potentially increasing the risk of lateral erosion.

The proposed improvements are intended to closely match existing grades, and outside of the installation of the restroom building, no significant alterations to the site are anticipated. Care was taken to ensure that no fill was placed within the floodway as a result of site grading. As the proposed improvements will result in minor impacts to the existing developed conditions of the site, the intended use of the area matches the current use, the existing right (west) overbank has remained stable for over 60 years and no disturbance will occur below the top of the bank, erosion protection is recommended to specifically protect the restroom building from the high velocity flows expected during a 100-year flood event.

The sole use of bioengineering techniques was considered for the proposed erosion protection improvements but was deemed to be insufficient due to the erosion protection improvements specifically addressing the restroom building. As riparian species need access to water year-round, plants used for bioengineering would be

unable to establish within the low terrace. As the erosion protection improvements are to be located within the high terrace, no specific bioengineering improvements are considered feasible for this site.

A calculation of required rock rip-rap size for the study reach based on tractive stress was used along with the scour depth listed above to determine the quantity of rock necessary to protect the restroom building. A rock rip-rap section consisting of 24" D50 (median particle size) rock, 4 feet thick, extending from a height 1 foot above the base flood elevation to a depth 2.04 feet below the flowline on a 1.5:1 slope would require 4.0 cubic yards of rock per linear foot. In lieu of placing rock rip-rap erosion protection, the building footings for the restroom can be extended 5' below the proposed finished floor elevation to provide adequate erosion protection.

Based on the Engineer's experience working in this reach of the North Fork of the Virgin River, it is assumed that the project is susceptible to potential damage caused by major flooding and scour. It is the opinion of the Engineer that extension of the building footings is required to adequately protect the restroom facility, and the temporary river viewing platform should be designed to break away from its foundation during high water events.

4.0 RECOMMENDATIONS

4.1 PROPOSED IMPROVEMENTS

Extending the building footings 5' below the finished floor elevation is recommended to protect the restroom facility from potential scour resulting from future flood events. The finished floor elevation (FFE) of the restroom building should be one foot above the 100 year water surface elevation. The proposed river viewing platform is to be considered temporary and be designed to break away during major floor events. See the Proposed Erosion Protection Plans in the Appendix for additional information.

All applicable provisions of the Uniform Building Code must be adhered to while constructing the proposed improvements and any associated site grading activities. Any public utilities or facilities constructed with the proposed development should be located and constructed to minimize the risk of flood and erosion damage.

4.2 DO NOT DISTURB THE STREAM BANKS & RIPARIAN ZONE

No disturbance should be allowed within the regulatory floodplain, North Fork of the Virgin River wet stream, or the riparian zone without the necessary regulatory permits. Significant biological conditions are anticipated to be part of the regulatory permits issued by the Corps of Engineers or the State Engineers Office as part of any proposed disturbance within the jurisdictional areas. The existing North Fork Virgin River riparian zones should remain undisturbed during the construction process except for the permitted activities. In addition, any disturbed areas within the riparian corridor should be re-vegetated with native Coyote Willow, Gooding Willow or Fremont Cottonwood plantings as appropriate. All proposed grading should adhere to the recommendations of the *Virgin River Management Plan* (Reference 7) as it relates to grading, surface drainage and surface roughness. A Grading Permit and a Floodplain Development

Permit is required by the Town of Springdale prior to construction of erosion protection improvements.

4.3 IMPACTS TO STREAM STABILITY AND ADJACENT PROPERTIES

As shown in Table 1 and the Floodplain Exhibit included in the Appendix, 100 year water surface elevations within adjacent properties will not increase above the effective water surface elevations as a result of the proposed improvements. No changes or impacts to the regulatory floodway shall occur with this project. As designed, construction of the proposed improvements should not impact the Waters of the U.S., riparian vegetation, or federally protected endangered species. No impacts to stream stability or sediment transport patterns are anticipated with the project.

4.4 PROVIDE FOR PERPETUAL ACCESS & MAINTENANCE

Perpetual maintenance of the proposed erosion protection improvements and access to the area between the restroom building and SR-9 and the parking lot is required. Routine inspection of the improvements and access should be completed at least annually and immediately following any major flood event in the river. Maintenance of the proposed erosion protection and access will be the responsibility of the property owner. Any required repair of the improvements or access shall be completed in a timely manner as per the direction of a professional engineer or his assignee.

4.5 PROPERTY OWNERS SHALL ACKNOWLEDGE RISKS

It should be acknowledged by any current or future property owners that flood events larger than the 100 year flood can and do occur. Areas adjacent to the North Fork of the Virgin River are susceptible to flooding and erosion damage beyond the design events analyzed in this report. Development plans should consider the risk of erosion, sedimentation, and flood damage from large flood events during the design of structural foundation systems, utilities, pavements, and site drainage. Approval of future building permit approvals for the property should be conditioned upon acknowledgement by property owners of the potential risks of flood and erosion damage at this location.

5.0 ENGINEER'S OPINION OF RISK

The findings and recommendations presented in this document are based on a review of existing technical studies concerning the flooding and erosion hazard risks at this location on the North Fork of the Virgin River; a site investigation to determine existing conditions; evaluation of other erosion protection counter measures already in place; engineering analysis and past professional experience working in the area. It is the professional engineering opinion of Rosenberg Associates that if the recommendations presented in this document are implemented and maintained properly, then the risk of lateral bank erosion to the expanded Springdale River Park will be mitigated as required by the Town of Springdale code. No adverse effects to properties upstream, downstream, or across the river are anticipated with the proposed project.

REFERENCES

1. Draft Erosion Hazard Delineation, Rosenberg Associates, January, 2020.

2. Custom Soil Resource Report for Washington County Area, Utah, Natural Resources Conservation Service, January 18, 2024.

3. Geologic Map of the St. George and East Part of the Clover Mountains 30' x 60' Quadrangles, Washington and Iron Counties, Utah, Utah Geologic Survey, 2010.

4. Washington County Flood Insurance Study, Federal Emergency Management Agency, April 2, 2009.

5. Hydrologic Criteria and Drainage Design Manual, Clark County Regional Flood Control District, 1999.

6. Bank Stabilization Design Guidelines, U.S. Department of the Interior, 2015.

7. Virgin River Management Plan, Town of Springdale, 2019.

APPENDIX

Custom Soil Resource Report for Washington County Area, Utah – NRCS
FIRMette Washington County FIS, Panel 49053C 0895G
Floodplain Exhibit – North Fork Virgin River, Rosenberg Associates, 2026
Site Plan – Springdale River Park Expansion
Proposed Erosion Protection Plans, Rosenberg Associates, 2026

Hydraulic Model Data
Total Scour Calculations

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Washington County Area, Utah

February 26, 2025

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,660 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Washington County Area, Utah
Survey Area Data: Version 18, Aug 28, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 8, 2022—Sep 29, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FA	Fluvaquents and torrifluvents, sandy	2.1	26.0%
NaC	Naplene silt loam, 2 to 6 percent slopes	4.3	53.9%
W	Water	1.6	20.0%
Totals for Area of Interest		**7.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The

delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Washington County Area, Utah

FA—Fluvaquents and torrifluvents, sandy

Map Unit Setting

National map unit symbol: j8dt
Elevation: 2,500 to 3,000 feet
Mean annual precipitation: 8 to 11 inches
Mean annual air temperature: 57 to 67 degrees F
Frost-free period: 190 to 205 days
Farmland classification: Not prime farmland

Map Unit Composition

Fluvaquents and similar soils: 55 percent
Torrifluvents and similar soils: 35 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fluvaquents

Setting

Landform: Swales
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy alluvium derived from limestone, sandstone, and shale

Typical profile

H1 - 0 to 5 inches: fine sand
H2 - 5 to 60 inches: stratified fine sand to silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: Frequent
Frequency of ponding: Rare
Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A/D
Ecological site: R035XY011UT - Loamy Bottom (Basin Big Sagebrush)
Hydric soil rating: Yes

Description of Torrifluvents

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from limestone, sandstone, and shale

Typical profile

H1 - 0 to 5 inches: loamy fine sand
H2 - 5 to 60 inches: stratified loamy fine sand to silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 42 to 72 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline to moderately saline (0.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: R035XY011UT - Loamy Bottom (Basin Big Sagebrush)
Other vegetative classification: Loamy Bottom (Basin Big Sagebrush) (035XY011UT)
Hydric soil rating: No

Minor Components

Riverwash

Percent of map unit: 4 percent
Landform: Flood plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Tobler, silty clay loam

Percent of map unit: 3 percent

Tobler, fine sandy loam

Percent of map unit: 3 percent

NaC—Naplene silt loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: j8fz
Elevation: 3,600 to 5,300 feet
Mean annual precipitation: 14 to 15 inches
Mean annual air temperature: 44 to 52 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Naplene and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Naplene

Setting

Landform: Alluvial fans, valleys
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

H1 - 0 to 2 inches: silt loam
H2 - 2 to 7 inches: silt loam
H3 - 7 to 15 inches: silt loam
H4 - 15 to 22 inches: silty clay loam
H5 - 22 to 39 inches: silt loam
H6 - 39 to 60 inches: silt loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: C
Ecological site: R035XY306UT - Upland Loam (Basin Big Sagebrush)
Hydric soil rating: No

Minor Components

Schmutz
Percent of map unit: 5 percent

Redbank
Percent of map unit: 5 percent

Mespun
Percent of map unit: 5 percent

Clovis
Percent of map unit: 5 percent

Chilton
Percent of map unit: 5 percent

W—Water

Map Unit Composition
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission

rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group

index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–Washington County Area, Utah														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
FA—Fluvaquents and torrifluvents, sandy														
Fluvaquents	55	A/D	0-5	Fine sand	SM	A-2-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	65-73-80	20-28-35	0-7 -14	NP
			5-60	Stratified fine sand to silt loam	SM	A-2-4	0- 0- 0	0- 0- 0	100-100-100	95-98-100	65-73-80	20-28-35	15-20-25	NP-3 -5
Torrifluvents	35	A	0-5	Loamy fine sand	SM	A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	75-83-90	35-43-50	0-7 -14	NP
			5-60	Stratified loamy fine sand to silt loam	SM	A-2-4	0- 0- 0	0- 0- 0	100-100-100	95-98-100	50-63-75	10-20-30	15-20-25	NP-3 -5
NaC—Naplene silt loam, 2 to 6 percent slopes														
Naplene	75	C	0-2	Silt loam	CL, CL-ML	A-6, A-4	0- 0- 0	0- 0- 0	100-100-100	95-98-100	85-93-100	65-78-90	25-30-35	5-10-15
			2-7	Silt loam	CL-ML, CL	A-6, A-4	0- 0- 0	0- 0- 0	100-100-100	95-98-100	85-93-100	65-78-90	25-30-35	5-10-15
			7-15	Silt loam	CL-ML, CL	A-6, A-4	0- 0- 0	0- 0- 0	100-100-100	95-98-100	85-93-100	65-78-90	25-30-35	5-10-15
			15-22	Silty clay loam	CL	A-6	0- 0- 0	0- 0- 0	100-100-100	95-98-100	85-93-100	80-88-95	30-35-40	10-13-15
			22-39	Silt loam	CL-ML, CL	A-6, A-4	0- 0- 0	0- 0- 0	100-100-100	95-98-100	85-93-100	65-78-90	25-30-35	5-10-15
			39-60	Silt loam	CL-ML, CL	A-6, A-4	0- 0- 0	0- 0- 0	100-100-100	95-98-100	85-93-100	65-78-90	25-30-35	5-10-15

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

National Flood Hazard Layer FIRMette

FEMA

113°0'51"W 37°10'50"N

113°0'13"W 37°10'21"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/26/2025 at 10:08 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

LEGEND

PROJECT AREA

DATE:	2/26/2025
JOB NO.:	2824-24-002
DESIGNED BY:	WJP
CHECKED BY:	JWB
DWG:	EHZ

REVISIONS — DATE

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS
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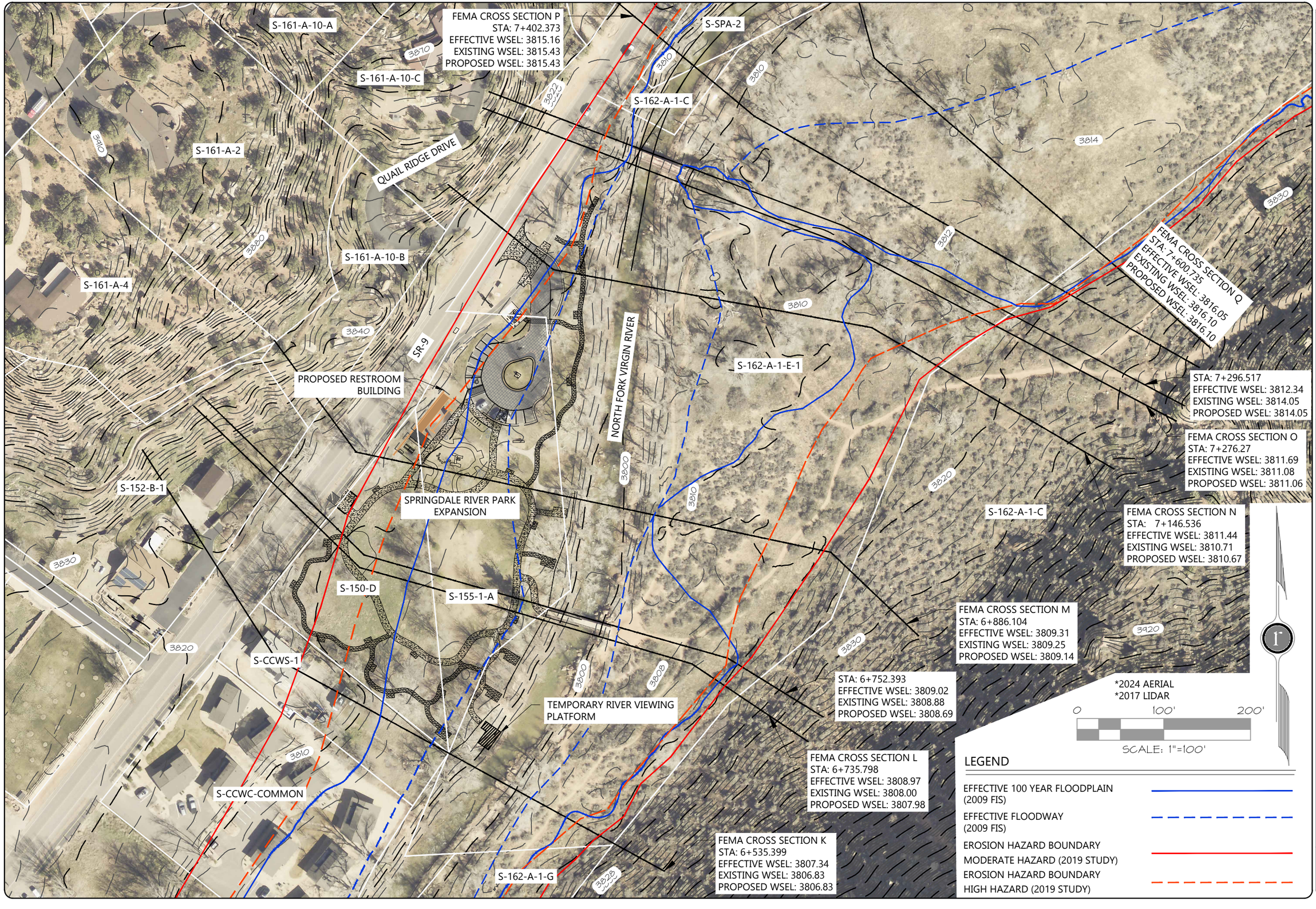
www.racivil.com

FEMA FIRMETTE - 0895G
FOR
SPRINGDALE RIVER PARK EXPANSION
SPRINGDALE
UTAH

SHEET
1
1 OF 1 SHEETS



DATE: 2/20/2025
JOB NO.: 2848-24-002
DESIGNED BY: WJP
CHECKED BY: JWB
DWG: EHZ

REVISIONS
DATE

ROSENBERG ASSOCIATES
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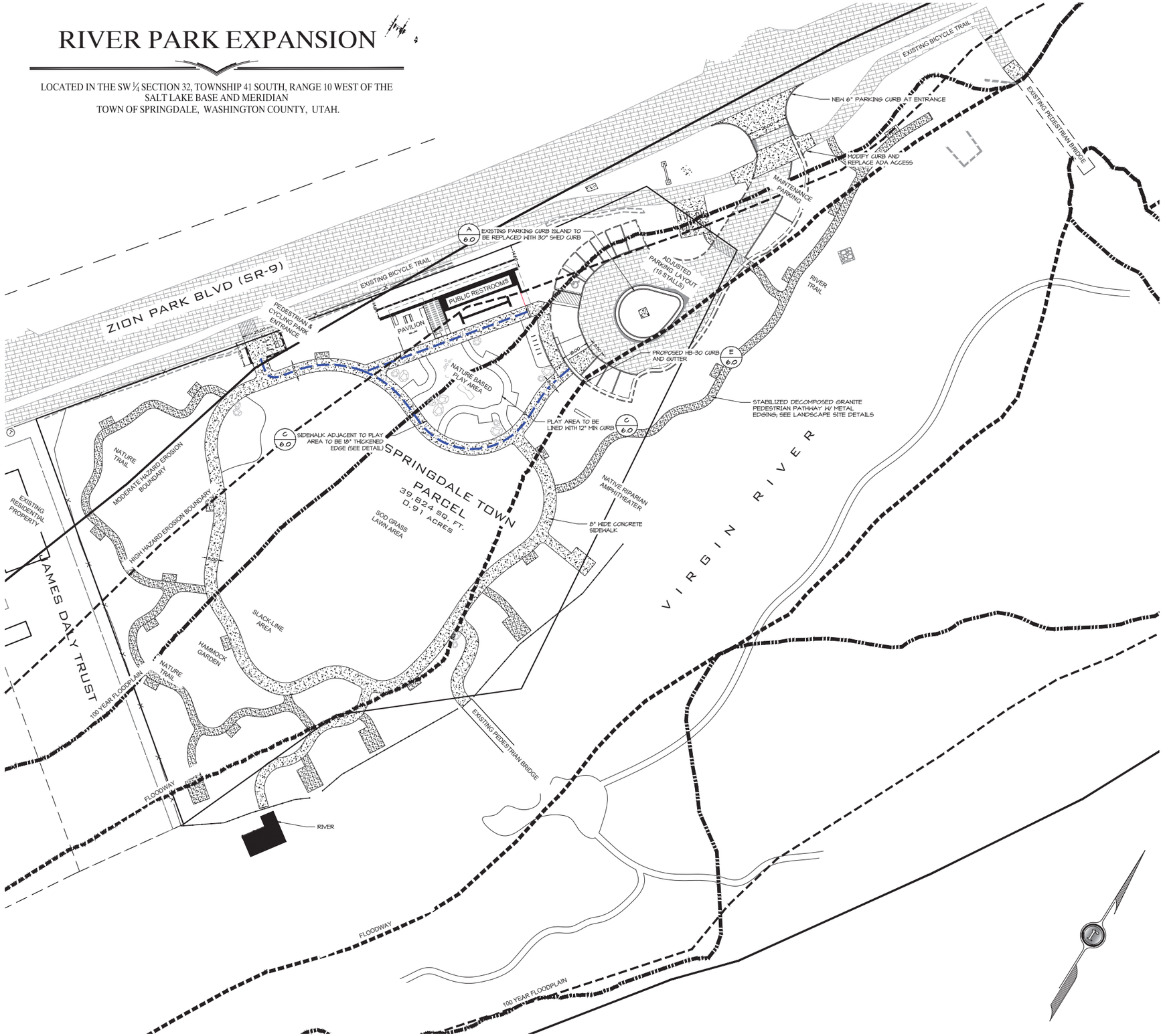
www.racivil.com

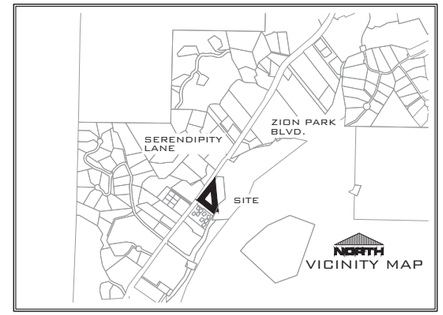
FLOODPLAIN EXHIBIT - NORTH FORK VIRGIN RIVER
FOR
SPRINGDALE RIVER PARK EXPANSION
SPRINGDALE
UTAH

SHEET
1
1 OF 1 SHEETS

RIVER PARK EXPANSION

LOCATED IN THE SW ¼ SECTION 32, TOWNSHIP 41 SOUTH, RANGE 10 WEST OF THE SALT LAKE BASE AND MERIDIAN
TOWN OF SPRINGDALE, WASHINGTON COUNTY, UTAH.





SITE NOTES

ALL AREAS OUTSIDE OF THE GRADING LIMITS WILL BE FENCED OR TAPED OFF DURING CONSTRUCTION TO PREVENT ACCIDENTAL OR INCIDENTAL DISTURBANCE OF THESE AREAS

LEGEND

EXISTING	DESCRIPTION	PROPOSED
	TOP BACK CURB	
	WALL	
	ADA PATH	
	ASPHALT PAVEMENT	
	CONCRETE	

0 30' 60'
SCALE: 1"=30'

Know what's below. Call before you dig.

NOTICE:
EXISTING UTILITIES ARE SHOWN ON PLANS FOR THE CONVENIENCE OF THE CONTRACTOR ONLY. THE CONTRACTOR IS RESPONSIBLE FOR THE LOCATION AND PROTECTION OF ALL UTILITIES. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR SHOWN INCORRECTLY.

DATE:	1-10-25
JOB NO.:	#2848-24-002
DESIGNED BY:	ETY
CHECKED BY:	JMB
DWG:	CONST SET

REVISIONS DATE

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS
352 East Riverside Drive, Suite A-2
St. George, Utah 84790
Ph (435) 673-8586 Fx (435) 673-8397
www.racivil.com

SITE PLAN
FOR
SPRINGDALE RIVER PARK EXPANSION
SPRINGDALE
UTAH

SHEET
3.0
3 OF 7 SHEETS

S-161-A-10-A

S-161-A-10-C

S-161-A-2

EXTEND PROPOSED BUILDING FOOTINGS 5' BELOW PROPOSED FINISHED FLOOR ELEVATION

PROJECT AREA

RESTROOM BUILDING
PROPOSED FFE: 3810.9

S-161-A-10-B

SPRINGDALE RIVER PARK EXPANSION

SR-9

NORTH FORK VIRGIN RIVER

S-162-A-1-E-1

S-162-A-1-C

S-155-1-A

S-150-D

SOUTHERN PEDESTRIAN BRIDGE

S-CCWS-1

TEMPORARY RIVER VIEWING PLATFORM

S-CCWC-COMMON

PROFESSIONAL ENGINEER
JARED W. BATES
11/4/2026
NO. 18868
STATE OF UTAH

*2024 AERIAL

0 60' 120'

SCALE: 1"=60'

LEGEND

- EFFECTIVE 100 YEAR FLOODPLAIN (2009 FIS)
- EROSION HAZARD BOUNDARY MODERATE HAZARD (2019 STUDY)
- EROSION HAZARD BOUNDARY HIGH HAZARD (2019 STUDY)
- PROPERTY BOUNDARIES

DATE: 2/26/2025
JOB NO.: 2824-24-002
DESIGNED BY: WJP
CHECKED BY: JWB
DWG: EHZ

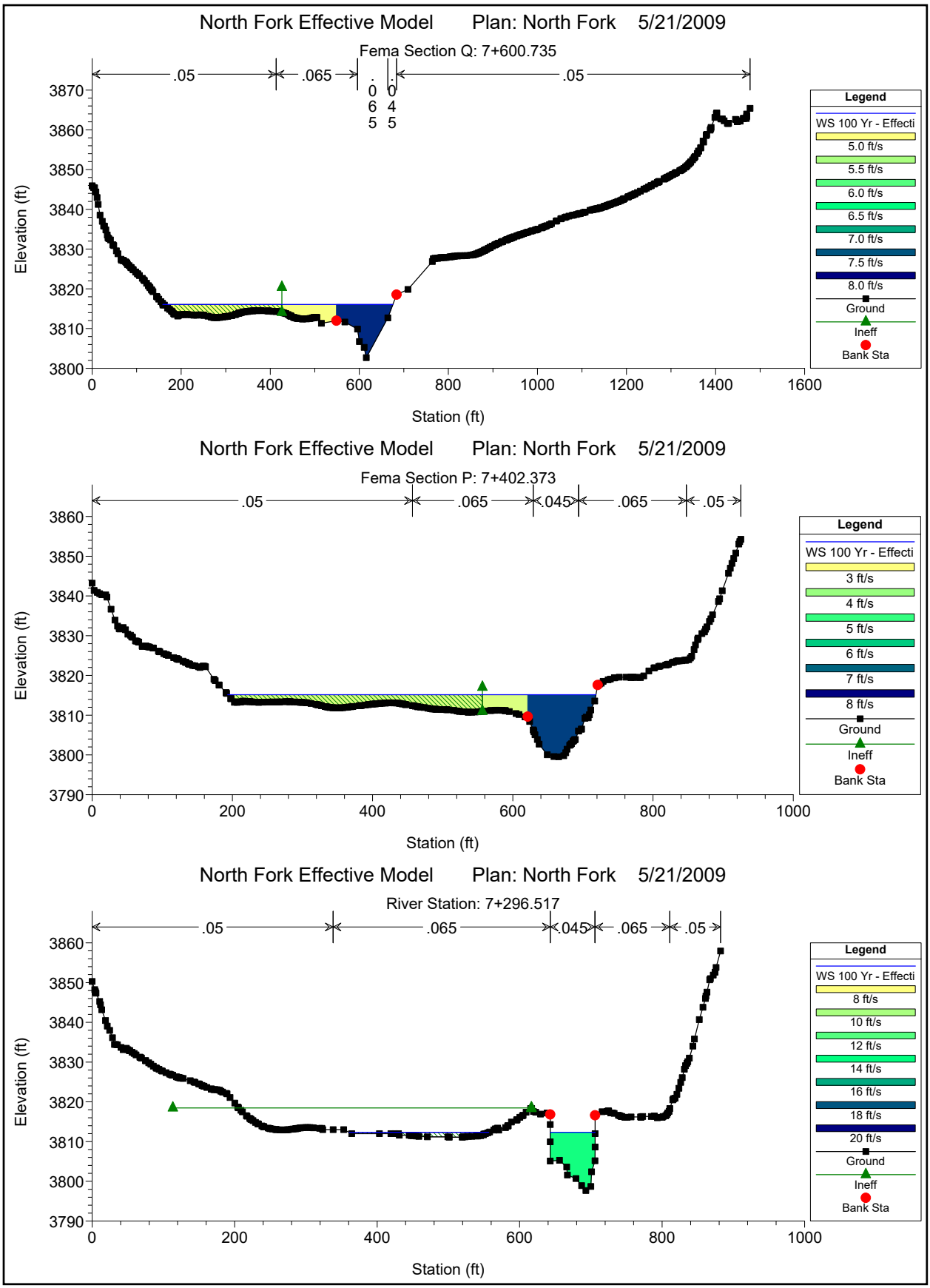
REVISIONS
DATE

ROSENBERG ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS
352 East Riverside Drive, Suite A-2
St. George, Utah 84790
Ph (435) 673-8586 Fx (435) 673-8397
www.racivil.com

EROSION PROTECTION PLAN - NORTH FORK VIRGIN RIVER
FOR
SPRINGDALE RIVER PARK EXPANSION
SPRINGDALE
UTAH

SHEET
PV
1 OF 1 SHEETS

HEC-RAS Model Results - Effective Conditions - North Fork Virgin River													
FEMA Sta	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Max Chl Dpth	Hydr Dpth
			(cfs)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)	(ft)
Q	7+600.735	100 Yr	8830	3802.67	3816.05	3816.85	0.008924	7.76	1291.01	516.69	0.53	13.38	5.18
P	7+402.373	100 Yr	8830	3799.55	3815.16	3815.94	0.002976	7.39	1351.23	525.19	0.39	15.61	8.35
	7+296.517	100 Yr	8830	3797.7	3812.32	3815.17	0.01258	13.56	651.4	259.02	0.74	14.61	10.33
	7+286.394		Bridge										
O	7+276.270	100 Yr	8830	3797.41	3811.69	3814.73	0.01282	13.99	630.99	208.89	0.78	14.28	10.01
N	7+146.536		8830	3794.44	3811.44	3812.38	0.008043	7.84	1176.81	333.48	0.48	17	6.05
M	6+886.104	100 Yr	8830	3792.32	3809.31	3810.33	0.007704	8.24	1194.41	243.64	0.5	16.99	4.9
	6+752.393	100 Yr	8830	3789.42	3809.02	3809.61	0.002845	6.49	1801.01	390.6	0.3	19.6	4.61
	6+742.344		Bridge										
L	6+735.798	100 Yr	8830	3789.4	3808.97	3809.5	0.003161	6.13	1824.47	380.96	0.31	19.57	4.79
K	6+535.399	100 Yr	8830	3790.43	3807.34	3808.46	0.006261	8.87	1154.68	242.81	0.55	16.91	4.76


North Fork Effective Model Plan: North Fork 5/21/2009
Fema Section Q: 7+600.735
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River Station: 7+296.517
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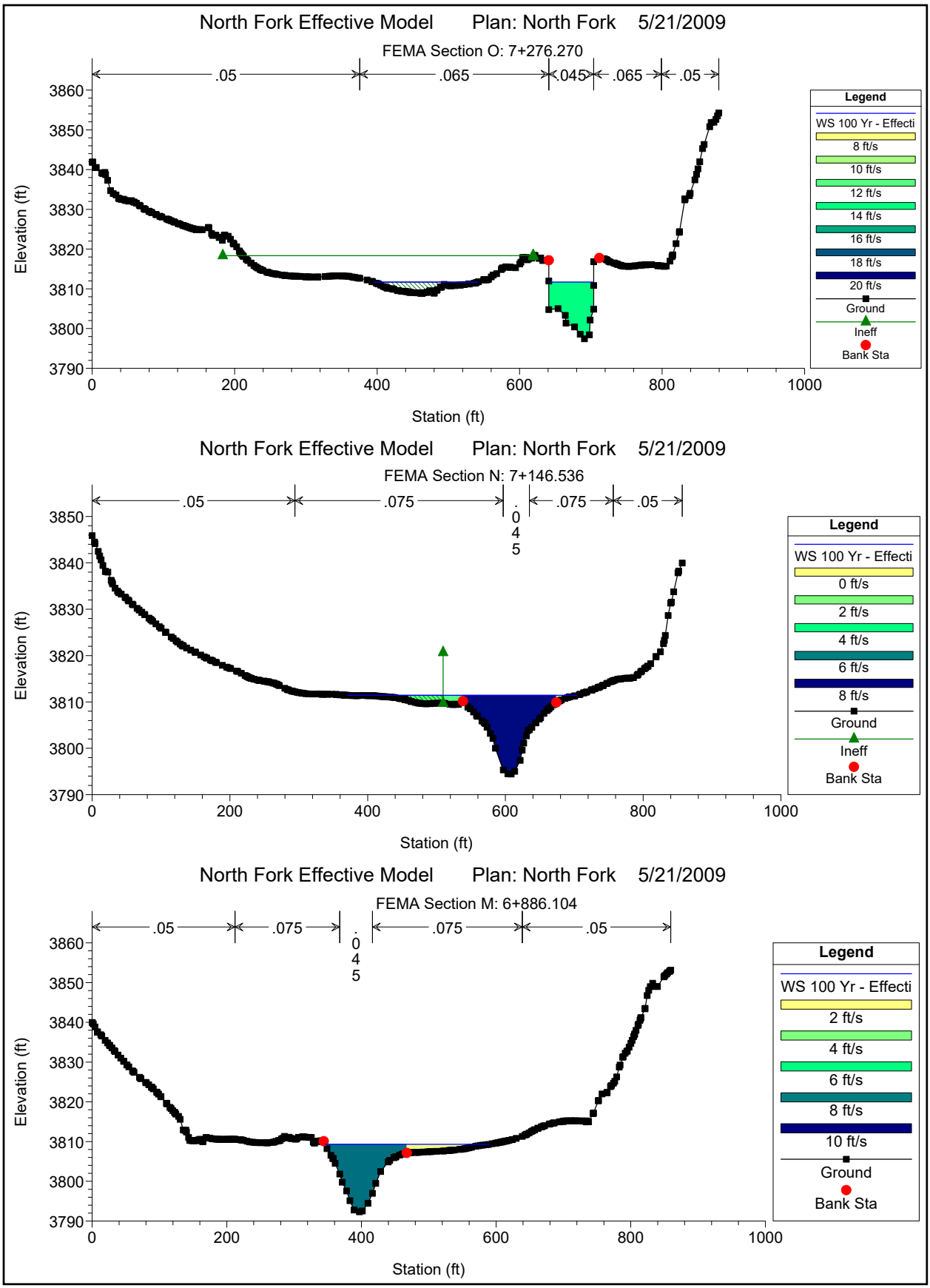
North Fork Effective Model Plan: North Fork 5/21/2009
FEMA Section O: 7+276.270
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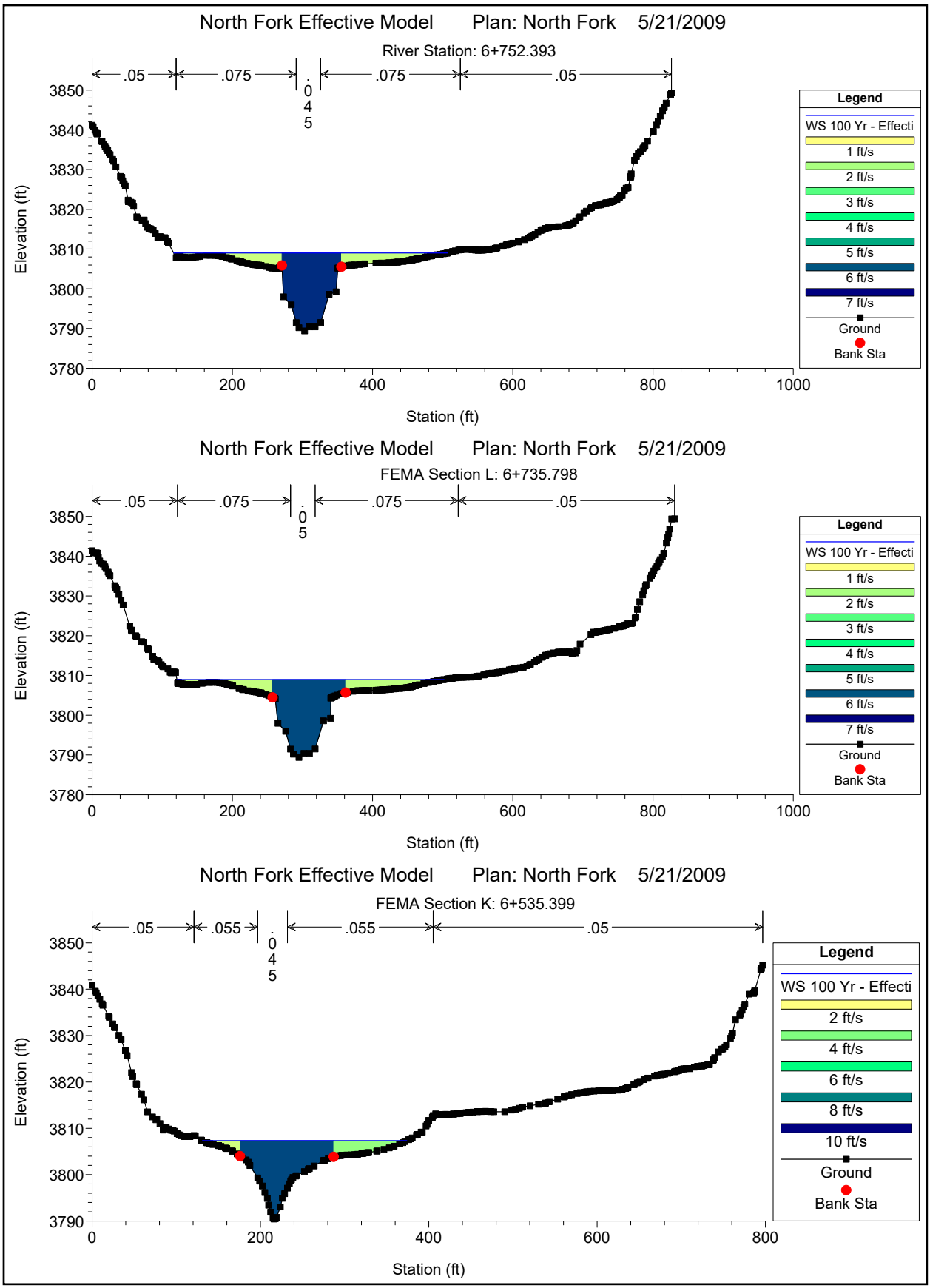
North Fork Effective Model Plan: North Fork 5/21/2009
River Station: 6+752.393
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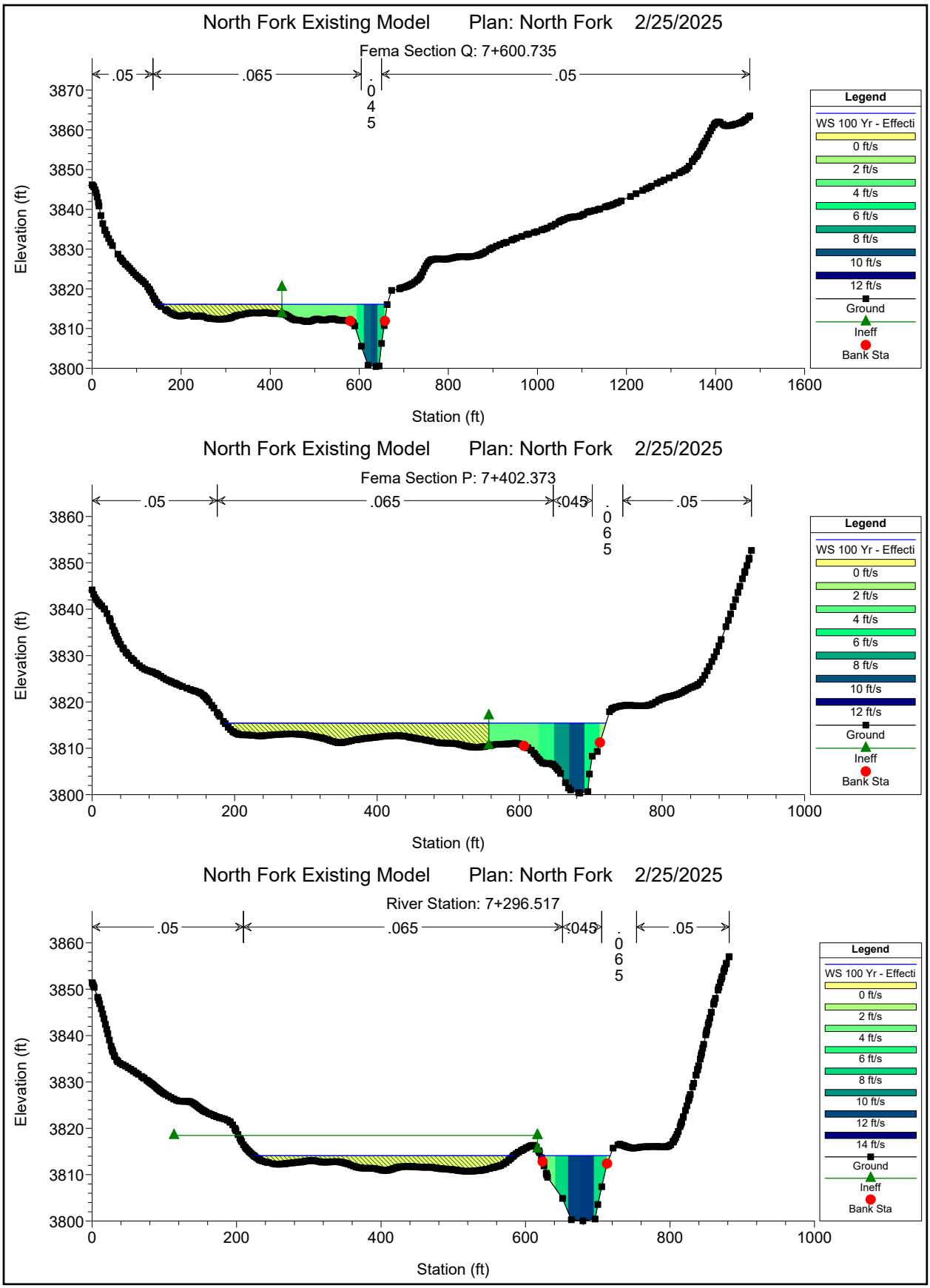
HEC-RAS Model Results - Existing Conditions - North Fork Virgin River													
FEMA Sta	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Max Chl Dpth	Hydr Dpth
			(cfs)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)	(ft)
Q	7+600.735	100 Yr	8830	3800.44	3816.1	3816.9	0.003462	7.97	1460.64	513.81	0.42	15.66	6.17
P	7+402.373	100 Yr	8830	3800.37	3815.43	3816.22	0.003685	7.41	1313.74	535	0.41	15.06	7.98
	7+296.517	100 Yr	8830	3800.05	3814.09	3815.64	0.006588	9.98	888.84	455.62	0.56	14.04	9.25
	7+286.394		Bridge										
O	7+276.270	100 Yr	8830	3799.61	3811.08	3813.76	0.012091	13.12	673.2	216.44	0.82	11.48	7.98
N	7+146.536		8830	3798.79	3810.71	3812.11	0.005431	9.5	934.69	220.02	0.67	11.92	5.63
M	6+886.104	100 Yr	8830	3796.9	3809.25	3810.64	0.005824	9.81	1105.39	285.93	0.56	12.35	3.87
	6+752.393	100 Yr	8830	3794.61	3808.88	3809.95	0.003548	8.75	1393.71	392.08	0.52	14.27	3.55
	6+742.344		Bridge										
L	6+735.798	100 Yr	8830	3794.58	3808	3809.43	0.00856	9.98	1090.74	321.73	0.63	13.42	3.39
K	6+535.399	100 Yr	8830	3794.12	3806.83	3808.12	0.004673	9.32	1098.31	236.75	0.58	12.71	4.64


North Fork Existing Model Plan: North Fork 2/25/2025
Fema Section Q: 7+600.735
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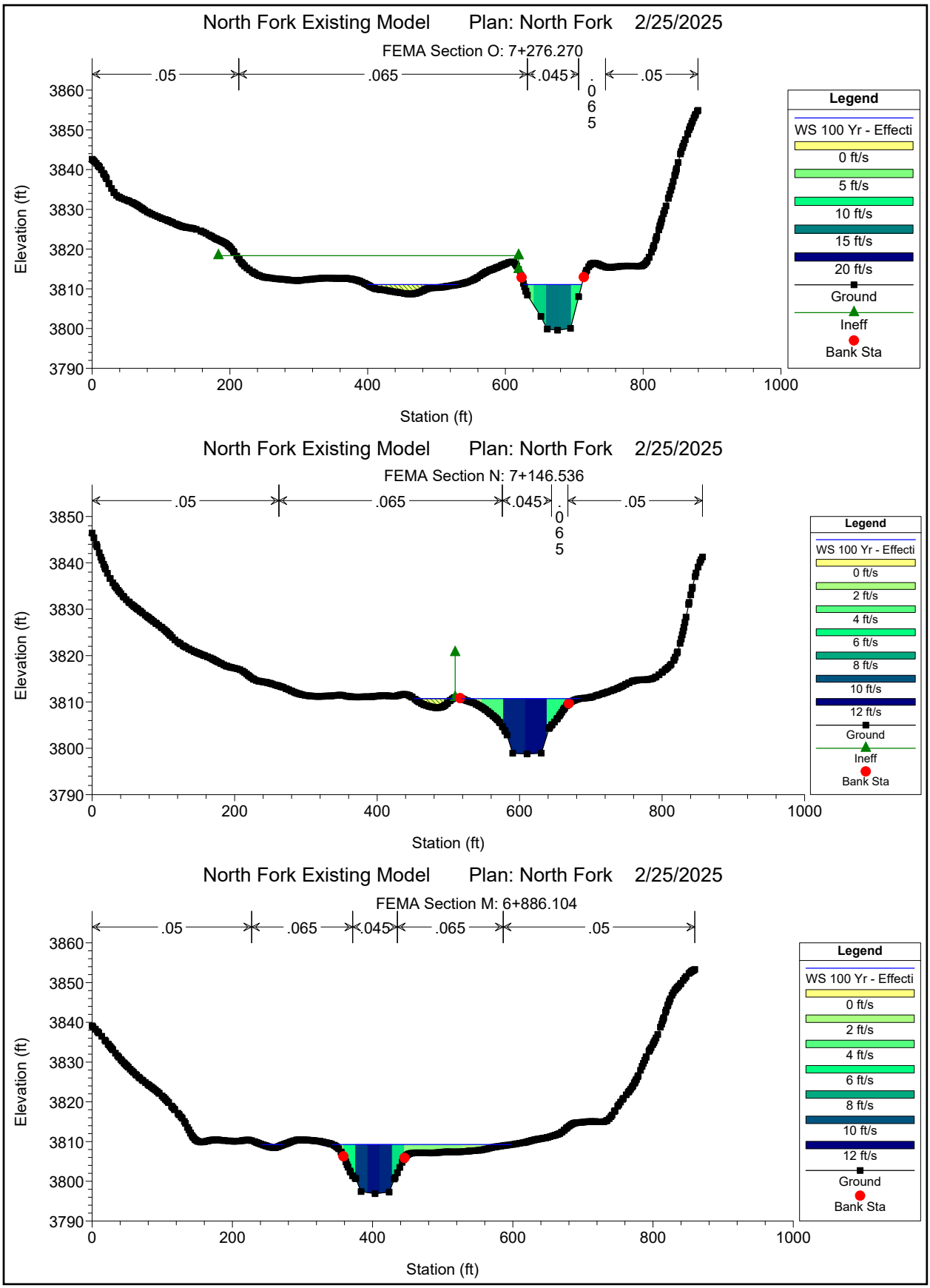
North Fork Existing Model Plan: North Fork 2/25/2025
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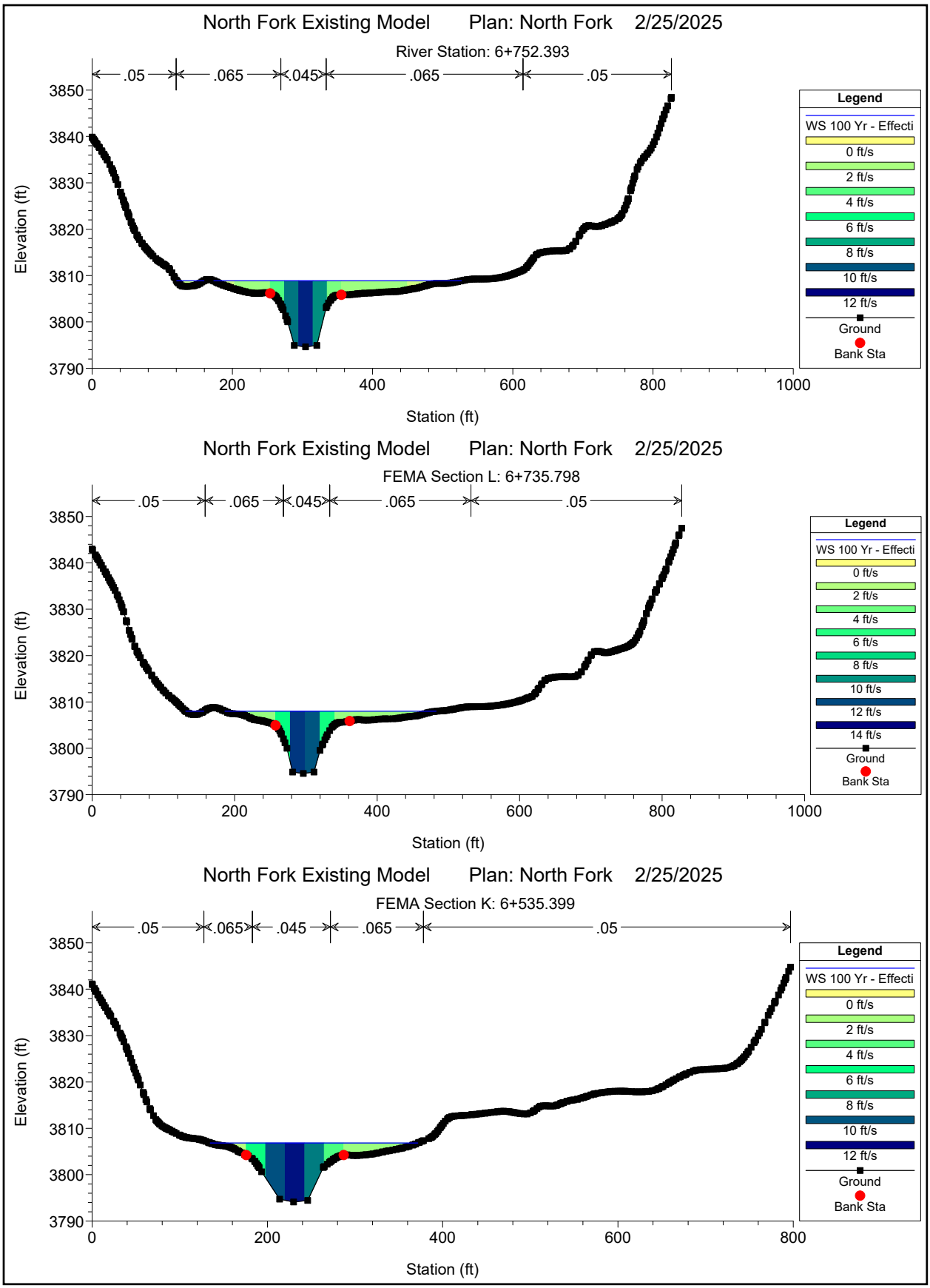
North Fork Existing Model Plan: North Fork 2/25/2025
River Station: 6+752.393
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North Fork Existing Model Plan: North Fork 2/25/2025
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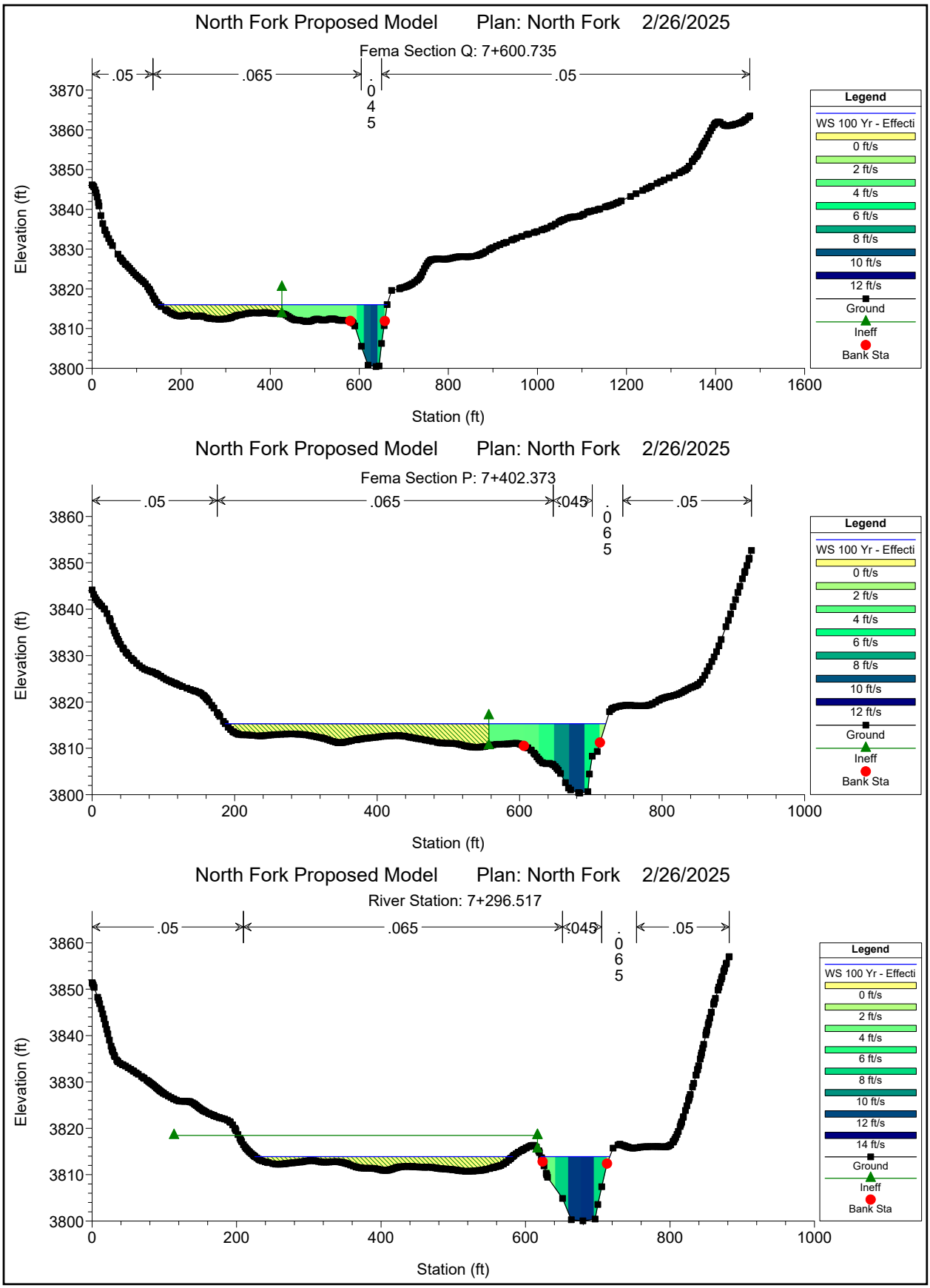
HEC-RAS Model Results - Proposed Conditions - North Fork Virgin River													
FEMA Sta	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Max Chl Dpth	Hydr Dpth
			(cfs)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)	(ft)
Q	7+600.735	100 Yr	8830	3800.44	3816.1	3816.9	0.003462	7.97	1460.64	513.81	0.42	15.66	6.17
P	7+402.373	100 Yr	8830	3800.37	3815.43	3816.22	0.003685	7.41	1313.74	535	0.41	15.06	7.98
	7+296.517	100 Yr	8830	3800.05	3814.09	3815.64	0.006588	9.98	888.84	455.62	0.56	14.04	9.25
	7+286.394		Bridge										
O	7+276.270	100 Yr	8830	3799.61	3811.06	3813.75	0.012183	13.16	671.22	215.39	0.82	11.45	7.96
N	7+146.536		8830	3798.79	3810.67	3812.09	0.005504	9.56	928.97	217.32	0.68	11.88	5.66
M	6+886.104	100 Yr	8830	3796.9	3809.14	3810.58	0.006091	9.96	1075.31	259.7	0.57	12.24	4.14
	6+752.393	100 Yr	8830	3794.61	3808.69	3809.86	0.003907	9.09	1314.05	385.26	0.55	14.08	3.41
	6+742.344		Bridge										
L	6+735.798	100 Yr	8830	3794.58	3807.98	3809.39	0.00816	9.88	1099.82	331.79	0.62	13.41	3.31
K	6+535.399	100 Yr	8830	3794.12	3806.83	3808.12	0.004673	9.32	1098.31	236.75	0.58	12.71	4.64


North Fork Proposed Model Plan: North Fork 2/26/2025
Fema Section Q: 7+600.735
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River Station: 7+296.517
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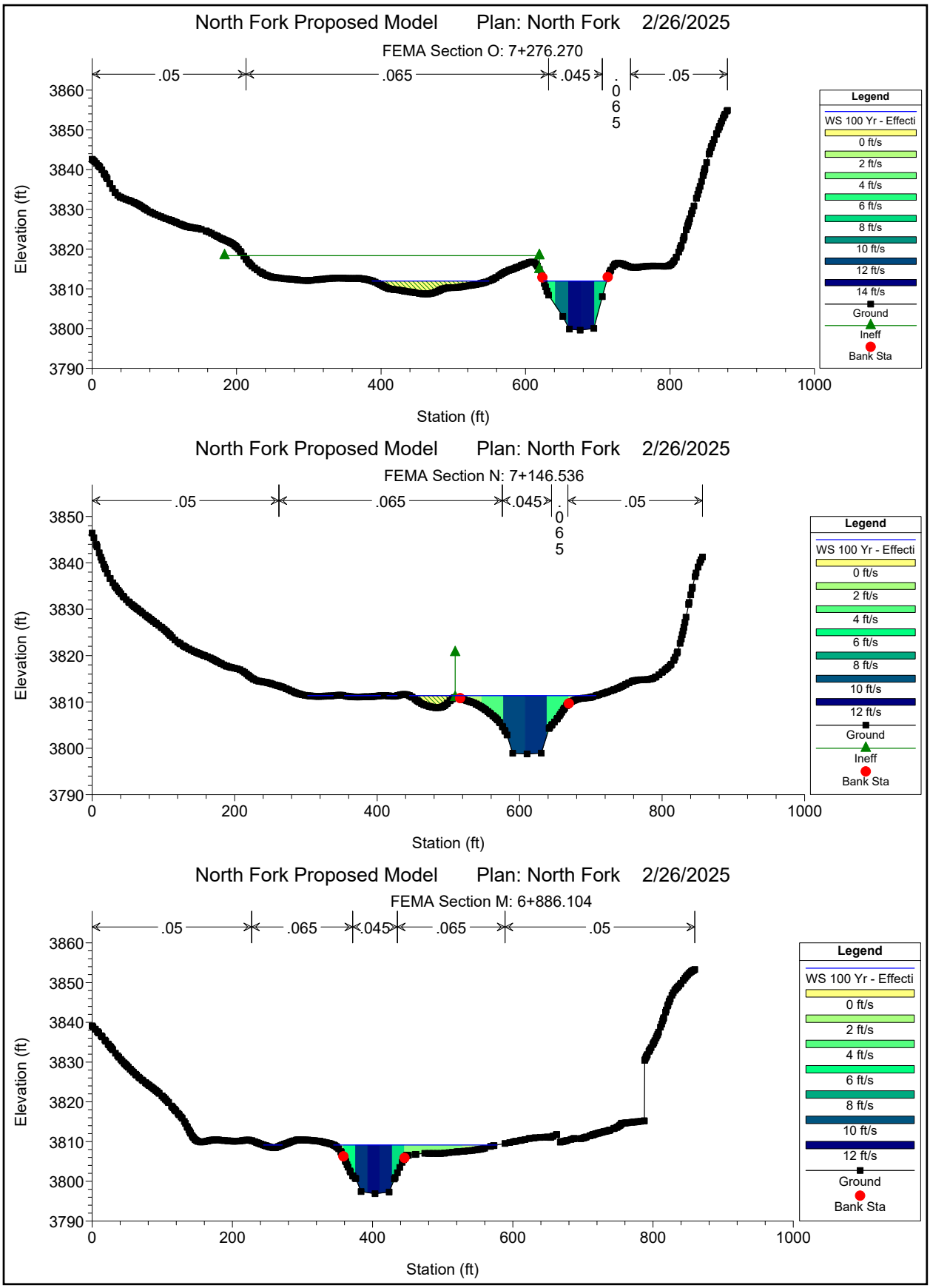
North Fork Proposed Model Plan: North Fork 2/26/2025
FEMA Section O: 7+276.270
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North Fork Proposed Model Plan: North Fork 2/26/2025
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North Fork Proposed Model Plan: North Fork 2/26/2025
FEMA Section M: 6+886.104
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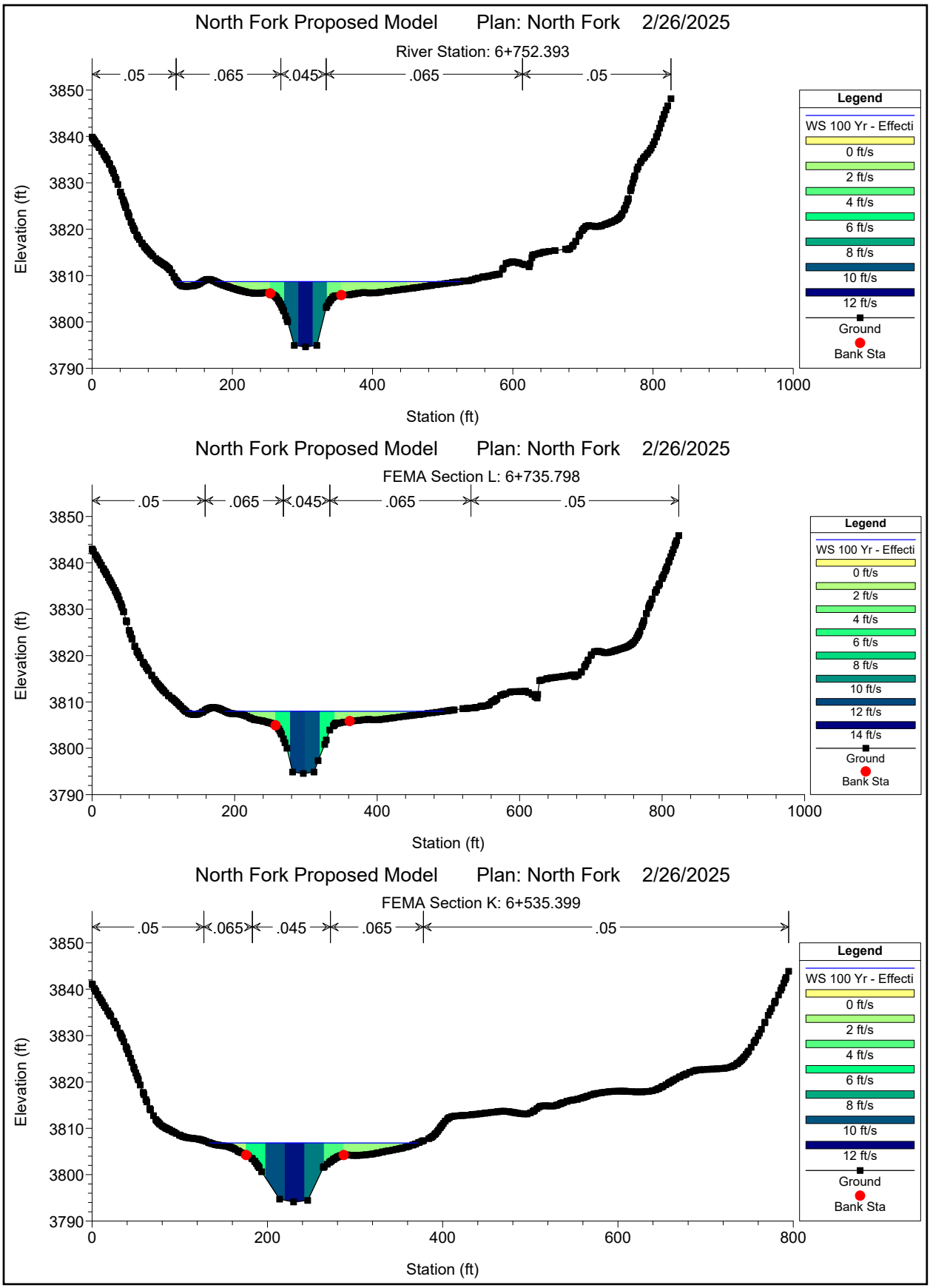
North Fork Proposed Model Plan: North Fork 2/26/2025
River Station: 6+752.393
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Ground
Bank Sta

Project: Springdale River Park Expansion BY: WJP DATE: 2/25/2025

Subject: Long Term Degradation CHKD. BY: JWB DATE: 2/25/2025

Assumptions:

Long Term Degradation for this site was determined by estimating the elevation difference in the North Fork Virgin River flowline between 2009 (2009 Washington County Flood Insurance Study) and 2017 (2017 Washington County Lidar Topography). This method was chosen as accurate river topography was available and two 50 yr+/- storm events occurred during this time period. Table 3 shows the difference in flowline elevations at several locations within the study reach. As the 2009 elevation data is based on ground survey points and the 2017 LiDAR topography provides the water surface elevations along the river, the LiDAR elevations were reduced by 2'. The value of 2' was used based on recent ground surveys in similar areas close to the study reach and site visits. Based on these elevations, the North Fork Virgin River flowline experienced an elevation increase of 1.8' at Sta. 7+402.3 and an elevation increase of 3.7' at Sta. 6+535.3. Review of historical images (1960-present) indicate that the location of the central channel has remained stable throughout the course of the study period. No evidence of head cutting or significant bed degradation is present within the reach. Due to the net aggradation within the channel over an 8 year period in which significant storm events have occurred, the stability of the central channel within the study reach, and the Engineer's experience working within the reach, it can be assumed that long term degradation is unlikely to contribute significantly to channel scour. A long term degradation value of 1' was used as a conservative estimate.

Table 3 - North Fork Virgin River Flowline Elevations

River Station	2009 Flowline Elevation (ft)	2017 Flowline Elevation (ft)	8 Year Change (ft)
7+402.3	3799.5	3801.3	1.8
6+535.3	3790.4	3794.1	3.7

Project: Springdale River Park Expansion BY: WJP DATE: 2/25/2025

Subject: Bend Scour CHKD. BY: JWB DATE: 2/25/2025

Bend Scour: (Section 704.2.1.4 - Bend Scour
Clark County Hydraulic Criteria and Drainage Design Manual, 8/12/99)

Location:
North Fork Virgin River Sta. 7+402.373

Given:

Average velocity upstream from bend, V =	7.52	ft/s
Maximum depth upstream of bend, Y_{max} =	14.95	ft
Hydraulic depth in channel upstream of bend, Y_h =	7.88	ft
Energy slope upstream of bend, S_e =	0.003852	ft/ft
Angle of bend, α =	18	deg

*Determined by acute angle formed by intersection between projection of flowline and line tangent to outer bank of bend

Equation:

$$Z_{bs} = \left(\frac{0.0685 * Y_{max} * V^{0.8}}{Y_h^{0.4} * S_e^{0.5}} \right) \left(2.1 \left(\frac{\sin^2 \left(\frac{\alpha}{2} \right)^{0.2}}{\cos \alpha} \right) - 1 \right)$$

Bend Scour, Z_{bs} = **0.36 ft** ←

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PROJECT NO. 2824-24-002

Project: Springdale River Park Expansion BY: WJP DATE: 2/25/2025

Subject: 100 YR Anti Dune Trough Scour CHKD. BY: JWB DATE 2/25/2025

Anti Dune Trough: (Section 704.2.1.3 - Anti Dune Trough Depth
Clark County Hydraulic Criteria and Drainiage Design Manual, 8/12/99)

Location:
North Fork Virgin River Sta. 6+886.104

Given:

100 YR	Average channel velocity, V =	9.96	ft/s
	Hydraulic depth, Y =	4.14	ft

Anti Dune Depth based on Velocity:

Equation:

$$Z_a = 0.0137 * V^2$$

Anti Dune Trough Depth, Z_a = **1.36 ft** ←

Anti Dune Trough Depth (max), Z_a = **2.07**

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SHEET 4 of 4
PROJECT NO. 2824-24-002

Project: Springdale River Park Expansion BY: WJP DATE: 2/25/2025
Subject: Rip-Rap Size CHKD. BY: JWB DATE: 2/25/2025

Riprap Design for Channel Lining Based on Channel Velocity

Rip-Rap: (Section 704.2.1.3 - Clark County Hydraulic Criteria and Drainiage Design Manual, 8/12/99)

Location:
North Fork Virgin River Sta. 6+752.393

Given:

Mean Channel Velocity, V =	9.09	fps
Longitudinal Channel Slope, S =	0.0023	ft/ft
Specific Gravity of Riprap Lining, S_S =	2.50	minimum S_s = 2.50

Smith and Murray Model Equation:

Equation:

$$V = 3(d_{50})^{0.5}(S_s-1)/S^{0.17}$$

Median Rock Size d_{50} = **0.52** ft *Equation 734*
6 in

Riprap Design for Channel Lining Based on Tractive Stress*

Maximum Channel Depth, Y_{max} =	14.08	ft	
Average Energy Slope, S_e =	0.003907	ft/ft	
Channel Stability Factor, F_s =	1.1	1.0 - 1.2	Straight or mildly curving reach
		1.2 - 1.4	Moderate bend curvature with minor impact from floating debris
		1.4 -1.6	Sharp bend with significant impact from floating debris and wave
		1.6 - 2.0	Rapidly varying flow with significant uncertainty in design
Channel Side Slopes =	1.50	H : 1V	2H : 1V max
Trial Average Rock Size, d_{50} =	18.00	in	insert a first trial, then adjust

Tractive Stress Equation $d_{50} = 14.2F_sY_{max}(S_e/K_1)$ *Equation 736*

Solving

Slope Angle with Horizontal, a =	0.5880	rad
Angle of Repose, h =	0.7313	rad
Bank Angle Modification Factor, K_1 =	0.55687	$= (1-(\sin^2 a/\sin^2 h))^{0.5}$
		Lane Equation
Median Rock Size, d_{50} =	**1.54**	ft
	19	in ←

The hydrodynamic force of water flowing in a channel is known as the tractive force. Flow-induced tractive force should not exceed the permissible or critical shearstress of the riprap. Theabove equation is a relationship to estimate d50 assuming a specific gravity of 2.50