

Preliminary Floodplain Modification Study

FOR

**TERRAIN NORTH BASIN PHASE II
CASTLE ROCK, COLORADO
PROJECT NO. SDP20-0033**

Prepared for:

Stratus Terrain, LLC
8480 E. Orchard Road, Suite 1100
Greenwood Village, CO 80111
Contact: Richard Dean
Phone: 720-214-5000

Prepared by:



CORE Consultants, Inc.
3473 South Broadway
Englewood, CO 80113
Contact: Kevin Rohrbough, PE
Phone: 303-703-4444
CORE Project Number: 14-001

February 3, 2023

Table of Contents

I. GENERAL LOCATION AND DESCRIPTION.....	1
Site Location	1
Description of Property	1
Description of Project.....	2
II. DRAINAGE DESIGN CRITERIA	3
Regulations.....	3
Hydrology	3
Hydraulics	Error! Bookmark not defined.
III. CONCLUSIONS	5
Compliance with Standards	5
IV. REFERENCES.....	7
APPENDIX A	8
APPENDIX B.....	9
APPENDIX C	10

I. GENERAL LOCATION AND DESCRIPTION

1. Site Location

CORE Consultants, Inc. (CORE) was retained by Stratus Terrain, LLC (Terrain) to complete a Floodplain Modification Study (FMS) for the northern portion (Phase II) of the proposed Terrain North Basin development and the associated channel improvements along McMurdo Gulch and its tributaries. The northern portion of the proposed Terrain development includes Planning Area (PA) PA-8, one (1) culvert crossing, and targeted channel improvements, as detailed on the Proposed Site and Effective FIRM Panel Map in **Appendix A**. Following technical concurrence with the Town of Castle Rock, this FMS will be submitted as a Conditional Letter of Map Revision (CLOMR) to the Federal Emergency Management Agency (FEMA).

This report presents the floodplain modifications proposed as part of the Terrain North Basin Phase II project. This report is intended to accompany the Site Development Plan (SDP) submitted to the Town of Castle Rock for the Terrain North Basin Phase II development.

2. Description of Property

a) General Characteristics

Although the area around McMurdo Gulch (Gulch) is rapidly developing, the Terrain North Basin Phase II site is situated along a generally undeveloped section of the Gulch. Specifically, the site encompasses the portion of the Gulch that flows from just south of the current utility access road crossing to just downstream of the proposed Weststrand St Bridge, which represents approximately 325-feet of total stream length. Slopes through this area are at about 2 percent.

Within this area, native brush and shrubs cover the floodplain overbanks, while the channel is mainly clear with some existing boulder stabilization measures, small pools and riffles, and areas of degradation.

Soils present in the site are categorized as hydrologic soil groups (HSGs) C and D, which indicate soils of typically slow infiltration when thoroughly wetted. A HSG map obtained through the United States Department of Agriculture (USDA) Web Soil Survey (WSS) is included in **Appendix C**.

b) Flood Hazard Zone & Effective Study Information

McMurdo Gulch is a major tributary to Cherry Creek within the Town of Castle Rock, Colorado. The Gulch begins just upstream of State Highway 86 and flows approximately 6.7 miles before reaching its confluence with Cherry Creek. The watershed is approximately 6.5 mi² in area and includes swathes of both developed and natural land of varying topography and landcover.

Significant development is planned and currently underway in the areas immediately surrounding the Gulch. To determine the impacts of development on the local flood hazard zones and assess the change in hydrology due to increase imperviousness, numerous hydrologic and hydraulic studies have been conducted along the Gulch and most of the channel is mapped as Zone AE on the effective Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panels.

The project site boundary is annotated on the effective FIRM panels (08035C0189G, 08035C0193G, 08035C0187G, and 08035C0191G) and on the Proposed Site and Effective FIRM Panel Map in **Appendix A**. Currently, the section of the Gulch that flows through the project site is mapped as

Zone AE, which represents an area of 1% annual chance flood hazard with designated base flood elevations (BFEs), as determined by the original Flood Insurance Study (FIS) for the entire Gulch.

Several channel improvements have recently been constructed along the portion of the Gulch downstream of the proposed site. It should be noted that a Letter of Map Revision (LOMR) for these channel improvements has been completed by Muller Engineering Company (Muller) and the study is currently under review by FEMA (Case No. 19-08-090R). This pending LOMR boundary is also shown on the Proposed Site and Effective FIRM Panel Map in **Appendix A** and has been incorporated into this study appropriately. Tributaries 3 and 4, which are also being analyzed for this study, are currently mapped as Zone A, which represents an area of 1% annual chance flood hazard without designated BFEs.

Since the proposed Terrain North Basin Phase 2 development will impact the currently mapped Zone AE floodplain, a detailed CLOMR will be required following approval of this FMS to remap the effective flood hazard areas for the portion of McMurdo Gulch within the project site boundary, as well as any impacted tributaries. The detailed CLOMR will show that the proposed development does not adversely impact the surrounding insurable structures along McMurdo Gulch.

A floodway encroachment analysis will also be conducted in future submittals to show that the proposed development will not cause any floodway WSEL rises above the standard set forth by the State of Colorado and that the floodway will be appropriately contained within the study boundary.

c) Description of Project

The Terrain North Basin Phase II development includes Planning Area (PA) PA-8, three (3) culvert crossings, and targeted channel improvements. A new crossing over McMurdo Gulch, for the proposed Weststrand St, will be constructed to allow for access to PA-8. Triple reinforced concrete box culverts (RCBs) will be required to pass the 100-year effective flow of 2037.43 cfs. The center barrel has been designed as a 12' x 8' RCB, while the left and right barrels have been designed as 12' x 7' RCBs placed 1-foot higher than the center barrel. It should be noted that this road will replace the current utility access road located just to the south, which will be removed with the construction of this project.

A drop structure will be constructed upstream of the crossing. Riprap and boulders will be placed at the downstream end to manage shear forces and velocities to mitigate potential erosion. Additionally, existing grade control structures have been implemented about 850-ft downstream as a part of a previous project.

III. DRAINAGE DESIGN CRITERIA

a) Regulations

This Floodplain Modification Study (FMS) is in accordance with the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual and the Mile High Flood District (MHFD) Storm Drainage Criteria Manual. These manuals were used as a basis of design for the site and this analysis.

b) Hydrology

For this study, the analyzed flow rates were adopted from the effective FIS and FEMA approved hydraulic model. Table 1 below summarizes these flows as applied within the proposed condition model. To ensure continuity between the proposed condition and effective model, the downstream boundary condition was set to the published water surface elevation (WSEL) at a location sufficiently far downstream beyond the extent of hydraulic impact of the proposed development for each storm event of interest. Table 2 below summarizes the known WSELs utilized for the downstream boundary conditions for the storm events analyzed.

TABLE 1: PROPOSED CONDITION MODEL STEADY FLOW DATA									
RIVER	REACH	CROSS-SECTION	STORM EVENT						
			2-YEAR	5-YEAR	10-YEAR	25-YEAR	50-YEAR	100-YEAR	500-YEAR
McMURDO GULCH	3	26955.67	398.78	678.02	838.12	1280.81	1473.52	1820.75	2386.95
McMURDO GULCH	4	23258.40	432.66	734.91	904.93	1392.7	1602.12	2037.43	2885.84
TRIB 4	Trib 4	533.55	32.79	89.8	121.08	232.46	292.11	409.47	579.79

TABLE 2: DOWNSTREAM BOUNDARY CONDITIONS	
STORM EVENT	KNOWN WSEL (FT)
2-Year	6282.02
5-Year	6282.49
10-Year	6282.64
25-Year	6283.04
50-Year	6283.14
100-Year	6283.35
500-Year	6283.77

c) Hydraulics

Four models were analyzed for the hydraulics component of this study: The Duplicate Effective, Corrected Effective, Existing Condition, and Proposed Condition. For each model, a one-dimensional, standard-step method steady flow analysis was conducted using the Hydrologic Engineering Center's River Analysis System (HEC-RAS) v 6.2 computational software, an open-source program released by the United States Army Corps of Engineers (USACE) in January of 2010.

Although the HEC-RAS models were all run assuming the supercritical, subcritical, and mixed flow regimes to assess the stability and correctness of each model, only the subcritical results were utilized for reporting and mapping purposes.

The following subsections describe the HEC-RAS models analyzed for this study.

Duplicate Effective Model

As previously noted, the effective hydraulic model for the Gulch is the 2020 Sunstone LOMR (20-080649P). Although this model only updated the upstream-most extent of the Gulch, it is the latest approved study to model the Gulch as a whole (i.e. not truncated) and is therefore referred to as the effective model. Per FEMA requirements, the Duplicate Effective Model is an exact copy of the Effective Model truncated to the study area of interest. It has been run in the current HEC-RAS v 6.2.

Corrected Effective Model

One significant error was noted regarding model setup upon review of the portion of the Duplicate Effective Model within the study area. In the effective model, the existing utility access road crossing, which is located just downstream of the confluence of McMurdo Gulch and Tributary 4, was not included in the Effective Model. The Corrected Effective Model adds this crossing to the effective model without any additional edits.

Existing Condition Model

To update the Corrected Effective Model to the current site conditions, cross-sections were updated according to field survey information collected between 2018 and 2021 as necessary. Specifically, cross-sections 23417.48 through 23186.50 along McMurdo Gulch were recut to the available topography data.

The downstream tie-in cross-section along McMurdo Gulch, cross-section 22784.04, did not need to be recut because it is beyond the development extents of the project.

All cross-sections updated by the McMurdo Gulch Priority 1 Reaches LOMR (Case No. 19-08-090R) within the project site were directly incorporated into the model for this analysis because they represent the latest available as-built survey information for that section of the Gulch. In accordance with previous studies a Manning's N-Value of 0.04 was applied to the channel and a value of 0.06 was applied to the overbanks. Channels were determined according to natural grade breaks and changes in land use designation.

Proposed Condition Model

As previously noted, the proposed development incorporates a culvert at the proposed Weststrand St crossing, overbank grading, and one drop structure proposed as a part of the Terrain North Basin Phase II development. Similar to the Existing Condition Model a Manning's N-Value of 0.04 was applied to the channel and a value of 0.06 was applied to the overbanks. For areas of exposed boulders along the proposed drop structure and heavy riprap, a value of 0.075 was applied. All cross-sections recut for the Corrected Effective Model were also recut from the design surface for the proposed condition. Channels were determined according to natural grade breaks of the proposed surface or changes in land use designation.

V. CONCLUSIONS

a) Compliance with Standards

Hydraulic Design

In order to assess the effectiveness of the preliminary proposed channel improvements within the project site, the hydraulic model results were compared to the hydraulic design criteria detailed in Table 12-2 of the Town of Castle Rock SDDTCM (2019), which is included below.

TABLE 3: SDDTCM 2019 TABLE 12-2 HYDRAULIC DESIGN CRITERIA FOR NATURAL CHANNELS		
DESIGN PARAMETER	EROSIVE SOILS OR POOR VEGETATION	EROSION RESISTANT SOILS AND VEGETATION
MAXIMUM 2-YEAR VELOCITY	3.5 ft/s	5.0 ft/s
MAXIMUM 100-YEAR VELOCITY	5.0 ft/s	7.0 ft/s
FROUDE NO., 2-YEAR	0.5	0.7
FROUDE NO., 100-YEAR	0.6	0.8
MAXIMUM TRACTIVE FORCE (SHEAR STRESS), 100-YEAR	0.60 lb/sf	1.0 lb/sf

Although the 2-, 10-, 25-, 50-, 100-, 500-year storm events were all analyzed for this study, the 2- and 100-year were the primary focus of the following results assessment per the Town of Castle standards noted above. Detailed summary results tables for the 2-year and 100-year storm events are included in **Appendix B**. Additionally, a comparison of the Existing and Proposed Condition model 100-year storm event results has also been included.

As evident from the results of the HEC-RAS model, the proposed stabilization design produces notable improvement in the hydraulic characteristics indicative of stream stability at the downstream end of Tributary 3 and the section of McMurdo Gulch that flows through the site. Consistently, the proposed drop structures lowered the shear stress forces and velocities calculated along channels when compared to the Duplicate Effective and Existing Condition results. However, additional opportunity for improvements have been noted and will be discussed with the Town. Specifically, additional opportunity for shear stress and velocity reduction may be achieved with additional floodplain terrace grading in both overbanks of proposed condition cross-sections 20322.38 and 20378.88. Upon finalization of the proposed design, the 500-year floodplain boundary will be mapped and provided to the Town.

Endangered Species Act (ESA)

A Threatened and Endangered Species Review was completed by CORE Consultants, Inc. in March 2020. This assessment determined that two federally threatened species, the Preble's Meadow Jumping Mouse (PMJM) the Ute Ladies'-Tresses Orchid (ULTO), have a low to moderate potential of occurrence within the site. A habitat assessment and trapping surveys were conducted to determine if the PMJM is present within the project site. Ultimately the United States Fish and Wildlife Survey issued a determination of "No Concerns" regarding the PMJM due to Habitat constraints including dysconnectivity and lacking presence of shrubs. CORE also conducted a ULTO Survey in 2020 and confirmed that no ULTO are present within the impact areas of the development. All supporting documentation for ESA compliance can be found in **Appendix C**.

Wetland Impacts and Permitting

McMurdo Gulch contains jurisdictional wetlands and a permit from the United State Army Corps of Engineers (USACE) is required prior to construction. It is anticipated an individual permit will be required for the project.

VII. REFERENCES

TOCR (Town of Castle Rock). June 2019. Storm Drainage Design and Technical Criteria Manual.

MHFD (Mile High Flood District). Revised August 2018. Urban Storm Drainage Criteria Manual. Volume I.

MHFD (Mile High Flood District). Revised September 2017. Urban Storm Drainage Criteria Manual. Volume II.

MHFD (Mile High Flood District). Revised January 2021. Urban Storm Drainage Criteria Manual. Volume III.

Muller Engineering Company. October 2021. McMurdo Gulch Priority 1 Reaches LOMR (Case No. 19-08-0904R).

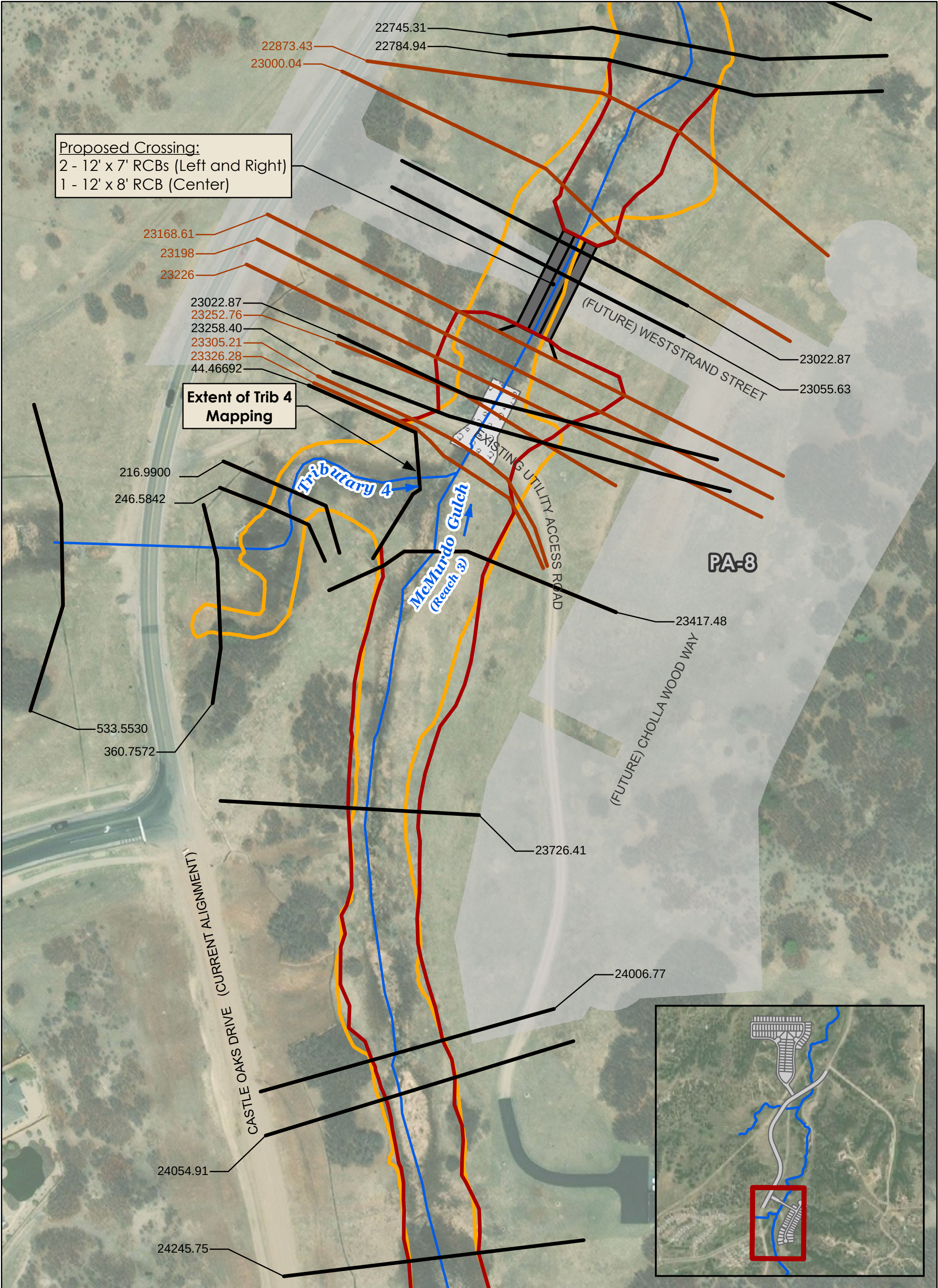
Muller Engineering Company. January 2017. McMurdo Gulch Reach Assessment Memorandum.

NRCS Soil Survey Staff. (Natural Resources Conservation Service). United States Department of Agriculture. Web Soil Survey. Available online at the following link:
<https://websoilsurvey.sc.egov.usda.gov/>. Accessed January 6, 2020.

CORE Consultants, Inc. Effective August 2021. Sunstone LOMR (Case No. 20-08-0649P).

Appendix A

Maps



Terrain North Basin Phase II
2023 FMS
Proposed Condition
Model Work Map

Douglas County, CO

Legend

	Proposed Development (PAs and R.O.W.)		Proposed Condition Model Cross-Section
	Proposed Drop Structure		Proposed Condition 100-Year Floodplain
	Proposed Culvert Crossing		FEMA Effective 100-Year Floodplain
	2-Foot Contour (Proposed Condition)		Proposed Condition Model Streamline

Note: Proposed Condition 500-Year floodplain will be mapped following finalization of the proposed channel improvement design

0 75 150
Feet

Project #: 14-001
Date: 2/2/2023

CORE LAND DEVELOPMENT
ENERGY
PUBLIC INFRASTRUCTURE

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Floodway Data table shown on this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at: <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address

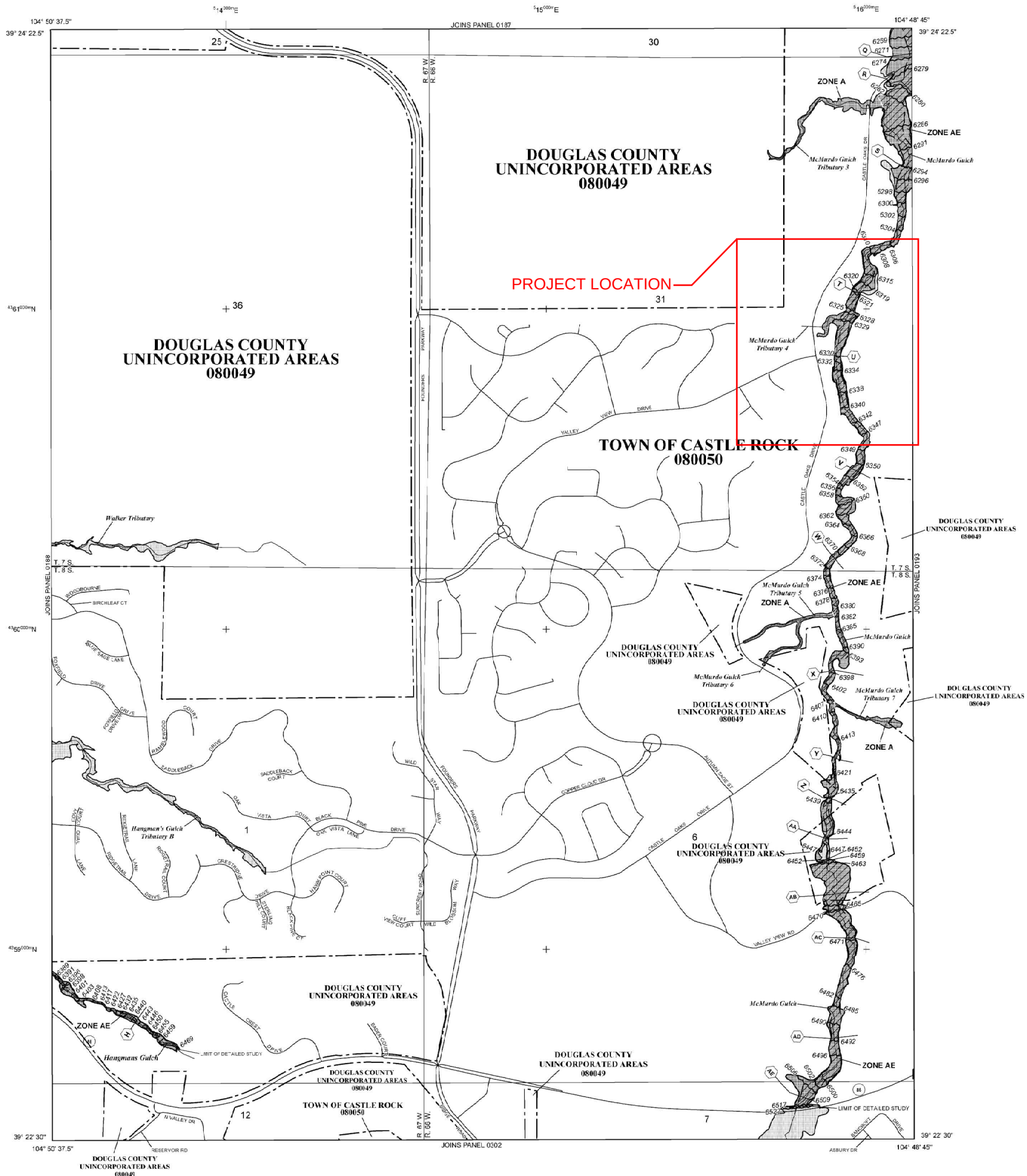
To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at: (301) 713- 3242, or visit its website at <http://www.ngs.noaa.gov>.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

Based on updated topographic information, this map reflects more detailed and up-to-date stream channel configurations and floodplain delineations than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unreviewed streams may differ from what is shown on previous maps.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

If you have questions about this map, how to order products, or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange (FMIX) at 1-877-FEMA-MAP (1-877-335-2627) or visit the FEMA website at <http://www.fema.gov/business/nfip>.



SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AC, AR, A99, V, and VE. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood.

 FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

OTHER AREAS

AREAS WITH HIGH RISK OF UNDESIRABLE OUTCOMES

 OTHERWISE PROTECTED AREAS (OPAs)

0.2% Annual Chance Floodplain Boundary

 Zone D boundary

dividing Special Flood Hazard Areas of different Base Flood Elevation flood depths, or flood velocities.

*Referenced to the North American Vertical Datum of 1988

(23) - - - - (23) Transect line

⁴⁸89⁰⁰N 1000-meter Universal Transverse Mercator grid values, zone 13

• M1.5 River Mile

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP

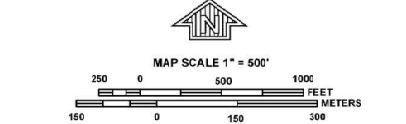
SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MARCH 16, 2016: to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names to reflect updated topographic information, to incorporate previously issued letters of map revision

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-300-638-6620.



PANEL 189 OF 495
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

<u>CONTAINS:</u>			
<u>COMMUNITY</u>	<u>NUMBER</u>	<u>PANEL</u>	<u>SUFFIX</u>
CASTLE ROCK, TOWN OF	C80053	0189	G
DOUGLAS COUNTY	C80049	0189	G

should be used when placing map orders; the

used on insurance applications for the subject community.

DEPARTMENT OF THE ARMY
MAP NUMBER 08035C0189G

MAP REVISED
MARCH 10, 2010

Federal Emergency Management Agency

Appendix B

Hydraulic Results

Duplicate Effective Subcritical Detailed Results Table													
River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Trib 4	Trib 4	533.553	2-Year	32.79	6339.1	6341.55	6340.1	6341.56	0.000311	0.7	47.05	42.13	0.12
Trib 4	Trib 4	533.553	5-Year	89.8	6339.1	6343.41	6340.71	6343.41	0.000084	0.56	161.23	76.04	0.07
Trib 4	Trib 4	533.553	10-Year	121.08	6339.1	6344.26	6340.9	6344.27	0.000055	0.53	230.51	85.98	0.06
Trib 4	Trib 4	533.553	25-Year	232.46	6339.1	6347.75	6341.37	6347.76	0.000012	0.41	592.16	121.59	0.03
Trib 4	Trib 4	533.553	50-Year	292.11	6339.1	6350.83	6341.59	6350.83	0.000004	0.32	1029.22	165.29	0.02
Trib 4	Trib 4	533.553	100-Year	409.47	6339.1	6353.37	6341.9	6353.37	0.000003	0.33	1500.61	208.79	0.02
Trib 4	Trib 4	533.553	500-Year	579.79	6339.1	6353.97	6342.26	6353.98	0.000005	0.44	1630.3	219.24	0.02
Trib 4	Trib 4	473.1134	Culvert										
Trib 4	Trib 4	360.7572	2-Year	32.79	6332.02	6332.68	6332.68	6332.93	0.030199	3.98	8.23	16.87	1.01
Trib 4	Trib 4	360.7572	5-Year	89.8	6332.02	6333.16	6333.16	6333.58	0.025379	5.17	17.37	21.04	1
Trib 4	Trib 4	360.7572	10-Year	121.08	6332.02	6333.36	6333.36	6333.85	0.024041	5.59	21.66	22.37	1
Trib 4	Trib 4	360.7572	25-Year	232.46	6332.02	6333.92	6333.92	6334.6	0.021826	6.61	35.14	26.12	1.01
Trib 4	Trib 4	360.7572	50-Year	292.11	6332.02	6334.16	6334.16	6334.92	0.021109	7	41.75	27.77	1.01
Trib 4	Trib 4	360.7572	100-Year	409.47	6332.02	6334.55	6334.55	6335.49	0.019233	7.76	53.12	30.16	1
Trib 4	Trib 4	360.7572	500-Year	579.79	6332.02	6335.06	6335.06	6336.2	0.017113	8.59	69.31	33.23	0.98
Trib 4	Trib 4	246.5842	2-Year	32.79	6328	6329.02	6328.64	6329.08	0.004418	1.99	16.5	22.71	0.41
Trib 4	Trib 4	246.5842	5-Year	89.8	6328	6329.61	6329.08	6329.74	0.005168	2.84	31.6	28.49	0.48
Trib 4	Trib 4	246.5842	10-Year	121.08	6328	6329.85	6329.27	6330	0.00522	3.14	38.6	30.91	0.49
Trib 4	Trib 4	246.5842	25-Year	232.46	6328	6330.48	6329.79	6330.72	0.005032	3.99	60.23	38.08	0.51
Trib 4	Trib 4	246.5842	50-Year	292.11	6328	6330.7		6331	0.005346	4.44	69.24	40.84	0.54
Trib 4	Trib 4	246.5842	100-Year	409.47	6328	6331	6330.38	6331.44	0.006605	5.39	82.29	46.36	0.61
Trib 4	Trib 4	246.5842	500-Year	579.79	6328	6331.29	6330.86	6331.97	0.00883	6.72	96.43	51.83	0.72
Trib 4	Trib 4	216.99	2-Year	32.79	6328	6328.56	6328.56	6328.79	0.030173	3.87	8.47	18.12	1
Trib 4	Trib 4	216.99	5-Year	89.8	6328	6329.01	6329.01	6329.42	0.025532	5.1	17.62	21.89	1
Trib 4	Trib 4	216.99	10-Year	121.08	6328	6329.2	6329.2	6329.68	0.024566	5.53	21.9	23.39	1.01
Trib 4	Trib 4	216.99	25-Year	232.46	6328	6329.74	6329.74	6330.41	0.021437	6.58	35.54	28.78	1
Trib 4	Trib 4	216.99	50-Year	292.11	6328	6330.1	6330.1	6330.73	0.014631	6.38	50.52	59.95	0.86
Trib 4	Trib 4	216.99	100-Year	409.47	6328	6330.48	6330.48	6331.15	0.012839	6.83	74.7	67.01	0.83
Trib 4	Trib 4	216.99	500-Year	579.79	6328	6330.88	6330.88	6331.65	0.012553	7.57	102.24	74.09	0.85
Trib 4	Trib 4	44.46692	2-Year	32.79	6323.91	6327.17		6327.18	0.000021	0.25	129.1	69.46	0.03

Trib 4	Trib 4	44.46692 5-Year	89.8	6323.91	6327.76		6327.77	0.00007	0.52	172.62	78.95	0.06
Trib 4	Trib 4	44.46692 10-Year	121.08	6323.91	6328.04		6328.04	0.000089	0.62	195.9	103.93	0.07
Trib 4	Trib 4	44.46692 25-Year	232.46	6323.91	6328.7		6328.72	0.000138	0.91	273.84	129.36	0.09
Trib 4	Trib 4	44.46692 50-Year	292.11	6323.91	6328.95		6328.97	0.000164	1.05	307.41	139.81	0.1
Trib 4	Trib 4	44.46692 100-Year	409.47	6323.91	6329.42		6329.44	0.000197	1.26	375.95	154.57	0.11
Trib 4	Trib 4	44.46692 500-Year	579.79	6323.91	6330.2		6330.23	0.000191	1.4	505.71	176.31	0.12
McMurdo Gulch	REACH 3	24245.75 2-Year	398.78	6336	6337.72		6338.11	0.012405	5	79.96	60.93	0.76
McMurdo Gulch	REACH 3	24245.75 5-Year	678.02	6336	6338.2	6337.98	6338.8	0.012916	6.22	110.68	67.16	0.82
McMurdo Gulch	REACH 3	24245.75 10-Year	838.12	6336	6338.43	6338.22	6339.14	0.013115	6.79	126.35	69.1	0.84
McMurdo Gulch	REACH 3	24245.75 25-Year	1280.81	6336	6338.99	6338.82	6339.98	0.013279	8.04	166.41	73.83	0.88
McMurdo Gulch	REACH 3	24245.75 50-Year	1473.52	6336	6339.21	6339.05	6340.31	0.013172	8.47	183.28	75.72	0.89
McMurdo Gulch	REACH 3	24245.75 100-Year	1820.75	6336	6339.59	6339.45	6340.85	0.013078	9.17	212	78.84	0.91
McMurdo Gulch	REACH 3	24245.75 500-Year	2386.95	6336	6340.15	6340.03	6341.67	0.012749	10.09	257.5	83.49	0.92
McMurdo Gulch	REACH 3	24054.91 2-Year	398.78	6332.09	6334.34	6334.34	6335.01	0.021675	6.56	60.93	47.71	1.01
McMurdo Gulch	REACH 3	24054.91 5-Year	678.02	6332.09	6334.92	6334.92	6335.84	0.018517	7.72	89.85	52.76	0.99
McMurdo Gulch	REACH 3	24054.91 10-Year	838.12	6332.09	6335.21	6335.21	6336.25	0.017301	8.21	105.75	55.38	0.98
McMurdo Gulch	REACH 3	24054.91 25-Year	1280.81	6332.09	6335.92	6335.92	6337.23	0.015267	9.31	147.32	61.45	0.96
McMurdo Gulch	REACH 3	24054.91 50-Year	1473.52	6332.09	6336.19	6336.19	6337.61	0.014798	9.72	164.18	63.65	0.96
McMurdo Gulch	REACH 3	24054.91 100-Year	1820.75	6332.09	6336.65	6336.65	6338.24	0.013984	10.34	194.38	67.36	0.96
McMurdo Gulch	REACH 3	24054.91 500-Year	2386.95	6332.09	6337.32	6337.32	6339.16	0.013137	11.22	241.37	73.13	0.95
McMurdo Gulch	REACH 3	24006.77 2-Year	398.78	6330.11	6333		6333.4	0.007566	5.04	79.3	41.23	0.63
McMurdo Gulch	REACH 3	24006.77 5-Year	678.02	6330.11	6333.71		6334.31	0.007964	6.22	110.75	47.19	0.68
McMurdo Gulch	REACH 3	24006.77 10-Year	838.12	6330.11	6334.03		6334.75	0.008271	6.84	126.09	50.53	0.71
McMurdo Gulch	REACH 3	24006.77 25-Year	1280.81	6330.11	6334.75	6334.23	6335.79	0.009018	8.27	165.47	59.3	0.76
McMurdo Gulch	REACH 3	24006.77 50-Year	1473.52	6330.11	6335.01	6334.55	6336.19	0.009342	8.82	181.4	62.67	0.79
McMurdo Gulch	REACH 3	24006.77 100-Year	1820.75	6330.11	6335.41	6335.09	6336.83	0.010012	9.75	207.84	67.97	0.83
McMurdo Gulch	REACH 3	24006.77 500-Year	2386.95	6330.11	6336.02	6335.86	6337.78	0.010601	10.96	251.89	76.62	0.87
McMurdo Gulch	REACH 3	23726.41 2-Year	398.78	6326.27	6329.24	6329.24	6330.06	0.02063	7.29	54.7	33.84	1.01
McMurdo Gulch	REACH 3	23726.41 5-Year	678.02	6326.27	6329.96	6329.96	6331.05	0.017847	8.39	82.16	41.7	0.99
McMurdo Gulch	REACH 3	23726.41 10-Year	838.12	6326.27	6330.33	6330.33	6331.54	0.016317	8.87	98.05	46.17	0.97
McMurdo Gulch	REACH 3	23726.41 25-Year	1280.81	6326.27	6331.2	6331.2	6332.66	0.013763	9.87	143.21	57.77	0.93
McMurdo Gulch	REACH 3	23726.41 50-Year	1473.52	6326.27	6331.53	6331.53	6333.08	0.013028	10.21	163.28	62.22	0.92
McMurdo Gulch	REACH 3	23726.41 100-Year	1820.75	6326.27	6332.09	6332.09	6333.75	0.011952	10.72	199.93	69.08	0.91
McMurdo Gulch	REACH 3	23726.41 500-Year	2386.95	6326.27	6332.81	6332.81	6334.7	0.01138	11.59	252.41	75.39	0.91

McMurdo Gulch	REACH 3	23417.48	2-Year	398.78	6322.16	6327.26		6327.31	0.000443	1.77	227.2	73.26	0.17
McMurdo Gulch	REACH 3	23417.48	5-Year	678.02	6322.16	6327.89		6327.99	0.000727	2.54	275.72	81.32	0.22
McMurdo Gulch	REACH 3	23417.48	10-Year	838.12	6322.16	6328.18		6328.31	0.000876	2.92	299.95	85.63	0.25
McMurdo Gulch	REACH 3	23417.48	25-Year	1280.81	6322.16	6328.86		6329.08	0.001229	3.81	362.44	96.57	0.3
McMurdo Gulch	REACH 3	23417.48	50-Year	1473.52	6322.16	6329.11		6329.37	0.001372	4.15	386.95	101.08	0.32
McMurdo Gulch	REACH 3	23417.48	100-Year	1820.75	6322.16	6329.56		6329.89	0.001562	4.68	434.49	109.6	0.34
McMurdo Gulch	REACH 3	23417.48	500-Year	2386.95	6322.16	6330.31		6330.73	0.001711	5.31	522.36	124.84	0.37
McMurdo Gulch	REACH 4	23258.4	2-Year	432.66	6325.08	6326.56	6326.56	6327.03	0.024467	5.5	78.73	85.5	1.01
McMurdo Gulch	REACH 4	23258.4	5-Year	734.91	6325.08	6326.98	6326.98	6327.58	0.022354	6.23	118.13	102.26	1.01
McMurdo Gulch	REACH 4	23258.4	10-Year	904.93	6325.08	6327.17	6327.17	6327.85	0.020869	6.63	137.71	109.4	1
McMurdo Gulch	REACH 4	23258.4	25-Year	1392.7	6325.08	6327.64	6327.64	6328.5	0.017958	7.49	194	127.62	0.97
McMurdo Gulch	REACH 4	23258.4	50-Year	1602.12	6325.08	6327.83	6327.83	6328.75	0.017093	7.79	218.08	134.84	0.96
McMurdo Gulch	REACH 4	23258.4	100-Year	2037.43	6325.08	6328.19	6328.19	6329.21	0.01548	8.26	269.39	148.11	0.94
McMurdo Gulch	REACH 4	23258.4	500-Year	2885.84	6325.08	6328.77	6328.77	6329.99	0.014187	9.14	360.55	167.19	0.93
McMurdo Gulch	REACH 4	23225.16	2-Year	432.66	6320	6322.59		6323.22	0.013951	6.34	68.24	38.75	0.84
McMurdo Gulch	REACH 4	23225.16	5-Year	734.91	6320	6323.21	6323.15	6324.16	0.016613	7.85	93.66	44.37	0.95
McMurdo Gulch	REACH 4	23225.16	10-Year	904.93	6320	6323.45	6323.45	6324.61	0.017963	8.67	104.66	46.66	1
McMurdo Gulch	REACH 4	23225.16	25-Year	1392.7	6320	6324.26	6324.26	6325.74	0.01561	9.78	146.7	57.42	0.98
McMurdo Gulch	REACH 4	23225.16	50-Year	1602.12	6320	6324.61	6324.61	6326.16	0.014342	10.06	167.85	65.15	0.95
McMurdo Gulch	REACH 4	23225.16	100-Year	2037.43	6320	6325.3	6325.3	6326.93	0.01204	10.41	218.37	80.33	0.9
McMurdo Gulch	REACH 4	23225.16	500-Year	2885.84	6320	6326.27	6326.27	6328.15	0.011005	11.44	305.95	103.58	0.89
McMurdo Gulch	REACH 4	23055.63	2-Year	432.66	6317.82	6319.65	6319.65	6320.29	0.021865	6.45	67.06	52.36	1.01
McMurdo Gulch	REACH 4	23055.63	5-Year	734.91	6317.82	6320.22	6320.22	6321.07	0.019742	7.4	99.73	62.06	1
McMurdo Gulch	REACH 4	23055.63	10-Year	904.93	6317.82	6320.48	6320.48	6321.44	0.018467	7.87	116.56	66.33	0.99
McMurdo Gulch	REACH 4	23055.63	25-Year	1392.7	6317.82	6321.15	6321.15	6322.36	0.015902	8.89	164.72	76.49	0.97
McMurdo Gulch	REACH 4	23055.63	50-Year	1602.12	6317.82	6321.42	6321.42	6322.71	0.014973	9.21	185.79	79.99	0.95
McMurdo Gulch	REACH 4	23055.63	100-Year	2037.43	6317.82	6321.9	6321.9	6323.36	0.014103	9.89	225.19	84.91	0.95
McMurdo Gulch	REACH 4	23055.63	500-Year	2885.84	6317.82	6322.69	6322.69	6324.47	0.013241	11.03	296.09	95.01	0.95
McMurdo Gulch	REACH 4	23022.87	2-Year	432.66	6316.14	6318.57	6318.57	6319.25	0.021691	6.63	65.22	48.42	1.01
McMurdo Gulch	REACH 4	23022.87	5-Year	734.91	6316.14	6319.17	6319.17	6320.07	0.019302	7.62	97.07	57.48	1
McMurdo Gulch	REACH 4	23022.87	10-Year	904.93	6316.14	6319.45	6319.45	6320.47	0.018188	8.08	114.08	62.52	0.99
McMurdo Gulch	REACH 4	23022.87	25-Year	1392.7	6316.14	6320.21	6320.21	6321.42	0.014738	8.94	167.44	78.36	0.94
McMurdo Gulch	REACH 4	23022.87	50-Year	1602.12	6316.14	6320.47	6320.47	6321.77	0.014159	9.3	188.28	80.5	0.93

McMurdo Gulch	REACH 4	23022.87	100-Year	2037.43	6316.14	6320.95	6320.95	6322.43	0.013559	10.02	227.71	84.33	0.94
McMurdo Gulch	REACH 4	23022.87	500-Year	2885.84	6316.14	6321.75	6321.75	6323.54	0.012898	11.19	298.15	91.17	0.94
McMurdo Gulch	REACH 4	22784.94	2-Year	432.66	6312	6313.16		6313.46	0.01261	4.38	99.29	93.56	0.74
McMurdo Gulch	REACH 4	22784.94	5-Year	734.91	6312	6313.55		6314.01	0.013292	5.42	136.94	98.42	0.8
McMurdo Gulch	REACH 4	22784.94	10-Year	904.93	6312	6313.73		6314.27	0.013587	5.93	154.59	100.21	0.83
McMurdo Gulch	REACH 4	22784.94	25-Year	1392.7	6312	6314.16	6314.01	6314.95	0.014341	7.14	199.03	104.09	0.88
McMurdo Gulch	REACH 4	22784.94	50-Year	1602.12	6312	6314.32	6314.2	6315.21	0.014803	7.62	215.26	104.98	0.91
McMurdo Gulch	REACH 4	22784.94	100-Year	2037.43	6312	6314.59	6314.55	6315.72	0.016204	8.61	243.56	106.5	0.97
McMurdo Gulch	REACH 4	22784.94	500-Year	2885.84	6312	6315.17	6315.17	6316.63	0.015721	9.78	306.94	109.84	0.99
McMurdo Gulch	REACH 4	22745.31	2-Year	432.66	6310.51	6312.31	6312.31	6312.76	0.02474	5.41	79.97	89.58	1.01
McMurdo Gulch	REACH 4	22745.31	5-Year	734.91	6310.51	6312.69	6312.69	6313.32	0.022014	6.35	115.94	96.04	1.01
McMurdo Gulch	REACH 4	22745.31	10-Year	904.93	6310.51	6312.88	6312.88	6313.6	0.020817	6.78	134.48	99.07	1
McMurdo Gulch	REACH 4	22745.31	25-Year	1392.7	6310.51	6313.36	6313.36	6314.29	0.01859	7.76	183.49	106.2	0.99
McMurdo Gulch	REACH 4	22745.31	50-Year	1602.12	6310.51	6313.55	6313.55	6314.56	0.017808	8.09	203.88	109.03	0.99
McMurdo Gulch	REACH 4	22745.31	100-Year	2037.43	6310.51	6313.92	6313.92	6315.07	0.016563	8.69	244.89	114.74	0.98
McMurdo Gulch	REACH 4	22745.31	500-Year	2885.84	6310.51	6314.55	6314.55	6315.96	0.015077	9.66	320.61	125.8	0.97
McMurdo Gulch	REACH 4	22509.23	2-Year	432.66	6306	6308.83		6309.05	0.005411	3.8	113.93	69.23	0.52
McMurdo Gulch	REACH 4	22509.23	5-Year	734.91	6306	6309.44		6309.77	0.00605	4.61	159.6	79.66	0.57
McMurdo Gulch	REACH 4	22509.23	10-Year	904.93	6306	6309.7		6310.09	0.006169	5.01	181.18	84.19	0.59
McMurdo Gulch	REACH 4	22509.23	25-Year	1392.7	6306	6310.38		6310.92	0.00605	5.91	241.04	92.71	0.61
McMurdo Gulch	REACH 4	22509.23	50-Year	1602.12	6306	6310.65		6311.24	0.005904	6.19	266.83	95.59	0.61
McMurdo Gulch	REACH 4	22509.23	100-Year	2037.43	6306	6311.18		6311.87	0.00566	6.71	318.61	101.19	0.61
McMurdo Gulch	REACH 4	22509.23	500-Year	2885.84	6306	6312.13		6312.96	0.005141	7.44	420.26	112.8	0.61
McMurdo Gulch	REACH 4	22408.41	2-Year	432.66	6305.72	6307.87		6308.26	0.01184	4.99	86.78	62.79	0.75
McMurdo Gulch	REACH 4	22408.41	5-Year	734.91	6305.72	6308.61		6309.02	0.009075	5.14	142.97	80.89	0.68
McMurdo Gulch	REACH 4	22408.41	10-Year	904.93	6305.72	6308.93		6309.37	0.008205	5.35	169.03	83.35	0.66
McMurdo Gulch	REACH 4	22408.41	25-Year	1392.7	6305.72	6309.75		6310.27	0.006673	5.8	240.1	89.72	0.63
McMurdo Gulch	REACH 4	22408.41	50-Year	1602.12	6305.72	6310.07		6310.62	0.00621	5.95	269.23	92.04	0.61
McMurdo Gulch	REACH 4	22408.41	100-Year	2037.43	6305.72	6310.68		6311.29	0.005359	6.27	326.19	95.35	0.59
McMurdo Gulch	REACH 4	22408.41	500-Year	2885.84	6305.72	6311.73		6312.45	0.004501	6.83	429.14	101.05	0.56
McMurdo Gulch	REACH 4	22371.4	2-Year	432.66	6304.13	6307.46	6307.02	6307.85	0.009978	5.03	85.99	53.87	0.7
McMurdo Gulch	REACH 4	22371.4	5-Year	734.91	6304.13	6308.1	6307.68	6308.65	0.010321	5.96	123.47	63.28	0.74
McMurdo Gulch	REACH 4	22371.4	10-Year	904.93	6304.13	6308.36	6307.96	6309.01	0.010366	6.49	140.4	65.58	0.76

McMurdo Gulch	REACH 4	22371.4	25-Year	1392.7	6304.13	6308.99	6308.61	6309.92	0.010696	7.76	183.64	71.02	0.8
McMurdo Gulch	REACH 4	22371.4	50-Year	1602.12	6304.13	6309.23	6308.91	6310.27	0.010757	8.21	201.16	73.02	0.82
McMurdo Gulch	REACH 4	22371.4	100-Year	2037.43	6304.13	6309.71	6309.35	6310.95	0.010687	9	237.08	76.96	0.83
McMurdo Gulch	REACH 4	22371.4	500-Year	2885.84	6304.13	6310.55	6310.2	6312.12	0.010387	10.19	304.27	83.25	0.85
McMurdo Gulch	REACH 4	22043.6	2-Year	432.66	6300.85	6302.51	6302.51	6303.22	0.021235	6.75	64.14	45.58	1
McMurdo Gulch	REACH 4	22043.6	5-Year	734.91	6300.85	6303.13	6303.13	6304.09	0.019318	7.87	93.38	49.04	1
McMurdo Gulch	REACH 4	22043.6	10-Year	904.93	6300.85	6303.42	6303.42	6304.52	0.018538	8.41	107.83	50.76	1
McMurdo Gulch	REACH 4	22043.6	25-Year	1392.7	6300.85	6304.17	6304.17	6305.59	0.016371	9.56	147.72	55.05	0.99
McMurdo Gulch	REACH 4	22043.6	50-Year	1602.12	6300.85	6304.46	6304.46	6306	0.015738	9.98	163.72	56.21	0.98
McMurdo Gulch	REACH 4	22043.6	100-Year	2037.43	6300.85	6305	6305	6306.79	0.01489	10.79	194.94	58.4	0.98
McMurdo Gulch	REACH 4	22043.6	500-Year	2885.84	6300.85	6305.96	6305.96	6308.16	0.01372	12.04	252.35	62.26	0.98
McMurdo Gulch	REACH 4	21826.79	2-Year	432.66	6298	6299.87		6300.1	0.005431	3.86	112.03	66.36	0.52
McMurdo Gulch	REACH 4	21826.79	5-Year	734.91	6298	6300.32		6300.74	0.007206	5.14	143.02	68.79	0.63
McMurdo Gulch	REACH 4	21826.79	10-Year	904.93	6298	6300.63		6301.1	0.006972	5.53	164.04	70.06	0.63
McMurdo Gulch	REACH 4	21826.79	25-Year	1392.7	6298	6301.19		6301.93	0.008139	6.88	204.28	72.42	0.7
McMurdo Gulch	REACH 4	21826.79	50-Year	1602.12	6298	6301.39		6302.24	0.00863	7.4	219.01	73.26	0.73
McMurdo Gulch	REACH 4	21826.79	100-Year	2037.43	6298	6301.76		6302.86	0.009654	8.42	246.12	74.79	0.79
McMurdo Gulch	REACH 4	21826.79	500-Year	2885.84	6298	6302.26	6302.06	6303.93	0.012364	10.41	284.14	76.87	0.91
McMurdo Gulch	REACH 4	21777.38	2-Year	432.66	6298	6299.07	6299.07	6299.58	0.023634	5.72	75.63	75.2	1.01
McMurdo Gulch	REACH 4	21777.38	5-Year	734.91	6298	6299.75		6300.26	0.012833	5.75	127.9	79.71	0.8
McMurdo Gulch	REACH 4	21777.38	10-Year	904.93	6298	6299.73	6299.73	6300.52	0.020144	7.15	126.5	79.6	1
McMurdo Gulch	REACH 4	21777.38	25-Year	1392.7	6298	6300.26	6300.26	6301.31	0.018419	8.25	169.24	82.41	1
McMurdo Gulch	REACH 4	21777.38	50-Year	1602.12	6298	6300.47	6300.47	6301.62	0.017735	8.63	186.66	83.49	1
McMurdo Gulch	REACH 4	21777.38	100-Year	2037.43	6298	6300.87	6300.87	6302.22	0.016684	9.32	220.96	85.58	1
McMurdo Gulch	REACH 4	21777.38	500-Year	2885.84	6298	6301.6	6301.6	6303.26	0.014991	10.35	285.2	90.16	0.98
McMurdo Gulch	REACH 4	21417.19	2-Year	432.66	6292	6293.24	6293.24	6293.73	0.02375	5.63	76.92	78.88	1
McMurdo Gulch	REACH 4	21417.19	5-Year	734.91	6292	6293.68	6293.68	6294.33	0.021777	6.47	113.71	90.19	1.01
McMurdo Gulch	REACH 4	21417.19	10-Year	904.93	6292	6293.87	6293.87	6294.61	0.020547	6.9	131.98	97.07	1
McMurdo Gulch	REACH 4	21417.19	25-Year	1392.7	6292	6294.56	6294.56	6295.22	0.011685	6.72	256.75	239.76	0.8
McMurdo Gulch	REACH 4	21417.19	50-Year	1602.12	6292	6294.71	6294.71	6295.4	0.011575	7	293.21	241.96	0.81
McMurdo Gulch	REACH 4	21417.19	100-Year	2037.43	6292	6294.98	6294.98	6295.75	0.011754	7.58	357.25	245.58	0.83
McMurdo Gulch	REACH 4	21417.19	500-Year	2885.84	6292	6295.41	6295.41	6296.33	0.012098	8.52	464.17	251.5	0.86
McMurdo Gulch	REACH 4	21370.41	2-Year	432.66	6290.52	6292.4	6292.25	6292.77	0.015871	4.9	88.25	82.2	0.83

McMurdo Gulch	REACH 4	21370.41	5-Year	734.91	6290.52	6292.82	6292.72	6293.34	0.016217	5.83	129.35	124.84	0.88
McMurdo Gulch	REACH 4	21370.41	10-Year	904.93	6290.52	6292.93	6292.93	6293.6	0.01863	6.59	143.87	131.51	0.95
McMurdo Gulch	REACH 4	21370.41	25-Year	1392.7	6290.52	6293.43	6293.43	6294.22	0.015502	7.29	216.96	162	0.91
McMurdo Gulch	REACH 4	21370.41	50-Year	1602.12	6290.52	6293.61	6293.61	6294.44	0.014889	7.56	246.54	171.89	0.91
McMurdo Gulch	REACH 4	21370.41	100-Year	2037.43	6290.52	6293.93	6293.93	6294.86	0.014072	8.07	304.93	186.17	0.9
McMurdo Gulch	REACH 4	21370.41	500-Year	2885.84	6290.52	6294.48	6294.48	6295.52	0.012749	8.77	417.22	212.12	0.89
McMurdo Gulch	REACH 4	21133.42	2-Year	432.66	6288	6289.23		6289.48	0.012015	3.95	109.55	116.73	0.71
McMurdo Gulch	REACH 4	21133.42	5-Year	734.91	6288	6289.58		6289.95	0.012423	4.92	152.16	132.75	0.76
McMurdo Gulch	REACH 4	21133.42	10-Year	904.93	6288	6289.74		6290.18	0.01244	5.34	174.97	139.49	0.78
McMurdo Gulch	REACH 4	21133.42	25-Year	1392.7	6288	6290.15	6289.96	6290.76	0.012485	6.31	234.7	150.36	0.81
McMurdo Gulch	REACH 4	21133.42	50-Year	1602.12	6288	6290.31	6290.13	6290.98	0.012557	6.67	257.7	152.54	0.83
McMurdo Gulch	REACH 4	21133.42	100-Year	2037.43	6288	6290.59	6290.43	6291.39	0.012741	7.33	301.85	156.59	0.85
McMurdo Gulch	REACH 4	21133.42	500-Year	2885.84	6288	6291.06	6290.94	6292.11	0.013296	8.47	376.64	163.22	0.9
McMurdo Gulch	REACH 4	21063.55	2-Year	432.66	6286	6287.77	6287.77	6288.31	0.023497	5.86	73.83	70.61	1.01
McMurdo Gulch	REACH 4	21063.55	5-Year	734.91	6286	6288.3	6288.3	6288.9	0.017726	6.28	125.96	126.1	0.92
McMurdo Gulch	REACH 4	21063.55	10-Year	904.93	6286	6288.5	6288.5	6289.16	0.016661	6.64	152.11	135.68	0.92
McMurdo Gulch	REACH 4	21063.55	25-Year	1392.7	6286	6288.97	6288.97	6289.77	0.015065	7.49	222.13	158.44	0.91
McMurdo Gulch	REACH 4	21063.55	50-Year	1602.12	6286	6289.15	6289.15	6290	0.014621	7.79	251.07	167.2	0.91
McMurdo Gulch	REACH 4	21063.55	100-Year	2037.43	6286	6289.47	6289.47	6290.43	0.014127	8.36	307.9	183.01	0.91
McMurdo Gulch	REACH 4	21063.55	500-Year	2885.84	6286	6289.99	6289.99	6291.13	0.013946	9.37	408.75	210.04	0.93
McMurdo Gulch	REACH 4	20884.87	2-Year	432.66	6282	6284.59	6284.11	6284.86	0.005991	4.24	118.14	170.59	0.56
McMurdo Gulch	REACH 4	20884.87	5-Year	734.91	6282	6285.17	6284.68	6285.4	0.004388	4.37	269.72	267.49	0.5
McMurdo Gulch	REACH 4	20884.87	10-Year	904.93	6282	6284.97	6284.94	6285.65	0.012408	6.94	163.73	232.27	0.83
McMurdo Gulch	REACH 4	20884.87	25-Year	1392.7	6282	6285.45	6285.39	6285.94	0.008704	6.63	347.62	279.59	0.72
McMurdo Gulch	REACH 4	20884.87	50-Year	1602.12	6282	6285.55	6285.49	6286.1	0.009473	7.09	376.36	283.55	0.75
McMurdo Gulch	REACH 4	20884.87	100-Year	2037.43	6282	6285.8	6285.74	6286.4	0.009896	7.67	447.14	292.76	0.78
McMurdo Gulch	REACH 4	20884.87	500-Year	2885.84	6282	6286.22	6286.13	6286.92	0.010221	8.51	573.77	304.72	0.81
McMurdo Gulch	REACH 4	20842.12	2-Year	432.66	6282	6283.98	6283.8	6284.47	0.014046	5.58	77.59	54.2	0.82
McMurdo Gulch	REACH 4	20842.12	5-Year	734.91	6282	6284.5	6284.47	6285.08	0.01224	6.38	143.95	255.52	0.81
McMurdo Gulch	REACH 4	20842.12	10-Year	904.93	6282	6284.72	6284.72	6285.14	0.009138	5.92	245.85	278.81	0.71
McMurdo Gulch	REACH 4	20842.12	25-Year	1392.7	6282	6285.02	6285.02	6285.56	0.010703	6.99	331.12	284.54	0.79
McMurdo Gulch	REACH 4	20842.12	50-Year	1602.12	6282	6285.16	6285.14	6285.71	0.010486	7.19	372.58	287.28	0.78
McMurdo Gulch	REACH 4	20842.12	100-Year	2037.43	6282	6285.45	6285.37	6286.01	0.009903	7.49	456.11	292.59	0.78
McMurdo Gulch	REACH 4	20842.12	500-Year	2885.84	6282	6285.88	6285.69	6286.52	0.010094	8.28	582.06	300.24	0.8

McMurdo Gulch	REACH 4	20645.9 2-Year	432.66	6280	6282.02	6281.6	6282.28	0.008527	4.12	104.98	79.55	0.63
McMurdo Gulch	REACH 4	20645.9 5-Year	734.91	6280	6282.49	6282.12	6282.88	0.01008	4.98	151.45	178.25	0.71
McMurdo Gulch	REACH 4	20645.9 10-Year	904.93	6280	6282.64	6282.35	6283.11	0.011028	5.54	174.56	220.15	0.75
McMurdo Gulch	REACH 4	20645.9 25-Year	1392.7	6280	6283.04	6282.98	6283.57	0.010394	6.19	293.65	271.01	0.75
McMurdo Gulch	REACH 4	20645.9 50-Year	1602.12	6280	6283.14	6283.14	6283.74	0.0112	6.63	320.89	273.16	0.79
McMurdo Gulch	REACH 4	20645.9 100-Year	2037.43	6280	6283.35	6283.35	6284.05	0.012016	7.31	379.79	277.58	0.83
McMurdo Gulch	REACH 4	20645.9 500-Year	2885.84	6280	6283.77	6283.76	6284.58	0.011983	8.12	496.89	285.22	0.85
McMurdo Gulch	REACH 4	20884.87 100-Year	2037.43	6282	6285.8	6285.74	6286.4	0.009896	7.67	447.14	292.76	0.78
McMurdo Gulch	REACH 4	20884.87 500-Year	2885.84	6282	6286.22	6286.13	6286.92	0.010221	8.51	573.77	304.72	0.81
McMurdo Gulch	REACH 4	20842.12 2-Year	432.66	6282	6283.98	6283.8	6284.47	0.014046	5.58	77.59	54.2	0.82
McMurdo Gulch	REACH 4	20842.12 5-Year	734.91	6282	6284.5	6284.47	6285.08	0.01224	6.38	143.95	255.52	0.81
McMurdo Gulch	REACH 4	20842.12 10-Year	904.93	6282	6284.72	6284.72	6285.14	0.009138	5.92	245.85	278.81	0.71
McMurdo Gulch	REACH 4	20842.12 25-Year	1392.7	6282	6285.02	6285.02	6285.56	0.010703	6.99	331.12	284.54	0.79
McMurdo Gulch	REACH 4	20842.12 50-Year	1602.12	6282	6285.16	6285.14	6285.71	0.010486	7.19	372.58	287.28	0.78
McMurdo Gulch	REACH 4	20842.12 100-Year	2037.43	6282	6285.45	6285.37	6286.01	0.009903	7.49	456.11	292.59	0.78
McMurdo Gulch	REACH 4	20842.12 500-Year	2885.84	6282	6285.88	6285.69	6286.52	0.010094	8.28	582.06	300.24	0.8
McMurdo Gulch	REACH 4	20645.9 2-Year	432.66	6280	6282.02	6281.6	6282.28	0.008527	4.12	104.98	79.55	0.63
McMurdo Gulch	REACH 4	20645.9 5-Year	734.91	6280	6282.49	6282.12	6282.88	0.01008	4.98	151.45	178.25	0.71
McMurdo Gulch	REACH 4	20645.9 10-Year	904.93	6280	6282.64	6282.35	6283.11	0.011028	5.54	174.56	220.15	0.75
McMurdo Gulch	REACH 4	20645.9 25-Year	1392.7	6280	6283.04	6282.98	6283.57	0.010394	6.19	293.65	271.01	0.75
McMurdo Gulch	REACH 4	20645.9 50-Year	1602.12	6280	6283.14	6283.14	6283.74	0.0112	6.63	320.89	273.16	0.79
McMurdo Gulch	REACH 4	20645.9 100-Year	2037.43	6280	6283.35	6283.35	6284.05	0.012016	7.31	379.79	277.58	0.83
McMurdo Gulch	REACH 4	20645.9 500-Year	2885.84	6280	6283.77	6283.76	6284.58	0.011983	8.12	496.89	285.22	0.85

Corrected Effective Subcritical Detailed Results Table													
River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Trib 4	Trib 4	533.553	2-Year	32.79	6339.1	6341.55	6340.1	6341.56	0.000311	0.7	47.05	42.13	0.12
Trib 4	Trib 4	533.553	5-Year	89.8	6339.1	6343.41	6340.71	6343.41	0.000084	0.56	161.23	76.04	0.07
Trib 4	Trib 4	533.553	10-Year	121.08	6339.1	6344.26	6340.9	6344.27	0.000055	0.53	230.51	85.98	0.06
Trib 4	Trib 4	533.553	25-Year	232.46	6339.1	6347.75	6341.37	6347.76	0.000012	0.41	592.16	121.59	0.03
Trib 4	Trib 4	533.553	50-Year	292.11	6339.1	6350.83	6341.59	6350.83	0.000004	0.32	1029.22	165.29	0.02
Trib 4	Trib 4	533.553	100-Year	409.47	6339.1	6353.37	6341.9	6353.37	0.000003	0.33	1500.61	208.79	0.02
Trib 4	Trib 4	533.553	500-Year	579.79	6339.1	6353.93	6342.26	6353.93	0.000005	0.45	1621.31	218.65	0.02
Trib 4	Trib 4	473.1134	Culvert										
Trib 4	Trib 4	360.7572	2-Year	32.79	6332.02	6332.68	6332.68	6332.93	0.030199	3.98	8.23	16.87	1.01
Trib 4	Trib 4	360.7572	5-Year	89.8	6332.02	6333.16	6333.16	6333.58	0.025379	5.17	17.37	21.04	1
Trib 4	Trib 4	360.7572	10-Year	121.08	6332.02	6333.36	6333.36	6333.85	0.024041	5.59	21.66	22.37	1
Trib 4	Trib 4	360.7572	25-Year	232.46	6332.02	6333.92	6333.92	6334.6	0.021826	6.61	35.14	26.12	1.01
Trib 4	Trib 4	360.7572	50-Year	292.11	6332.02	6334.16	6334.16	6334.92	0.021109	7	41.75	27.77	1.01
Trib 4	Trib 4	360.7572	100-Year	409.47	6332.02	6334.55	6334.55	6335.49	0.019233	7.76	53.12	30.16	1
Trib 4	Trib 4	360.7572	500-Year	579.79	6332.02	6335.06	6335.06	6336.2	0.017113	8.59	69.31	33.23	0.98
Trib 4	Trib 4	246.5842	2-Year	32.79	6328	6329.02	6328.64	6329.08	0.004418	1.99	16.5	22.71	0.41
Trib 4	Trib 4	246.5842	5-Year	89.8	6328	6329.61	6329.08	6329.74	0.005168	2.84	31.6	28.49	0.48
Trib 4	Trib 4	246.5842	10-Year	121.08	6328	6329.85	6329.27	6330	0.00522	3.14	38.6	30.91	0.49
Trib 4	Trib 4	246.5842	25-Year	232.46	6328	6330.48	6329.79	6330.72	0.005032	3.99	60.23	38.08	0.51
Trib 4	Trib 4	246.5842	50-Year	292.11	6328	6330.7		6331	0.00535	4.44	69.22	40.83	0.54
Trib 4	Trib 4	246.5842	100-Year	409.47	6328	6331	6330.38	6331.44	0.00661	5.39	82.27	46.36	0.61
Trib 4	Trib 4	246.5842	500-Year	579.79	6328	6331.29	6330.86	6331.97	0.00883	6.72	96.43	51.83	0.72
Trib 4	Trib 4	216.99	2-Year	32.79	6328	6328.56	6328.56	6328.79	0.030173	3.87	8.47	18.12	1
Trib 4	Trib 4	216.99	5-Year	89.8	6328	6329.01	6329.01	6329.42	0.025532	5.1	17.62	21.89	1
Trib 4	Trib 4	216.99	10-Year	121.08	6328	6329.2	6329.2	6329.68	0.024566	5.53	21.9	23.39	1.01
Trib 4	Trib 4	216.99	25-Year	232.46	6328	6329.74	6329.74	6330.41	0.021437	6.58	35.54	28.78	1
Trib 4	Trib 4	216.99	50-Year	292.11	6328	6330.1	6330.1	6330.73	0.014631	6.38	50.52	59.95	0.86
Trib 4	Trib 4	216.99	100-Year	409.47	6328	6330.48	6330.48	6331.15	0.012839	6.83	74.7	67.01	0.83
Trib 4	Trib 4	216.99	500-Year	579.79	6328	6330.88	6330.88	6331.65	0.012553	7.57	102.24	74.09	0.85
Trib 4	Trib 4	44.46692	2-Year	32.79	6323.91	6326.92		6326.92	0.000031	0.29	111.89	66.11	0.04

Trib 4	Trib 4	44.46692 5-Year	89.8	6323.91	6327.64		6327.65	0.000081	0.55	163.23	76.78	0.07
Trib 4	Trib 4	44.46692 10-Year	121.08	6323.91	6327.94		6327.94	0.000102	0.65	186.62	83.98	0.08
Trib 4	Trib 4	44.46692 25-Year	232.46	6323.91	6328.68		6328.69	0.000143	0.92	270.51	128.3	0.09
Trib 4	Trib 4	44.46692 50-Year	292.11	6323.91	6328.99		6329.01	0.000157	1.03	313.04	141.25	0.1
Trib 4	Trib 4	44.46692 100-Year	409.47	6323.91	6329.61		6329.63	0.000163	1.18	406.26	160.5	0.1
Trib 4	Trib 4	44.46692 500-Year	579.79	6323.91	6330.48		6330.5	0.000152	1.3	555	183.51	0.1
McMurdo Gulch	REACH 3	24245.75 2-Year	398.78	6336	6337.72		6338.11	0.012405	5	79.96	60.93	0.76
McMurdo Gulch	REACH 3	24245.75 5-Year	678.02	6336	6338.2	6337.98	6338.8	0.012916	6.22	110.68	67.16	0.82
McMurdo Gulch	REACH 3	24245.75 10-Year	838.12	6336	6338.43	6338.22	6339.14	0.013115	6.79	126.35	69.1	0.84
McMurdo Gulch	REACH 3	24245.75 25-Year	1280.81	6336	6338.99	6338.82	6339.98	0.013279	8.04	166.41	73.83	0.88
McMurdo Gulch	REACH 3	24245.75 50-Year	1473.52	6336	6339.21	6339.05	6340.31	0.013172	8.47	183.28	75.72	0.89
McMurdo Gulch	REACH 3	24245.75 100-Year	1820.75	6336	6339.59	6339.45	6340.85	0.013078	9.17	212	78.84	0.91
McMurdo Gulch	REACH 3	24245.75 500-Year	2386.95	6336	6340.15	6340.03	6341.67	0.012749	10.09	257.5	83.49	0.92
McMurdo Gulch	REACH 3	24054.91 2-Year	398.78	6332.09	6334.34	6334.34	6335.01	0.021675	6.56	60.93	47.71	1.01
McMurdo Gulch	REACH 3	24054.91 5-Year	678.02	6332.09	6334.92	6334.92	6335.84	0.018517	7.72	89.85	52.76	0.99
McMurdo Gulch	REACH 3	24054.91 10-Year	838.12	6332.09	6335.21	6335.21	6336.25	0.017301	8.21	105.75	55.38	0.98
McMurdo Gulch	REACH 3	24054.91 25-Year	1280.81	6332.09	6335.92	6335.92	6337.23	0.015267	9.31	147.32	61.45	0.96
McMurdo Gulch	REACH 3	24054.91 50-Year	1473.52	6332.09	6336.19	6336.19	6337.61	0.014798	9.72	164.18	63.65	0.96
McMurdo Gulch	REACH 3	24054.91 100-Year	1820.75	6332.09	6336.65	6336.65	6338.24	0.013984	10.34	194.38	67.36	0.96
McMurdo Gulch	REACH 3	24054.91 500-Year	2386.95	6332.09	6337.32	6337.32	6339.16	0.013137	11.22	241.37	73.13	0.95
McMurdo Gulch	REACH 3	24006.77 2-Year	398.78	6330.11	6333		6333.4	0.007566	5.04	79.3	41.23	0.63
McMurdo Gulch	REACH 3	24006.77 5-Year	678.02	6330.11	6333.71		6334.31	0.007964	6.22	110.75	47.19	0.68
McMurdo Gulch	REACH 3	24006.77 10-Year	838.12	6330.11	6334.03		6334.75	0.008271	6.84	126.09	50.53	0.71
McMurdo Gulch	REACH 3	24006.77 25-Year	1280.81	6330.11	6334.75	6334.23	6335.79	0.009018	8.27	165.47	59.3	0.76
McMurdo Gulch	REACH 3	24006.77 50-Year	1473.52	6330.11	6335.01	6334.55	6336.19	0.009342	8.82	181.4	62.67	0.79
McMurdo Gulch	REACH 3	24006.77 100-Year	1820.75	6330.11	6335.41	6335.09	6336.83	0.010012	9.75	207.84	67.97	0.83
McMurdo Gulch	REACH 3	24006.77 500-Year	2386.95	6330.11	6336.03	6335.86	6337.78	0.01059	10.95	252	76.64	0.87
McMurdo Gulch	REACH 3	23726.41 2-Year	398.78	6326.27	6329.24	6329.24	6330.06	0.02063	7.29	54.7	33.84	1.01
McMurdo Gulch	REACH 3	23726.41 5-Year	678.02	6326.27	6329.96	6329.96	6331.05	0.017847	8.39	82.16	41.7	0.99
McMurdo Gulch	REACH 3	23726.41 10-Year	838.12	6326.27	6330.33	6330.33	6331.54	0.016317	8.87	98.05	46.17	0.97
McMurdo Gulch	REACH 3	23726.41 25-Year	1280.81	6326.27	6331.2	6331.2	6332.66	0.013763	9.87	143.21	57.77	0.93
McMurdo Gulch	REACH 3	23726.41 50-Year	1473.52	6326.27	6331.53	6331.53	6333.08	0.013028	10.21	163.28	62.22	0.92
McMurdo Gulch	REACH 3	23726.41 100-Year	1820.75	6326.27	6332.09	6332.09	6333.75	0.011952	10.72	199.93	69.08	0.91
McMurdo Gulch	REACH 3	23726.41 500-Year	2386.95	6326.27	6332.81	6332.81	6334.7	0.011396	11.6	252.27	75.37	0.91

McMurdo Gulch	REACH 3	23417.48	2-Year	398.78	6322.16	6326.87		6326.93	0.000664	2	199.39	68.27	0.2
McMurdo Gulch	REACH 3	23417.48	5-Year	678.02	6322.16	6327.54		6327.66	0.000985	2.79	248.2	76.82	0.25
McMurdo Gulch	REACH 3	23417.48	10-Year	838.12	6322.16	6327.8		6327.96	0.001196	3.21	268.63	80.18	0.28
McMurdo Gulch	REACH 3	23417.48	25-Year	1280.81	6322.16	6328.46		6328.72	0.001651	4.17	324.48	90.01	0.34
McMurdo Gulch	REACH 3	23417.48	50-Year	1473.52	6322.16	6328.74		6329.05	0.001779	4.51	350.32	94.39	0.36
McMurdo Gulch	REACH 3	23417.48	100-Year	1820.75	6322.16	6329.31		6329.67	0.001843	4.93	406.84	104.6	0.37
McMurdo Gulch	REACH 3	23417.48	500-Year	2386.95	6322.16	6330.09		6330.55	0.001944	5.54	495.38	120.23	0.39
McMurdo Gulch	REACH 4	23304	2-Year	432.66	6322.09	6326.74		6326.85	0.000992	2.78	202.94	113.11	0.25
McMurdo Gulch	REACH 4	23304	5-Year	734.91	6322.09	6327.35		6327.54	0.001469	3.75	280.11	136.38	0.32
McMurdo Gulch	REACH 4	23304	10-Year	904.93	6322.09	6327.58		6327.81	0.001769	4.26	312.05	144.08	0.35
McMurdo Gulch	REACH 4	23304	25-Year	1392.7	6322.09	6328.19		6328.53	0.002333	5.32	404.91	160.05	0.41
McMurdo Gulch	REACH 4	23304	50-Year	1602.12	6322.09	6328.48		6328.84	0.002386	5.58	452.89	167.85	0.42
McMurdo Gulch	REACH 4	23304	100-Year	2037.43	6322.09	6329.08		6329.47	0.002373	5.96	557.81	184.37	0.43
McMurdo Gulch	REACH 4	23304	500-Year	2885.84	6322.09	6329.82		6330.32	0.002752	6.93	702.59	204.92	0.47
McMurdo Gulch	REACH 4	23294	2-Year	432.66	6322.13	6326.66	6324.88	6326.82	0.001606	3.36	160.17	89.63	0.32
McMurdo Gulch	REACH 4	23294	5-Year	734.91	6322.13	6327.19	6325.72	6327.49	0.002558	4.67	213.7	111.1	0.41
McMurdo Gulch	REACH 4	23294	10-Year	904.93	6322.13	6327.34	6326.13	6327.74	0.003306	5.44	231.31	118.43	0.47
McMurdo Gulch	REACH 4	23294	25-Year	1392.7	6322.13	6327.64	6327.05	6328.38	0.005785	7.54	268.23	132.71	0.63
McMurdo Gulch	REACH 4	23294	50-Year	1602.12	6322.13	6327.84	6327.42	6328.67	0.006281	8.09	295.79	143.74	0.66
McMurdo Gulch	REACH 4	23294	100-Year	2037.43	6322.13	6327.94	6327.94	6329.17	0.009195	9.93	310.42	148.2	0.8
McMurdo Gulch	REACH 4	23294	500-Year	2885.84	6322.13	6328.75	6328.75	6330.04	0.008543	10.64	442.08	173.35	0.8
McMurdo Gulch	REACH 4	23275.85	Culvert										
McMurdo Gulch	REACH 4	23236.81	2-Year	432.66	6321.49	6324.72	6324.72	6324.88	0.001915	3.26	139.07	77.43	0.34
McMurdo Gulch	REACH 4	23236.81	5-Year	734.91	6321.49	6324.72	6324.72	6325.19	0.005525	5.53	139.07	77.43	0.58
McMurdo Gulch	REACH 4	23236.81	10-Year	904.93	6321.49	6324.72	6324.72	6325.43	0.008377	6.81	139.07	77.43	0.71
McMurdo Gulch	REACH 4	23236.81	25-Year	1392.7	6321.49	6324.87	6324.87	6326.05	0.014947	8.81	167.03	82.49	0.94
McMurdo Gulch	REACH 4	23236.81	50-Year	1602.12	6321.49	6325.15	6325.15	6326.4	0.013869	9.07	192.11	92.32	0.92
McMurdo Gulch	REACH 4	23236.81	100-Year	2037.43	6321.49	6325.68	6325.68	6327.03	0.012461	9.57	245.06	109.64	0.9
McMurdo Gulch	REACH 4	23236.81	500-Year	2885.84	6321.49	6326.5	6326.5	6328.02	0.011143	10.4	345.17	133.1	0.88
McMurdo Gulch	REACH 4	23186.5	2-Year	432.66	6317.83	6321.18		6321.41	0.004292	3.91	118.93	72.23	0.48
McMurdo Gulch	REACH 4	23186.5	5-Year	734.91	6317.83	6321.87		6322.21	0.004564	4.78	174.25	89.27	0.52
McMurdo Gulch	REACH 4	23186.5	10-Year	904.93	6317.83	6322.19		6322.57	0.004624	5.14	203.79	94.14	0.53

McMurdo Gulch	REACH 4	23186.5	25-Year	1392.7	6317.83	6322.98		6323.46	0.004635	5.88	279.52	98.49	0.55
McMurdo Gulch	REACH 4	23186.5	50-Year	1602.12	6317.83	6323.27		6323.79	0.004659	6.16	308.45	100.09	0.55
McMurdo Gulch	REACH 4	23186.5	100-Year	2037.43	6317.83	6323.83		6324.43	0.004614	6.64	366.75	110.57	0.56
McMurdo Gulch	REACH 4	23186.5	500-Year	2885.84	6317.83	6324.78		6325.5	0.0044	7.4	486.64	140.92	0.57
McMurdo Gulch	REACH 4	23055.63	2-Year	432.66	6317.82	6319.65	6319.65	6320.29	0.021865	6.45	67.06	52.36	1.01
McMurdo Gulch	REACH 4	23055.63	5-Year	734.91	6317.82	6320.22	6320.22	6321.07	0.019742	7.4	99.73	62.06	1
McMurdo Gulch	REACH 4	23055.63	10-Year	904.93	6317.82	6320.48	6320.48	6321.44	0.018467	7.87	116.56	66.33	0.99
McMurdo Gulch	REACH 4	23055.63	25-Year	1392.7	6317.82	6321.15	6321.15	6322.36	0.015902	8.89	164.72	76.49	0.97
McMurdo Gulch	REACH 4	23055.63	50-Year	1602.12	6317.82	6321.42	6321.42	6322.71	0.014973	9.21	185.79	79.99	0.95
McMurdo Gulch	REACH 4	23055.63	100-Year	2037.43	6317.82	6321.9	6321.9	6323.36	0.014103	9.89	225.19	84.91	0.95
McMurdo Gulch	REACH 4	23055.63	500-Year	2885.84	6317.82	6322.69	6322.69	6324.47	0.013241	11.03	296.09	95.01	0.95
McMurdo Gulch	REACH 4	23022.87	2-Year	432.66	6316.14	6318.57	6318.57	6319.25	0.021691	6.63	65.22	48.42	1.01
McMurdo Gulch	REACH 4	23022.87	5-Year	734.91	6316.14	6319.17	6319.17	6320.07	0.019302	7.62	97.07	57.48	1
McMurdo Gulch	REACH 4	23022.87	10-Year	904.93	6316.14	6319.45	6319.45	6320.47	0.018188	8.08	114.08	62.52	0.99
McMurdo Gulch	REACH 4	23022.87	25-Year	1392.7	6316.14	6320.21	6320.21	6321.42	0.014738	8.94	167.44	78.36	0.94
McMurdo Gulch	REACH 4	23022.87	50-Year	1602.12	6316.14	6320.47	6320.47	6321.77	0.014159	9.3	188.28	80.5	0.93
McMurdo Gulch	REACH 4	23022.87	100-Year	2037.43	6316.14	6320.95	6320.95	6322.43	0.013559	10.02	227.71	84.33	0.94
McMurdo Gulch	REACH 4	23022.87	500-Year	2885.84	6316.14	6321.75	6321.75	6323.54	0.012898	11.19	298.15	91.17	0.94
McMurdo Gulch	REACH 4	22784.94	2-Year	432.66	6312	6313.16		6313.46	0.01261	4.38	99.29	93.56	0.74
McMurdo Gulch	REACH 4	22784.94	5-Year	734.91	6312	6313.55		6314.01	0.013292	5.42	136.94	98.42	0.8
McMurdo Gulch	REACH 4	22784.94	10-Year	904.93	6312	6313.73		6314.27	0.013587	5.93	154.59	100.21	0.83
McMurdo Gulch	REACH 4	22784.94	25-Year	1392.7	6312	6314.16	6314.01	6314.95	0.014341	7.14	199.03	104.09	0.88
McMurdo Gulch	REACH 4	22784.94	50-Year	1602.12	6312	6314.32	6314.2	6315.21	0.014803	7.62	215.26	104.98	0.91
McMurdo Gulch	REACH 4	22784.94	100-Year	2037.43	6312	6314.59	6314.55	6315.72	0.016204	8.61	243.56	106.5	0.97
McMurdo Gulch	REACH 4	22784.94	500-Year	2885.84	6312	6315.17	6315.17	6316.63	0.015721	9.78	306.94	109.84	0.99
McMurdo Gulch	REACH 4	22745.31	2-Year	432.66	6310.51	6312.31	6312.31	6312.76	0.02474	5.41	79.97	89.58	1.01
McMurdo Gulch	REACH 4	22745.31	5-Year	734.91	6310.51	6312.69	6312.69	6313.32	0.022014	6.35	115.94	96.04	1.01
McMurdo Gulch	REACH 4	22745.31	10-Year	904.93	6310.51	6312.88	6312.88	6313.6	0.020817	6.78	134.48	99.07	1
McMurdo Gulch	REACH 4	22745.31	25-Year	1392.7	6310.51	6313.36	6313.36	6314.29	0.01859	7.76	183.49	106.2	0.99
McMurdo Gulch	REACH 4	22745.31	50-Year	1602.12	6310.51	6313.55	6313.55	6314.56	0.017808	8.09	203.88	109.03	0.99
McMurdo Gulch	REACH 4	22745.31	100-Year	2037.43	6310.51	6313.92	6313.92	6315.07	0.016563	8.69	244.89	114.74	0.98
McMurdo Gulch	REACH 4	22745.31	500-Year	2885.84	6310.51	6314.55	6314.55	6315.96	0.015077	9.66	320.61	125.8	0.97
McMurdo Gulch	REACH 4	22509.23	2-Year	432.66	6306	6308.83		6309.05	0.005411	3.8	113.93	69.23	0.52

McMurdo Gulch	REACH 4	22509.23	5-Year	734.91	6306	6309.44		6309.77	0.00605	4.61	159.6	79.66	0.57
McMurdo Gulch	REACH 4	22509.23	10-Year	904.93	6306	6309.7		6310.09	0.006169	5.01	181.18	84.19	0.59
McMurdo Gulch	REACH 4	22509.23	25-Year	1392.7	6306	6310.38		6310.92	0.00605	5.91	241.04	92.71	0.61
McMurdo Gulch	REACH 4	22509.23	50-Year	1602.12	6306	6310.65		6311.24	0.005904	6.19	266.83	95.59	0.61
McMurdo Gulch	REACH 4	22509.23	100-Year	2037.43	6306	6311.18		6311.87	0.00566	6.71	318.61	101.19	0.61
McMurdo Gulch	REACH 4	22509.23	500-Year	2885.84	6306	6312.13		6312.96	0.005141	7.44	420.26	112.8	0.61
McMurdo Gulch	REACH 4	22408.41	2-Year	432.66	6305.72	6307.87		6308.26	0.01184	4.99	86.78	62.79	0.75
McMurdo Gulch	REACH 4	22408.41	5-Year	734.91	6305.72	6308.61		6309.02	0.009075	5.14	142.97	80.89	0.68
McMurdo Gulch	REACH 4	22408.41	10-Year	904.93	6305.72	6308.93		6309.37	0.008205	5.35	169.03	83.35	0.66
McMurdo Gulch	REACH 4	22408.41	25-Year	1392.7	6305.72	6309.75		6310.27	0.006673	5.8	240.1	89.72	0.63
McMurdo Gulch	REACH 4	22408.41	50-Year	1602.12	6305.72	6310.07		6310.62	0.00621	5.95	269.23	92.04	0.61
McMurdo Gulch	REACH 4	22408.41	100-Year	2037.43	6305.72	6310.68		6311.29	0.005359	6.27	326.19	95.35	0.59
McMurdo Gulch	REACH 4	22408.41	500-Year	2885.84	6305.72	6311.73		6312.45	0.004501	6.83	429.14	101.05	0.56
McMurdo Gulch	REACH 4	22371.4	2-Year	432.66	6304.13	6307.46	6307.02	6307.85	0.009978	5.03	85.99	53.87	0.7
McMurdo Gulch	REACH 4	22371.4	5-Year	734.91	6304.13	6308.1	6307.68	6308.65	0.010321	5.96	123.47	63.28	0.74
McMurdo Gulch	REACH 4	22371.4	10-Year	904.93	6304.13	6308.36	6307.96	6309.01	0.010366	6.49	140.4	65.58	0.76
McMurdo Gulch	REACH 4	22371.4	25-Year	1392.7	6304.13	6308.99	6308.61	6309.92	0.010696	7.76	183.64	71.02	0.8
McMurdo Gulch	REACH 4	22371.4	50-Year	1602.12	6304.13	6309.23	6308.91	6310.27	0.010757	8.21	201.16	73.02	0.82
McMurdo Gulch	REACH 4	22371.4	100-Year	2037.43	6304.13	6309.71	6309.35	6310.95	0.010687	9	237.08	76.96	0.83
McMurdo Gulch	REACH 4	22371.4	500-Year	2885.84	6304.13	6310.55	6310.2	6312.12	0.010387	10.19	304.27	83.25	0.85
McMurdo Gulch	REACH 4	22043.6	2-Year	432.66	6300.85	6302.51	6302.51	6303.22	0.021235	6.75	64.14	45.58	1
McMurdo Gulch	REACH 4	22043.6	5-Year	734.91	6300.85	6303.13	6303.13	6304.09	0.019318	7.87	93.38	49.04	1
McMurdo Gulch	REACH 4	22043.6	10-Year	904.93	6300.85	6303.42	6303.42	6304.52	0.018538	8.41	107.83	50.76	1
McMurdo Gulch	REACH 4	22043.6	25-Year	1392.7	6300.85	6304.17	6304.17	6305.59	0.016371	9.56	147.72	55.05	0.99
McMurdo Gulch	REACH 4	22043.6	50-Year	1602.12	6300.85	6304.46	6304.46	6306	0.015738	9.98	163.72	56.21	0.98
McMurdo Gulch	REACH 4	22043.6	100-Year	2037.43	6300.85	6305	6305	6306.79	0.01489	10.79	194.94	58.4	0.98
McMurdo Gulch	REACH 4	22043.6	500-Year	2885.84	6300.85	6305.96	6305.96	6308.16	0.01372	12.04	252.35	62.26	0.98
McMurdo Gulch	REACH 4	21826.79	2-Year	432.66	6298	6299.87		6300.1	0.005431	3.86	112.03	66.36	0.52
McMurdo Gulch	REACH 4	21826.79	5-Year	734.91	6298	6300.32		6300.74	0.007206	5.14	143.02	68.79	0.63
McMurdo Gulch	REACH 4	21826.79	10-Year	904.93	6298	6300.63		6301.1	0.006972	5.53	164.04	70.06	0.63
McMurdo Gulch	REACH 4	21826.79	25-Year	1392.7	6298	6301.19		6301.93	0.008139	6.88	204.28	72.42	0.7
McMurdo Gulch	REACH 4	21826.79	50-Year	1602.12	6298	6301.39		6302.24	0.00863	7.4	219.01	73.26	0.73
McMurdo Gulch	REACH 4	21826.79	100-Year	2037.43	6298	6301.76		6302.86	0.009654	8.42	246.12	74.79	0.79
McMurdo Gulch	REACH 4	21826.79	500-Year	2885.84	6298	6302.26	6302.06	6303.93	0.012364	10.41	284.14	76.87	0.91

McMurdo Gulch	REACH 4	21777.38 2-Year	432.66	6298	6299.07	6299.07	6299.58	0.023634	5.72	75.63	75.2	1.01
McMurdo Gulch	REACH 4	21777.38 5-Year	734.91	6298	6299.75		6300.26	0.012833	5.75	127.9	79.71	0.8
McMurdo Gulch	REACH 4	21777.38 10-Year	904.93	6298	6299.73	6299.73	6300.52	0.020144	7.15	126.5	79.6	1
McMurdo Gulch	REACH 4	21777.38 25-Year	1392.7	6298	6300.26	6300.26	6301.31	0.018419	8.25	169.24	82.41	1
McMurdo Gulch	REACH 4	21777.38 50-Year	1602.12	6298	6300.47	6300.47	6301.62	0.017735	8.63	186.66	83.49	1
McMurdo Gulch	REACH 4	21777.38 100-Year	2037.43	6298	6300.87	6300.87	6302.22	0.016684	9.32	220.96	85.58	1
McMurdo Gulch	REACH 4	21777.38 500-Year	2885.84	6298	6301.6	6301.6	6303.26	0.014991	10.35	285.2	90.16	0.98
McMurdo Gulch	REACH 4	21417.19 2-Year	432.66	6292	6293.24	6293.24	6293.73	0.02375	5.63	76.92	78.88	1
McMurdo Gulch	REACH 4	21417.19 5-Year	734.91	6292	6293.68	6293.68	6294.33	0.021777	6.47	113.71	90.19	1.01
McMurdo Gulch	REACH 4	21417.19 10-Year	904.93	6292	6293.87	6293.87	6294.61	0.020547	6.9	131.98	97.07	1
McMurdo Gulch	REACH 4	21417.19 25-Year	1392.7	6292	6294.56	6294.56	6295.22	0.011685	6.72	256.75	239.76	0.8
McMurdo Gulch	REACH 4	21417.19 50-Year	1602.12	6292	6294.71	6294.71	6295.4	0.011575	7	293.21	241.96	0.81
McMurdo Gulch	REACH 4	21417.19 100-Year	2037.43	6292	6294.98	6294.98	6295.75	0.011754	7.58	357.25	245.58	0.83
McMurdo Gulch	REACH 4	21417.19 500-Year	2885.84	6292	6295.41	6295.41	6296.33	0.012098	8.52	464.17	251.5	0.86
McMurdo Gulch	REACH 4	21370.41 2-Year	432.66	6290.52	6292.4	6292.25	6292.77	0.015871	4.9	88.25	82.2	0.83
McMurdo Gulch	REACH 4	21370.41 5-Year	734.91	6290.52	6292.82	6292.72	6293.34	0.016217	5.83	129.35	124.84	0.88
McMurdo Gulch	REACH 4	21370.41 10-Year	904.93	6290.52	6292.93	6292.93	6293.6	0.01863	6.59	143.87	131.51	0.95
McMurdo Gulch	REACH 4	21370.41 25-Year	1392.7	6290.52	6293.43	6293.43	6294.22	0.015502	7.29	216.96	162	0.91
McMurdo Gulch	REACH 4	21370.41 50-Year	1602.12	6290.52	6293.61	6293.61	6294.44	0.014889	7.56	246.54	171.89	0.91
McMurdo Gulch	REACH 4	21370.41 100-Year	2037.43	6290.52	6293.93	6293.93	6294.86	0.014072	8.07	304.93	186.17	0.9
McMurdo Gulch	REACH 4	21370.41 500-Year	2885.84	6290.52	6294.48	6294.48	6295.52	0.012749	8.77	417.22	212.12	0.89
McMurdo Gulch	REACH 4	21133.42 2-Year	432.66	6288	6289.23		6289.48	0.012015	3.95	109.55	116.73	0.71
McMurdo Gulch	REACH 4	21133.42 5-Year	734.91	6288	6289.58		6289.95	0.012423	4.92	152.16	132.75	0.76
McMurdo Gulch	REACH 4	21133.42 10-Year	904.93	6288	6289.74		6290.18	0.01244	5.34	174.97	139.49	0.78
McMurdo Gulch	REACH 4	21133.42 25-Year	1392.7	6288	6290.15	6289.96	6290.76	0.012485	6.31	234.7	150.36	0.81
McMurdo Gulch	REACH 4	21133.42 50-Year	1602.12	6288	6290.31	6290.13	6290.98	0.012557	6.67	257.7	152.54	0.83
McMurdo Gulch	REACH 4	21133.42 100-Year	2037.43	6288	6290.59	6290.43	6291.39	0.012741	7.33	301.85	156.59	0.85
McMurdo Gulch	REACH 4	21133.42 500-Year	2885.84	6288	6291.06	6290.94	6292.11	0.013296	8.47	376.64	163.22	0.9
McMurdo Gulch	REACH 4	21063.55 2-Year	432.66	6286	6287.77	6287.77	6288.31	0.023497	5.86	73.83	70.61	1.01
McMurdo Gulch	REACH 4	21063.55 5-Year	734.91	6286	6288.3	6288.3	6288.9	0.017726	6.28	125.96	126.1	0.92
McMurdo Gulch	REACH 4	21063.55 10-Year	904.93	6286	6288.5	6288.5	6289.16	0.016661	6.64	152.11	135.68	0.92
McMurdo Gulch	REACH 4	21063.55 25-Year	1392.7	6286	6288.97	6288.97	6289.77	0.015065	7.49	222.13	158.44	0.91
McMurdo Gulch	REACH 4	21063.55 50-Year	1602.12	6286	6289.15	6289.15	6290	0.014621	7.79	251.07	167.2	0.91

McMurdo Gulch	REACH 4	21063.55	100-Year	2037.43	6286	6289.47	6289.47	6290.43	0.014127	8.36	307.9	183.01	0.91
McMurdo Gulch	REACH 4	21063.55	500-Year	2885.84	6286	6289.99	6289.99	6291.13	0.013946	9.37	408.75	210.04	0.93
McMurdo Gulch	REACH 4	20884.87	2-Year	432.66	6282	6284.59	6284.11	6284.86	0.005991	4.24	118.14	170.59	0.56
McMurdo Gulch	REACH 4	20884.87	5-Year	734.91	6282	6285.17	6284.68	6285.4	0.004388	4.37	269.72	267.49	0.5
McMurdo Gulch	REACH 4	20884.87	10-Year	904.93	6282	6284.97	6284.94	6285.65	0.012408	6.94	163.73	232.27	0.83
McMurdo Gulch	REACH 4	20884.87	25-Year	1392.7	6282	6285.45	6285.39	6285.94	0.008704	6.63	347.62	279.59	0.72
McMurdo Gulch	REACH 4	20884.87	50-Year	1602.12	6282	6285.55	6285.49	6286.1	0.009473	7.09	376.36	283.55	0.75
McMurdo Gulch	REACH 4	20884.87	100-Year	2037.43	6282	6285.8	6285.74	6286.4	0.009896	7.67	447.14	292.76	0.78
McMurdo Gulch	REACH 4	20884.87	500-Year	2885.84	6282	6286.22	6286.13	6286.92	0.010221	8.51	573.77	304.72	0.81
McMurdo Gulch	REACH 4	20842.12	2-Year	432.66	6282	6283.98	6283.8	6284.47	0.014046	5.58	77.59	54.2	0.82
McMurdo Gulch	REACH 4	20842.12	5-Year	734.91	6282	6284.5	6284.47	6285.08	0.01224	6.38	143.95	255.52	0.81
McMurdo Gulch	REACH 4	20842.12	10-Year	904.93	6282	6284.72	6284.72	6285.14	0.009138	5.92	245.85	278.81	0.71
McMurdo Gulch	REACH 4	20842.12	25-Year	1392.7	6282	6285.02	6285.02	6285.56	0.010703	6.99	331.12	284.54	0.79
McMurdo Gulch	REACH 4	20842.12	50-Year	1602.12	6282	6285.16	6285.14	6285.71	0.010486	7.19	372.58	287.28	0.78
McMurdo Gulch	REACH 4	20842.12	100-Year	2037.43	6282	6285.45	6285.37	6286.01	0.009903	7.49	456.11	292.59	0.78
McMurdo Gulch	REACH 4	20842.12	500-Year	2885.84	6282	6285.88	6285.69	6286.52	0.010094	8.28	582.06	300.24	0.8
McMurdo Gulch	REACH 4	20645.9	2-Year	432.66	6280	6282.02	6281.6	6282.28	0.008527	4.12	104.98	79.55	0.63
McMurdo Gulch	REACH 4	20645.9	5-Year	734.91	6280	6282.49	6282.12	6282.88	0.01008	4.98	151.45	178.25	0.71
McMurdo Gulch	REACH 4	20645.9	10-Year	904.93	6280	6282.64	6282.35	6283.11	0.011028	5.54	174.56	220.15	0.75
McMurdo Gulch	REACH 4	20645.9	25-Year	1392.7	6280	6283.04	6282.98	6283.57	0.010394	6.19	293.65	271.01	0.75
McMurdo Gulch	REACH 4	20645.9	50-Year	1602.12	6280	6283.14	6283.14	6283.74	0.0112	6.63	320.89	273.16	0.79
McMurdo Gulch	REACH 4	20645.9	100-Year	2037.43	6280	6283.35	6283.35	6284.05	0.012016	7.31	379.79	277.58	0.83
McMurdo Gulch	REACH 4	20645.9	500-Year	2885.84	6280	6283.77	6283.76	6284.58	0.011983	8.12	496.89	285.22	0.85

Existing Subcritical Detailed Results Table													
River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Trib 4	Trib 4	533.553	2-Year	32.79	6339.1	6341.55	6340.1	6341.56	0.000311	0.7	47.05	42.13	0.12
Trib 4	Trib 4	533.553	5-Year	89.8	6339.1	6343.41	6340.71	6343.41	0.000084	0.56	161.23	76.04	0.07
Trib 4	Trib 4	533.553	10-Year	121.08	6339.1	6344.26	6340.9	6344.27	0.000055	0.53	230.51	85.98	0.06
Trib 4	Trib 4	533.553	25-Year	232.46	6339.1	6347.75	6341.37	6347.76	0.000012	0.41	592.16	121.59	0.03
Trib 4	Trib 4	533.553	50-Year	292.11	6339.1	6350.83	6341.59	6350.83	0.000004	0.32	1029.22	165.29	0.02
Trib 4	Trib 4	533.553	100-Year	409.47	6339.1	6353.37	6341.9	6353.37	0.000003	0.33	1500.61	208.79	0.02
Trib 4	Trib 4	533.553	500-Year	579.79	6339.1	6353.93	6342.26	6353.93	0.000005	0.45	1621.31	218.65	0.02
Trib 4	Trib 4	473.1134	Culvert										
Trib 4	Trib 4	360.7572	2-Year	32.79	6332.02	6332.68	6332.68	6332.93	0.030199	3.98	8.23	16.87	1.01
Trib 4	Trib 4	360.7572	5-Year	89.8	6332.02	6333.16	6333.16	6333.58	0.025379	5.17	17.37	21.04	1
Trib 4	Trib 4	360.7572	10-Year	121.08	6332.02	6333.36	6333.36	6333.85	0.024041	5.59	21.66	22.37	1
Trib 4	Trib 4	360.7572	25-Year	232.46	6332.02	6333.92	6333.92	6334.6	0.021826	6.61	35.14	26.12	1.01
Trib 4	Trib 4	360.7572	50-Year	292.11	6332.02	6334.16	6334.16	6334.92	0.021109	7	41.75	27.77	1.01
Trib 4	Trib 4	360.7572	100-Year	409.47	6332.02	6334.55	6334.55	6335.49	0.019233	7.76	53.12	30.16	1
Trib 4	Trib 4	360.7572	500-Year	579.79	6332.02	6335.06	6335.06	6336.2	0.017113	8.59	69.31	33.23	0.98
Trib 4	Trib 4	246.5842	2-Year	32.79	6328	6329.02	6328.64	6329.08	0.004418	1.99	16.5	22.71	0.41
Trib 4	Trib 4	246.5842	5-Year	89.8	6328	6329.61	6329.08	6329.74	0.005161	2.84	31.61	28.5	0.48
Trib 4	Trib 4	246.5842	10-Year	121.08	6328	6329.85	6329.27	6330	0.00522	3.14	38.6	30.91	0.49
Trib 4	Trib 4	246.5842	25-Year	232.46	6328	6330.48	6329.79	6330.72	0.005032	3.99	60.23	38.08	0.51
Trib 4	Trib 4	246.5842	50-Year	292.11	6328	6330.7		6331	0.00535	4.44	69.22	40.83	0.54
Trib 4	Trib 4	246.5842	100-Year	409.47	6328	6331	6330.38	6331.44	0.006605	5.39	82.29	46.36	0.61
Trib 4	Trib 4	246.5842	500-Year	579.79	6328	6331.29	6330.86	6331.97	0.00883	6.72	96.43	51.83	0.72
Trib 4	Trib 4	216.99	2-Year	32.79	6328	6328.56	6328.56	6328.79	0.030173	3.87	8.47	18.12	1
Trib 4	Trib 4	216.99	5-Year	89.8	6328	6329.01	6329.01	6329.42	0.025532	5.1	17.62	21.89	1
Trib 4	Trib 4	216.99	10-Year	121.08	6328	6329.2	6329.2	6329.68	0.024566	5.53	21.9	23.39	1.01
Trib 4	Trib 4	216.99	25-Year	232.46	6328	6329.74	6329.74	6330.41	0.021437	6.58	35.54	28.78	1
Trib 4	Trib 4	216.99	50-Year	292.11	6328	6330.1	6330.1	6330.73	0.014631	6.38	50.52	59.95	0.86
Trib 4	Trib 4	216.99	100-Year	409.47	6328	6330.48	6330.48	6331.15	0.012839	6.83	74.7	67.01	0.83
Trib 4	Trib 4	216.99	500-Year	579.79	6328	6330.88	6330.88	6331.65	0.012553	7.57	102.24	74.09	0.85
Trib 4	Trib 4	44.46692	2-Year	32.79	6323.91	6326.93		6326.93	0.000031	0.29	112.18	66.17	0.04

Trib 4	Trib 4	44.46692 5-Year	89.8	6323.91	6327.57		6327.58	0.000088	0.57	157.98	75.54	0.07
Trib 4	Trib 4	44.46692 10-Year	121.08	6323.91	6327.88		6327.89	0.00011	0.67	181.93	81.7	0.08
Trib 4	Trib 4	44.46692 25-Year	232.46	6323.91	6328.62		6328.63	0.000153	0.94	262.94	125.88	0.1
Trib 4	Trib 4	44.46692 50-Year	292.11	6323.91	6328.87		6328.88	0.000181	1.08	295.22	136.08	0.11
Trib 4	Trib 4	44.46692 100-Year	409.47	6323.91	6329.44		6329.46	0.000194	1.25	378.98	155.17	0.11
Trib 4	Trib 4	44.46692 500-Year	579.79	6323.91	6330.34		6330.36	0.000171	1.35	529.98	179.92	0.11
McMurdo Gulch	REACH 3	24245.75 2-Year	398.78	6336	6337.72		6338.11	0.012405	5	79.96	60.93	0.76
McMurdo Gulch	REACH 3	24245.75 5-Year	678.02	6336	6338.2	6337.98	6338.8	0.012916	6.22	110.68	67.16	0.82
McMurdo Gulch	REACH 3	24245.75 10-Year	838.12	6336	6338.43	6338.22	6339.14	0.013115	6.79	126.35	69.1	0.84
McMurdo Gulch	REACH 3	24245.75 25-Year	1280.81	6336	6338.99	6338.82	6339.98	0.013279	8.04	166.41	73.83	0.88
McMurdo Gulch	REACH 3	24245.75 50-Year	1473.52	6336	6339.21	6339.05	6340.31	0.013172	8.47	183.28	75.72	0.89
McMurdo Gulch	REACH 3	24245.75 100-Year	1820.75	6336	6339.59	6339.45	6340.85	0.013078	9.17	212	78.84	0.91
McMurdo Gulch	REACH 3	24245.75 500-Year	2386.95	6336	6340.15	6340.03	6341.67	0.012749	10.09	257.5	83.49	0.92
McMurdo Gulch	REACH 3	24054.91 2-Year	398.78	6332.09	6334.34	6334.34	6335.01	0.021675	6.56	60.93	47.71	1.01
McMurdo Gulch	REACH 3	24054.91 5-Year	678.02	6332.09	6334.92	6334.92	6335.84	0.018517	7.72	89.85	52.76	0.99
McMurdo Gulch	REACH 3	24054.91 10-Year	838.12	6332.09	6335.21	6335.21	6336.25	0.017301	8.21	105.75	55.38	0.98
McMurdo Gulch	REACH 3	24054.91 25-Year	1280.81	6332.09	6335.92	6335.92	6337.23	0.015267	9.31	147.32	61.45	0.96
McMurdo Gulch	REACH 3	24054.91 50-Year	1473.52	6332.09	6336.19	6336.19	6337.61	0.014798	9.72	164.18	63.65	0.96
McMurdo Gulch	REACH 3	24054.91 100-Year	1820.75	6332.09	6336.65	6336.65	6338.24	0.013984	10.34	194.38	67.36	0.96
McMurdo Gulch	REACH 3	24054.91 500-Year	2386.95	6332.09	6337.32	6337.32	6339.16	0.013137	11.22	241.37	73.13	0.95
McMurdo Gulch	REACH 3	24006.77 2-Year	398.78	6330.11	6333		6333.4	0.007566	5.04	79.3	41.23	0.63
McMurdo Gulch	REACH 3	24006.77 5-Year	678.02	6330.11	6333.71		6334.31	0.007964	6.22	110.75	47.19	0.68
McMurdo Gulch	REACH 3	24006.77 10-Year	838.12	6330.11	6334.03		6334.75	0.008271	6.84	126.09	50.53	0.71
McMurdo Gulch	REACH 3	24006.77 25-Year	1280.81	6330.11	6334.75	6334.23	6335.79	0.009018	8.27	165.47	59.3	0.76
McMurdo Gulch	REACH 3	24006.77 50-Year	1473.52	6330.11	6335.01	6334.55	6336.19	0.009342	8.82	181.4	62.67	0.79
McMurdo Gulch	REACH 3	24006.77 100-Year	1820.75	6330.11	6335.41	6335.09	6336.83	0.010012	9.75	207.84	67.97	0.83
McMurdo Gulch	REACH 3	24006.77 500-Year	2386.95	6330.11	6336.03	6335.86	6337.78	0.01059	10.95	252	76.64	0.87
McMurdo Gulch	REACH 3	23726.41 2-Year	398.78	6326.27	6329.24	6329.24	6330.06	0.02063	7.29	54.7	33.84	1.01
McMurdo Gulch	REACH 3	23726.41 5-Year	678.02	6326.27	6329.96	6329.96	6331.05	0.017847	8.39	82.16	41.7	0.99
McMurdo Gulch	REACH 3	23726.41 10-Year	838.12	6326.27	6330.33	6330.33	6331.54	0.016317	8.87	98.05	46.17	0.97
McMurdo Gulch	REACH 3	23726.41 25-Year	1280.81	6326.27	6331.2	6331.2	6332.66	0.013763	9.87	143.21	57.77	0.93
McMurdo Gulch	REACH 3	23726.41 50-Year	1473.52	6326.27	6331.53	6331.53	6333.08	0.013028	10.21	163.28	62.22	0.92
McMurdo Gulch	REACH 3	23726.41 100-Year	1820.75	6326.27	6332.09	6332.09	6333.75	0.011952	10.72	199.93	69.08	0.91
McMurdo Gulch	REACH 3	23726.41 500-Year	2386.95	6326.27	6332.81	6332.81	6334.7	0.011396	11.6	252.27	75.37	0.91

McMurdo Gulch	REACH 3	23417.48	2-Year	398.78	6322.16	6326.91		6326.97	0.000635	1.98	202.3	68.81	0.2
McMurdo Gulch	REACH 3	23417.48	5-Year	678.02	6322.16	6327.52		6327.64	0.001	2.8	246.96	76.61	0.26
McMurdo Gulch	REACH 3	23417.48	10-Year	838.12	6322.16	6327.8		6327.96	0.001191	3.21	269.02	80.24	0.28
McMurdo Gulch	REACH 3	23417.48	25-Year	1280.81	6322.16	6328.47		6328.73	0.001636	4.16	325.58	90.2	0.34
McMurdo Gulch	REACH 3	23417.48	50-Year	1473.52	6322.16	6328.68		6329	0.001854	4.56	344.95	93.5	0.36
McMurdo Gulch	REACH 3	23417.48	100-Year	1820.75	6322.16	6329.2		6329.58	0.001977	5.04	395.81	102.66	0.38
McMurdo Gulch	REACH 3	23417.48	500-Year	2386.95	6322.16	6330.02		6330.49	0.002025	5.61	487.15	118.81	0.4
McMurdo Gulch	REACH 4	23304	2-Year	432.66	6322.1	6326.8		6326.9	0.000853	2.63	222.93	120.66	0.24
McMurdo Gulch	REACH 4	23304	5-Year	734.91	6322.1	6327.36		6327.53	0.001343	3.61	296.71	140.84	0.3
McMurdo Gulch	REACH 4	23304	10-Year	904.93	6322.1	6327.63		6327.83	0.001554	4.04	334.79	147.52	0.33
McMurdo Gulch	REACH 4	23304	25-Year	1392.7	6322.1	6328.27		6328.56	0.002021	5.02	434.39	164.01	0.38
McMurdo Gulch	REACH 4	23304	50-Year	1602.12	6322.1	6328.47		6328.8	0.002252	5.43	467.61	169.5	0.41
McMurdo Gulch	REACH 4	23304	100-Year	2037.43	6322.1	6328.99		6329.37	0.002371	5.92	560.98	184.01	0.43
McMurdo Gulch	REACH 4	23304	500-Year	2885.84	6322.1	6329.8		6330.27	0.002641	6.8	717.68	206.41	0.46
McMurdo Gulch	REACH 4	23294	2-Year	432.66	6322.1	6326.73	6324.88	6326.87	0.001351	3.18	172.09	93.12	0.29
McMurdo Gulch	REACH 4	23294	5-Year	734.91	6322.1	6327.19	6325.62	6327.48	0.002379	4.57	220.85	118.04	0.4
McMurdo Gulch	REACH 4	23294	10-Year	904.93	6322.1	6327.4	6326.01	6327.76	0.002894	5.21	246.18	126.61	0.44
McMurdo Gulch	REACH 4	23294	25-Year	1392.7	6322.1	6327.86	6326.97	6328.44	0.004298	6.8	309.93	149.08	0.55
McMurdo Gulch	REACH 4	23294	50-Year	1602.12	6322.1	6327.9	6327.35	6328.65	0.005482	7.72	315.41	150.27	0.62
McMurdo Gulch	REACH 4	23294	100-Year	2037.43	6322.1	6327.96	6327.96	6329.11	0.008352	9.61	324.33	151.87	0.77
McMurdo Gulch	REACH 4	23294	500-Year	2885.84	6322.1	6328.63	6328.63	6329.97	0.008844	10.78	433.32	170.2	0.81
McMurdo Gulch	REACH 4	23275.85	Culvert										
McMurdo Gulch	REACH 4	23236.81	2-Year	432.66	6321.68	6324.72	6324.72	6324.91	0.0026	3.57	124.93	66.97	0.39
McMurdo Gulch	REACH 4	23236.81	5-Year	734.91	6321.68	6324.72	6324.72	6325.29	0.007501	6.07	124.93	66.97	0.66
McMurdo Gulch	REACH 4	23236.81	10-Year	904.93	6321.68	6324.72	6324.72	6325.58	0.011374	7.47	124.93	66.97	0.81
McMurdo Gulch	REACH 4	23236.81	25-Year	1392.7	6321.68	6325.21	6325.21	6326.36	0.014462	8.7	172.02	87.68	0.92
McMurdo Gulch	REACH 4	23236.81	50-Year	1602.12	6321.68	6325.48	6325.48	6326.69	0.013541	8.97	197.72	97.5	0.91
McMurdo Gulch	REACH 4	23236.81	100-Year	2037.43	6321.68	6326.02	6326.02	6327.31	0.011965	9.4	254.52	115.09	0.88
McMurdo Gulch	REACH 4	23236.81	500-Year	2885.84	6321.68	6326.8	6326.8	6328.28	0.011032	10.3	353.67	137.6	0.87
McMurdo Gulch	REACH 4	23186.5	2-Year	432.66	6317.99	6320.67	6320.55	6321.21	0.015624	5.92	75.02	61.03	0.87
McMurdo Gulch	REACH 4	23186.5	5-Year	734.91	6317.99	6321.36	6321.13	6322.01	0.011985	6.57	121.49	74.26	0.8
McMurdo Gulch	REACH 4	23186.5	10-Year	904.93	6317.99	6321.61	6321.42	6322.36	0.012404	7.14	140.23	79.02	0.83

McMurdo Gulch	REACH 4	23186.5	25-Year	1392.7	6317.99	6322.2	6322.15	6323.22	0.013118	8.41	191.89	93.52	0.88
McMurdo Gulch	REACH 4	23186.5	50-Year	1602.12	6317.99	6322.43	6322.38	6323.53	0.013161	8.79	213.07	95.12	0.89
McMurdo Gulch	REACH 4	23186.5	100-Year	2037.43	6317.99	6322.82	6322.82	6324.1	0.013665	9.6	250.68	97.18	0.93
McMurdo Gulch	REACH 4	23186.5	500-Year	2885.84	6317.99	6323.54	6323.54	6325.08	0.013673	10.66	322.49	101.6	0.95
McMurdo Gulch	REACH 4	23055.63	2-Year	432.66	6315.64	6318.57	6318.39	6319.2	0.015153	6.33	68.34	41.08	0.87
McMurdo Gulch	REACH 4	23055.63	5-Year	734.91	6315.64	6319.23	6319.23	6320.05	0.019002	7.27	103.76	70.18	0.98
McMurdo Gulch	REACH 4	23055.63	10-Year	904.93	6315.64	6319.48	6319.48	6320.4	0.018164	7.76	121.4	72.64	0.98
McMurdo Gulch	REACH 4	23055.63	25-Year	1392.7	6315.64	6320.1	6320.1	6321.29	0.016521	8.89	168.44	79.03	0.97
McMurdo Gulch	REACH 4	23055.63	50-Year	1602.12	6315.64	6320.35	6320.35	6321.63	0.015823	9.25	188.66	82.75	0.97
McMurdo Gulch	REACH 4	23055.63	100-Year	2037.43	6315.64	6320.86	6320.86	6322.26	0.014151	9.77	232.59	88.17	0.94
McMurdo Gulch	REACH 4	23055.63	500-Year	2885.84	6315.64	6321.67	6321.67	6323.33	0.012876	10.77	307.08	119.32	0.93
McMurdo Gulch	REACH 4	23022.87	2-Year	432.66	6315.33	6317.95	6317.95	6318.61	0.021319	6.51	67.16	59.87	1
McMurdo Gulch	REACH 4	23022.87	5-Year	734.91	6315.33	6318.55	6318.55	6319.35	0.016839	7.3	109.42	73.49	0.94
McMurdo Gulch	REACH 4	23022.87	10-Year	904.93	6315.33	6318.8	6318.8	6319.7	0.016619	7.8	127.91	75.28	0.95
McMurdo Gulch	REACH 4	23022.87	25-Year	1392.7	6315.33	6319.42	6319.42	6320.56	0.016102	8.92	175.35	79.53	0.97
McMurdo Gulch	REACH 4	23022.87	50-Year	1602.12	6315.33	6319.65	6319.65	6320.89	0.015799	9.34	193.78	81.03	0.97
McMurdo Gulch	REACH 4	23022.87	100-Year	2037.43	6315.33	6320.05	6320.05	6321.54	0.015966	10.26	227.28	84.68	1
McMurdo Gulch	REACH 4	23022.87	500-Year	2885.84	6315.33	6320.95	6320.95	6322.62	0.013284	11.01	310.19	117.85	0.95
McMurdo Gulch	REACH 4	22784.94	2-Year	432.66	6312	6313.16		6313.46	0.01261	4.38	99.29	93.56	0.74
McMurdo Gulch	REACH 4	22784.94	5-Year	734.91	6312	6313.55		6314.01	0.013292	5.42	136.94	98.42	0.8
McMurdo Gulch	REACH 4	22784.94	10-Year	904.93	6312	6313.73		6314.27	0.013587	5.93	154.59	100.21	0.83
McMurdo Gulch	REACH 4	22784.94	25-Year	1392.7	6312	6314.16	6314.01	6314.95	0.014341	7.14	199.03	104.09	0.88
McMurdo Gulch	REACH 4	22784.94	50-Year	1602.12	6312	6314.32	6314.2	6315.21	0.014803	7.62	215.26	104.98	0.91
McMurdo Gulch	REACH 4	22784.94	100-Year	2037.43	6312	6314.59	6314.55	6315.72	0.016204	8.61	243.56	106.5	0.97
McMurdo Gulch	REACH 4	22784.94	500-Year	2885.84	6312	6315.17	6315.17	6316.63	0.015721	9.78	306.94	109.84	0.99
McMurdo Gulch	REACH 4	22745.31	2-Year	432.66	6310.51	6312.31	6312.31	6312.76	0.02474	5.41	79.97	89.58	1.01
McMurdo Gulch	REACH 4	22745.31	5-Year	734.91	6310.51	6312.69	6312.69	6313.32	0.022014	6.35	115.94	96.04	1.01
McMurdo Gulch	REACH 4	22745.31	10-Year	904.93	6310.51	6312.88	6312.88	6313.6	0.020817	6.78	134.48	99.07	1
McMurdo Gulch	REACH 4	22745.31	25-Year	1392.7	6310.51	6313.36	6313.36	6314.29	0.01859	7.76	183.49	106.2	0.99
McMurdo Gulch	REACH 4	22745.31	50-Year	1602.12	6310.51	6313.55	6313.55	6314.56	0.017808	8.09	203.88	109.03	0.99
McMurdo Gulch	REACH 4	22745.31	100-Year	2037.43	6310.51	6313.92	6313.92	6315.07	0.016563	8.69	244.89	114.74	0.98
McMurdo Gulch	REACH 4	22745.31	500-Year	2885.84	6310.51	6314.55	6314.55	6315.96	0.015077	9.66	320.61	125.8	0.97
McMurdo Gulch	REACH 4	22509.23	2-Year	432.66	6306	6308.83		6309.05	0.005411	3.8	113.93	69.23	0.52

McMurdo Gulch	REACH 4	22509.23	5-Year	734.91	6306	6309.44		6309.77	0.00605	4.61	159.6	79.66	0.57
McMurdo Gulch	REACH 4	22509.23	10-Year	904.93	6306	6309.7		6310.09	0.006169	5.01	181.18	84.19	0.59
McMurdo Gulch	REACH 4	22509.23	25-Year	1392.7	6306	6310.38		6310.92	0.00605	5.91	241.04	92.71	0.61
McMurdo Gulch	REACH 4	22509.23	50-Year	1602.12	6306	6310.65		6311.24	0.005904	6.19	266.83	95.59	0.61
McMurdo Gulch	REACH 4	22509.23	100-Year	2037.43	6306	6311.18		6311.87	0.00566	6.71	318.61	101.19	0.61
McMurdo Gulch	REACH 4	22509.23	500-Year	2885.84	6306	6312.13		6312.96	0.005141	7.44	420.26	112.8	0.61
McMurdo Gulch	REACH 4	22408.41	2-Year	432.66	6305.72	6307.87		6308.26	0.01184	4.99	86.78	62.79	0.75
McMurdo Gulch	REACH 4	22408.41	5-Year	734.91	6305.72	6308.61		6309.02	0.009075	5.14	142.97	80.89	0.68
McMurdo Gulch	REACH 4	22408.41	10-Year	904.93	6305.72	6308.93		6309.37	0.008205	5.35	169.03	83.35	0.66
McMurdo Gulch	REACH 4	22408.41	25-Year	1392.7	6305.72	6309.75		6310.27	0.006673	5.8	240.1	89.72	0.63
McMurdo Gulch	REACH 4	22408.41	50-Year	1602.12	6305.72	6310.07		6310.62	0.00621	5.95	269.23	92.04	0.61
McMurdo Gulch	REACH 4	22408.41	100-Year	2037.43	6305.72	6310.68		6311.29	0.005359	6.27	326.19	95.35	0.59
McMurdo Gulch	REACH 4	22408.41	500-Year	2885.84	6305.72	6311.73		6312.45	0.004501	6.83	429.14	101.05	0.56
McMurdo Gulch	REACH 4	22371.4	2-Year	432.66	6304.13	6307.46	6307.02	6307.85	0.009978	5.03	85.99	53.87	0.7
McMurdo Gulch	REACH 4	22371.4	5-Year	734.91	6304.13	6308.1	6307.68	6308.65	0.010321	5.96	123.47	63.28	0.74
McMurdo Gulch	REACH 4	22371.4	10-Year	904.93	6304.13	6308.36	6307.96	6309.01	0.010366	6.49	140.4	65.58	0.76
McMurdo Gulch	REACH 4	22371.4	25-Year	1392.7	6304.13	6308.99	6308.61	6309.92	0.010696	7.76	183.64	71.02	0.8
McMurdo Gulch	REACH 4	22371.4	50-Year	1602.12	6304.13	6309.23	6308.91	6310.27	0.010757	8.21	201.16	73.02	0.82
McMurdo Gulch	REACH 4	22371.4	100-Year	2037.43	6304.13	6309.71	6309.35	6310.95	0.010687	9	237.08	76.96	0.83
McMurdo Gulch	REACH 4	22371.4	500-Year	2885.84	6304.13	6310.55	6310.2	6312.12	0.010387	10.19	304.27	83.25	0.85
McMurdo Gulch	REACH 4	22043.6	2-Year	432.66	6300.85	6302.51	6302.51	6303.22	0.021235	6.75	64.14	45.58	1
McMurdo Gulch	REACH 4	22043.6	5-Year	734.91	6300.85	6303.13	6303.13	6304.09	0.019318	7.87	93.38	49.04	1
McMurdo Gulch	REACH 4	22043.6	10-Year	904.93	6300.85	6303.42	6303.42	6304.52	0.018538	8.41	107.83	50.76	1
McMurdo Gulch	REACH 4	22043.6	25-Year	1392.7	6300.85	6304.17	6304.17	6305.59	0.016371	9.56	147.72	55.05	0.99
McMurdo Gulch	REACH 4	22043.6	50-Year	1602.12	6300.85	6304.46	6304.46	6306	0.015738	9.98	163.72	56.21	0.98
McMurdo Gulch	REACH 4	22043.6	100-Year	2037.43	6300.85	6305	6305	6306.79	0.01489	10.79	194.94	58.4	0.98
McMurdo Gulch	REACH 4	22043.6	500-Year	2885.84	6300.85	6305.96	6305.96	6308.16	0.01372	12.04	252.35	62.26	0.98
McMurdo Gulch	REACH 4	21826.79	2-Year	432.66	6298	6299.87		6300.1	0.005431	3.86	112.03	66.36	0.52
McMurdo Gulch	REACH 4	21826.79	5-Year	734.91	6298	6300.32		6300.74	0.007206	5.14	143.02	68.79	0.63
McMurdo Gulch	REACH 4	21826.79	10-Year	904.93	6298	6300.63		6301.1	0.006972	5.53	164.04	70.06	0.63
McMurdo Gulch	REACH 4	21826.79	25-Year	1392.7	6298	6301.19		6301.93	0.008139	6.88	204.28	72.42	0.7
McMurdo Gulch	REACH 4	21826.79	50-Year	1602.12	6298	6301.39		6302.24	0.00863	7.4	219.01	73.26	0.73
McMurdo Gulch	REACH 4	21826.79	100-Year	2037.43	6298	6301.76		6302.86	0.009654	8.42	246.12	74.79	0.79
McMurdo Gulch	REACH 4	21826.79	500-Year	2885.84	6298	6302.26	6302.06	6303.93	0.012364	10.41	284.14	76.87	0.91

McMurdo Gulch	REACH 4	21777.38 2-Year	432.66	6298	6299.07	6299.07	6299.58	0.023634	5.72	75.63	75.2	1.01
McMurdo Gulch	REACH 4	21777.38 5-Year	734.91	6298	6299.75		6300.26	0.012833	5.75	127.9	79.71	0.8
McMurdo Gulch	REACH 4	21777.38 10-Year	904.93	6298	6299.73	6299.73	6300.52	0.020144	7.15	126.5	79.6	1
McMurdo Gulch	REACH 4	21777.38 25-Year	1392.7	6298	6300.26	6300.26	6301.31	0.018419	8.25	169.24	82.41	1
McMurdo Gulch	REACH 4	21777.38 50-Year	1602.12	6298	6300.47	6300.47	6301.62	0.017735	8.63	186.66	83.49	1
McMurdo Gulch	REACH 4	21777.38 100-Year	2037.43	6298	6300.87	6300.87	6302.22	0.016684	9.32	220.96	85.58	1
McMurdo Gulch	REACH 4	21777.38 500-Year	2885.84	6298	6301.6	6301.6	6303.26	0.014991	10.35	285.2	90.16	0.98
McMurdo Gulch	REACH 4	21417.19 2-Year	432.66	6292	6293.24	6293.24	6293.73	0.02375	5.63	76.92	78.88	1
McMurdo Gulch	REACH 4	21417.19 5-Year	734.91	6292	6293.68	6293.68	6294.33	0.021777	6.47	113.71	90.19	1.01
McMurdo Gulch	REACH 4	21417.19 10-Year	904.93	6292	6293.87	6293.87	6294.61	0.020547	6.9	131.98	97.07	1
McMurdo Gulch	REACH 4	21417.19 25-Year	1392.7	6292	6294.56	6294.56	6295.22	0.011685	6.72	256.75	239.76	0.8
McMurdo Gulch	REACH 4	21417.19 50-Year	1602.12	6292	6294.71	6294.71	6295.4	0.011575	7	293.21	241.96	0.81
McMurdo Gulch	REACH 4	21417.19 100-Year	2037.43	6292	6294.98	6294.98	6295.75	0.011754	7.58	357.25	245.58	0.83
McMurdo Gulch	REACH 4	21417.19 500-Year	2885.84	6292	6295.41	6295.41	6296.33	0.012098	8.52	464.17	251.5	0.86
McMurdo Gulch	REACH 4	21370.41 2-Year	432.66	6290.52	6292.4	6292.25	6292.77	0.015871	4.9	88.25	82.2	0.83
McMurdo Gulch	REACH 4	21370.41 5-Year	734.91	6290.52	6292.82	6292.72	6293.34	0.016217	5.83	129.35	124.84	0.88
McMurdo Gulch	REACH 4	21370.41 10-Year	904.93	6290.52	6292.93	6292.93	6293.6	0.01863	6.59	143.87	131.51	0.95
McMurdo Gulch	REACH 4	21370.41 25-Year	1392.7	6290.52	6293.43	6293.43	6294.22	0.015502	7.29	216.96	162	0.91
McMurdo Gulch	REACH 4	21370.41 50-Year	1602.12	6290.52	6293.61	6293.61	6294.44	0.014889	7.56	246.54	171.89	0.91
McMurdo Gulch	REACH 4	21370.41 100-Year	2037.43	6290.52	6293.93	6293.93	6294.86	0.014072	8.07	304.93	186.17	0.9
McMurdo Gulch	REACH 4	21370.41 500-Year	2885.84	6290.52	6294.48	6294.48	6295.52	0.012749	8.77	417.22	212.12	0.89
McMurdo Gulch	REACH 4	21133.42 2-Year	432.66	6288	6289.23		6289.48	0.012015	3.95	109.55	116.73	0.71
McMurdo Gulch	REACH 4	21133.42 5-Year	734.91	6288	6289.58		6289.95	0.012423	4.92	152.16	132.75	0.76
McMurdo Gulch	REACH 4	21133.42 10-Year	904.93	6288	6289.74		6290.18	0.01244	5.34	174.97	139.49	0.78
McMurdo Gulch	REACH 4	21133.42 25-Year	1392.7	6288	6290.15	6289.96	6290.76	0.012485	6.31	234.7	150.36	0.81
McMurdo Gulch	REACH 4	21133.42 50-Year	1602.12	6288	6290.31	6290.13	6290.98	0.012557	6.67	257.7	152.54	0.83
McMurdo Gulch	REACH 4	21133.42 100-Year	2037.43	6288	6290.59	6290.43	6291.39	0.012741	7.33	301.85	156.59	0.85
McMurdo Gulch	REACH 4	21133.42 500-Year	2885.84	6288	6291.06	6290.94	6292.11	0.013296	8.47	376.64	163.22	0.9
McMurdo Gulch	REACH 4	21063.55 2-Year	432.66	6286	6287.77	6287.77	6288.31	0.023497	5.86	73.83	70.61	1.01
McMurdo Gulch	REACH 4	21063.55 5-Year	734.91	6286	6288.3	6288.3	6288.9	0.017726	6.28	125.96	126.1	0.92
McMurdo Gulch	REACH 4	21063.55 10-Year	904.93	6286	6288.5	6288.5	6289.16	0.016661	6.64	152.11	135.68	0.92
McMurdo Gulch	REACH 4	21063.55 25-Year	1392.7	6286	6288.97	6288.97	6289.77	0.015065	7.49	222.13	158.44	0.91
McMurdo Gulch	REACH 4	21063.55 50-Year	1602.12	6286	6289.15	6289.15	6290	0.014621	7.79	251.07	167.2	0.91

McMurdo Gulch	REACH 4	21063.55	100-Year	2037.43	6286	6289.47	6289.47	6290.43	0.014127	8.36	307.9	183.01	0.91
McMurdo Gulch	REACH 4	21063.55	500-Year	2885.84	6286	6289.99	6289.99	6291.13	0.013946	9.37	408.75	210.04	0.93
McMurdo Gulch	REACH 4	20884.87	2-Year	432.66	6282	6284.59	6284.11	6284.86	0.005991	4.24	118.14	170.59	0.56
McMurdo Gulch	REACH 4	20884.87	5-Year	734.91	6282	6285.17	6284.68	6285.4	0.004388	4.37	269.72	267.49	0.5
McMurdo Gulch	REACH 4	20884.87	10-Year	904.93	6282	6284.97	6284.94	6285.65	0.012408	6.94	163.73	232.27	0.83
McMurdo Gulch	REACH 4	20884.87	25-Year	1392.7	6282	6285.45	6285.39	6285.94	0.008704	6.63	347.62	279.59	0.72
McMurdo Gulch	REACH 4	20884.87	50-Year	1602.12	6282	6285.55	6285.49	6286.1	0.009473	7.09	376.36	283.55	0.75
McMurdo Gulch	REACH 4	20884.87	100-Year	2037.43	6282	6285.8	6285.74	6286.4	0.009896	7.67	447.14	292.76	0.78
McMurdo Gulch	REACH 4	20884.87	500-Year	2885.84	6282	6286.22	6286.13	6286.92	0.010221	8.51	573.77	304.72	0.81
McMurdo Gulch	REACH 4	20842.12	2-Year	432.66	6282	6283.98	6283.8	6284.47	0.014046	5.58	77.59	54.2	0.82
McMurdo Gulch	REACH 4	20842.12	5-Year	734.91	6282	6284.5	6284.47	6285.08	0.01224	6.38	143.95	255.52	0.81
McMurdo Gulch	REACH 4	20842.12	10-Year	904.93	6282	6284.72	6284.72	6285.14	0.009138	5.92	245.85	278.81	0.71
McMurdo Gulch	REACH 4	20842.12	25-Year	1392.7	6282	6285.02	6285.02	6285.56	0.010703	6.99	331.12	284.54	0.79
McMurdo Gulch	REACH 4	20842.12	50-Year	1602.12	6282	6285.16	6285.14	6285.71	0.010486	7.19	372.58	287.28	0.78
McMurdo Gulch	REACH 4	20842.12	100-Year	2037.43	6282	6285.45	6285.37	6286.01	0.009903	7.49	456.11	292.59	0.78
McMurdo Gulch	REACH 4	20842.12	500-Year	2885.84	6282	6285.88	6285.69	6286.52	0.010094	8.28	582.06	300.24	0.8
McMurdo Gulch	REACH 4	20645.9	2-Year	432.66	6280	6282.02	6281.6	6282.28	0.008527	4.12	104.98	79.55	0.63
McMurdo Gulch	REACH 4	20645.9	5-Year	734.91	6280	6282.49	6282.12	6282.88	0.01008	4.98	151.45	178.25	0.71
McMurdo Gulch	REACH 4	20645.9	10-Year	904.93	6280	6282.64	6282.35	6283.11	0.011028	5.54	174.56	220.15	0.75
McMurdo Gulch	REACH 4	20645.9	25-Year	1392.7	6280	6283.04	6282.98	6283.57	0.010394	6.19	293.65	271.01	0.75
McMurdo Gulch	REACH 4	20645.9	50-Year	1602.12	6280	6283.14	6283.14	6283.74	0.0112	6.63	320.89	273.16	0.79
McMurdo Gulch	REACH 4	20645.9	100-Year	2037.43	6280	6283.35	6283.35	6284.05	0.012016	7.31	379.79	277.58	0.83
McMurdo Gulch	REACH 4	20645.9	500-Year	2885.84	6280	6283.77	6283.76	6284.58	0.011983	8.12	496.89	285.22	0.85

Proposed Subcritical Detailed Results Table													
River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Trib 4	Trib 4	533.553	2-Year	32.79	6339.1	6341.55	6340.1	6341.56	0.000311	0.7	47.05	42.13	0.12
Trib 4	Trib 4	533.553	5-Year	89.8	6339.1	6343.41	6340.71	6343.41	0.000084	0.56	161.23	76.04	0.07
Trib 4	Trib 4	533.553	10-Year	121.08	6339.1	6344.26	6340.9	6344.27	0.000055	0.53	230.51	85.98	0.06
Trib 4	Trib 4	533.553	25-Year	232.46	6339.1	6347.75	6341.37	6347.76	0.000012	0.41	592.16	121.59	0.03
Trib 4	Trib 4	533.553	50-Year	292.11	6339.1	6350.83	6341.59	6350.83	0.000004	0.32	1029.22	165.29	0.02
Trib 4	Trib 4	533.553	100-Year	409.47	6339.1	6353.37	6341.9	6353.37	0.000003	0.33	1500.61	208.79	0.02
Trib 4	Trib 4	533.553	500-Year	579.79	6339.1	6353.93	6342.26	6353.93	0.000005	0.45	1621.31	218.65	0.02
Trib 4	Trib 4	473.1134	Culvert										
Trib 4	Trib 4	360.7572	2-Year	32.79	6332.02	6332.68	6332.68	6332.93	0.030199	3.98	8.23	16.87	1.01
Trib 4	Trib 4	360.7572	5-Year	89.8	6332.02	6333.16	6333.16	6333.58	0.025379	5.17	17.37	21.04	1
Trib 4	Trib 4	360.7572	10-Year	121.08	6332.02	6333.36	6333.36	6333.85	0.024041	5.59	21.66	22.37	1
Trib 4	Trib 4	360.7572	25-Year	232.46	6332.02	6333.92	6333.92	6334.6	0.021826	6.61	35.14	26.12	1.01
Trib 4	Trib 4	360.7572	50-Year	292.11	6332.02	6334.16	6334.16	6334.92	0.021109	7	41.75	27.77	1.01
Trib 4	Trib 4	360.7572	100-Year	409.47	6332.02	6334.55	6334.55	6335.49	0.019233	7.76	53.12	30.16	1
Trib 4	Trib 4	360.7572	500-Year	579.79	6332.02	6335.06	6335.06	6336.2	0.017113	8.59	69.31	33.23	0.98
Trib 4	Trib 4	246.5842	2-Year	32.79	6328	6329.02		6329.08	0.004427	1.99	16.49	22.7	0.41
Trib 4	Trib 4	246.5842	5-Year	89.8	6328	6329.61	6329.08	6329.74	0.005161	2.84	31.61	28.5	0.48
Trib 4	Trib 4	246.5842	10-Year	121.08	6328	6329.85	6329.27	6330	0.005226	3.14	38.59	30.91	0.49
Trib 4	Trib 4	246.5842	25-Year	232.46	6328	6330.48	6329.79	6330.72	0.005028	3.99	60.25	38.09	0.51
Trib 4	Trib 4	246.5842	50-Year	292.11	6328	6330.7		6331	0.005346	4.44	69.24	40.84	0.54
Trib 4	Trib 4	246.5842	100-Year	409.47	6328	6331	6330.38	6331.44	0.00661	5.39	82.27	46.36	0.61
Trib 4	Trib 4	246.5842	500-Year	579.79	6328	6331.29	6330.86	6331.96	0.008847	6.72	96.35	51.8	0.72
Trib 4	Trib 4	216.99	2-Year	32.79	6328	6328.56	6328.56	6328.79	0.030173	3.87	8.47	18.12	1
Trib 4	Trib 4	216.99	5-Year	89.8	6328	6329.01	6329.01	6329.42	0.025532	5.1	17.62	21.89	1
Trib 4	Trib 4	216.99	10-Year	121.08	6328	6329.2	6329.2	6329.68	0.024566	5.53	21.9	23.39	1.01
Trib 4	Trib 4	216.99	25-Year	232.46	6328	6329.74	6329.74	6330.41	0.021437	6.58	35.54	28.78	1
Trib 4	Trib 4	216.99	50-Year	292.11	6328	6330.1	6330.1	6330.73	0.014631	6.38	50.52	59.95	0.86
Trib 4	Trib 4	216.99	100-Year	409.47	6328	6330.48	6330.48	6331.15	0.012839	6.83	74.7	67.01	0.83
Trib 4	Trib 4	216.99	500-Year	579.79	6328	6330.88	6330.88	6331.65	0.012553	7.57	102.24	74.09	0.85
Trib 4	Trib 4	44.46692	2-Year	32.79	6323.91	6325.2		6325.23	0.001702	1.35	24.32	29.31	0.26

Trib 4	Trib 4	44.46692	5-Year	89.8	6323.91	6326.08		6326.12	0.001359	1.47	61.25	54.94	0.24
Trib 4	Trib 4	44.46692	10-Year	121.08	6323.91	6326.5		6326.53	0.000928	1.42	85.4	60.47	0.21
Trib 4	Trib 4	44.46692	25-Year	232.46	6323.91	6327.55		6327.59	0.000609	1.49	156.33	75.15	0.18
Trib 4	Trib 4	44.46692	50-Year	292.11	6323.91	6327.95		6327.99	0.000581	1.56	187.98	84.63	0.18
Trib 4	Trib 4	44.46692	100-Year	409.47	6323.91	6328.54		6328.58	0.000526	1.72	252.63	122.5	0.18
Trib 4	Trib 4	44.46692	500-Year	579.79	6323.91	6329.74		6329.78	0.00029	1.61	427.27	164.16	0.14
McMurdo Gulch	REACH 3	24245.75	2-Year	398.78	6336	6337.72		6338.11	0.012405	5	79.96	60.93	0.76
McMurdo Gulch	REACH 3	24245.75	5-Year	678.02	6336	6338.2	6337.98	6338.8	0.012916	6.22	110.68	67.16	0.82
McMurdo Gulch	REACH 3	24245.75	10-Year	838.12	6336	6338.43	6338.22	6339.14	0.013115	6.79	126.35	69.1	0.84
McMurdo Gulch	REACH 3	24245.75	25-Year	1280.81	6336	6338.99	6338.82	6339.98	0.013279	8.04	166.41	73.83	0.88
McMurdo Gulch	REACH 3	24245.75	50-Year	1473.52	6336	6339.21	6339.05	6340.31	0.013172	8.47	183.28	75.72	0.89
McMurdo Gulch	REACH 3	24245.75	100-Year	1820.75	6336	6339.59	6339.45	6340.85	0.013078	9.17	212	78.84	0.91
McMurdo Gulch	REACH 3	24245.75	500-Year	2386.95	6336	6340.15	6340.03	6341.67	0.012749	10.09	257.5	83.49	0.92
McMurdo Gulch	REACH 3	24054.91	2-Year	398.78	6332.09	6334.34	6334.34	6335.01	0.021675	6.56	60.93	47.71	1.01
McMurdo Gulch	REACH 3	24054.91	5-Year	678.02	6332.09	6334.92	6334.92	6335.84	0.018517	7.72	89.85	52.76	0.99
McMurdo Gulch	REACH 3	24054.91	10-Year	838.12	6332.09	6335.21	6335.21	6336.25	0.017301	8.21	105.75	55.38	0.98
McMurdo Gulch	REACH 3	24054.91	25-Year	1280.81	6332.09	6335.92	6335.92	6337.23	0.015267	9.31	147.32	61.45	0.96
McMurdo Gulch	REACH 3	24054.91	50-Year	1473.52	6332.09	6336.19	6336.19	6337.61	0.014798	9.72	164.18	63.65	0.96
McMurdo Gulch	REACH 3	24054.91	100-Year	1820.75	6332.09	6336.65	6336.65	6338.24	0.013984	10.34	194.38	67.36	0.96
McMurdo Gulch	REACH 3	24054.91	500-Year	2386.95	6332.09	6337.32	6337.32	6339.16	0.013137	11.22	241.37	73.13	0.95
McMurdo Gulch	REACH 3	24006.77	2-Year	398.78	6330.11	6333		6333.4	0.007566	5.04	79.3	41.23	0.63
McMurdo Gulch	REACH 3	24006.77	5-Year	678.02	6330.11	6333.71		6334.31	0.007964	6.22	110.75	47.19	0.68
McMurdo Gulch	REACH 3	24006.77	10-Year	838.12	6330.11	6334.03		6334.75	0.008271	6.84	126.09	50.53	0.71
McMurdo Gulch	REACH 3	24006.77	25-Year	1280.81	6330.11	6334.75	6334.23	6335.79	0.009018	8.27	165.47	59.3	0.76
McMurdo Gulch	REACH 3	24006.77	50-Year	1473.52	6330.11	6335.01	6334.55	6336.19	0.009342	8.82	181.4	62.67	0.79
McMurdo Gulch	REACH 3	24006.77	100-Year	1820.75	6330.11	6335.41	6335.09	6336.83	0.010012	9.75	207.84	67.97	0.83
McMurdo Gulch	REACH 3	24006.77	500-Year	2386.95	6330.11	6336.03	6335.86	6337.78	0.01059	10.95	252	76.64	0.87
McMurdo Gulch	REACH 3	23726.41	2-Year	398.78	6326.27	6329.24	6329.24	6330.06	0.02063	7.29	54.7	33.84	1.01
McMurdo Gulch	REACH 3	23726.41	5-Year	678.02	6326.27	6329.96	6329.96	6331.05	0.017847	8.39	82.16	41.7	0.99
McMurdo Gulch	REACH 3	23726.41	10-Year	838.12	6326.27	6330.33	6330.33	6331.54	0.016317	8.87	98.05	46.17	0.97
McMurdo Gulch	REACH 3	23726.41	25-Year	1280.81	6326.27	6331.2	6331.2	6332.66	0.013763	9.87	143.21	57.77	0.93
McMurdo Gulch	REACH 3	23726.41	50-Year	1473.52	6326.27	6331.53	6331.53	6333.08	0.013028	10.21	163.28	62.22	0.92
McMurdo Gulch	REACH 3	23726.41	100-Year	1820.75	6326.27	6332.09	6332.09	6333.75	0.011952	10.72	199.93	69.08	0.91
McMurdo Gulch	REACH 3	23726.41	500-Year	2386.95	6326.27	6332.81	6332.81	6334.7	0.011396	11.6	252.27	75.37	0.91

McMurdo Gulch	REACH 3	23417.48	2-Year	398.78	6322.16	6325.24		6325.48	0.004499	3.87	102.94	52.53	0.49
McMurdo Gulch	REACH 3	23417.48	5-Year	678.02	6322.16	6326.07		6326.39	0.004454	4.56	148.85	58.97	0.51
McMurdo Gulch	REACH 3	23417.48	10-Year	838.12	6322.16	6326.48		6326.84	0.004465	4.82	173.78	63.33	0.51
McMurdo Gulch	REACH 3	23417.48	25-Year	1280.81	6322.16	6327.47		6327.92	0.003744	5.36	242.94	75.94	0.49
McMurdo Gulch	REACH 3	23417.48	50-Year	1473.52	6322.16	6327.83		6328.32	0.003593	5.6	271.34	80.62	0.49
McMurdo Gulch	REACH 3	23417.48	100-Year	1820.75	6322.16	6328.32		6328.89	0.003712	6.13	311.98	87.82	0.51
McMurdo Gulch	REACH 3	23417.48	500-Year	2386.95	6322.16	6329.35		6329.97	0.003076	6.4	411.56	105.42	0.48
McMurdo Gulch	REACH 4	23326.28	2-Year	432.66	6322.41	6324.49		6324.9	0.007751	5.28	89.92	51.92	0.65
McMurdo Gulch	REACH 4	23326.28	5-Year	734.91	6322.41	6325.18		6325.79	0.008102	6.55	127.7	58.22	0.7
McMurdo Gulch	REACH 4	23326.28	10-Year	904.93	6322.41	6325.47		6326.22	0.008609	7.22	145.56	63.94	0.73
McMurdo Gulch	REACH 4	23326.28	25-Year	1392.7	6322.41	6325.91	6325.72	6327.22	0.012716	9.61	176.55	78.13	0.91
McMurdo Gulch	REACH 4	23326.28	50-Year	1602.12	6322.41	6326.22	6326.1	6327.63	0.01243	10.05	202.87	93.62	0.91
McMurdo Gulch	REACH 4	23326.28	100-Year	2037.43	6322.41	6327.07	6326.92	6328.3	0.008787	9.68	300.4	131.91	0.79
McMurdo Gulch	REACH 4	23326.28	500-Year	2885.84	6322.41	6328.95		6329.63	0.003737	7.91	595.32	182.62	0.55
McMurdo Gulch	REACH 4	23305.21	2-Year	432.66	6322.26	6324.1		6324.59	0.037445	5.75	77.88	49.74	0.75
McMurdo Gulch	REACH 4	23305.21	5-Year	734.91	6322.26	6324.49	6324.46	6325.39	0.054013	7.84	97.74	52.88	0.93
McMurdo Gulch	REACH 4	23305.21	10-Year	904.93	6322.26	6324.75	6324.75	6325.79	0.054628	8.49	111.69	54.88	0.95
McMurdo Gulch	REACH 4	23305.21	25-Year	1392.7	6322.26	6325.5	6325.5	6326.78	0.048364	9.52	155.16	60.92	0.93
McMurdo Gulch	REACH 4	23305.21	50-Year	1602.12	6322.26	6325.91	6325.78	6327.17	0.041005	9.49	180.6	64.48	0.88
McMurdo Gulch	REACH 4	23305.21	100-Year	2037.43	6322.26	6326.85	6326.13	6327.98	0.0297	9.42	256.55	98.22	0.78
McMurdo Gulch	REACH 4	23305.21	500-Year	2885.84	6322.26	6328.96		6329.44	0.008986	6.67	562.26	179.01	0.45
McMurdo Gulch	REACH 4	23252.76	2-Year	432.66	6319.94	6321.72		6322.26	0.051749	5.88	73.56	48.92	0.85
McMurdo Gulch	REACH 4	23252.76	5-Year	734.91	6319.94	6322.86		6323.32	0.02431	5.46	135.77	62.83	0.62
McMurdo Gulch	REACH 4	23252.76	10-Year	904.93	6319.94	6323.43		6323.87	0.018107	5.31	174.21	70.32	0.56
McMurdo Gulch	REACH 4	23252.76	25-Year	1392.7	6319.94	6324.94		6325.3	0.009884	4.93	297.66	93.72	0.43
McMurdo Gulch	REACH 4	23252.76	50-Year	1602.12	6319.94	6325.55		6325.88	0.008017	4.77	357.02	103.93	0.4
McMurdo Gulch	REACH 4	23252.76	100-Year	2037.43	6319.94	6326.73		6327.01	0.005108	4.45	502.53	140.83	0.33
McMurdo Gulch	REACH 4	23252.76	500-Year	2885.84	6319.94	6328.87		6329.06	0.002528	3.88	868.6	197.12	0.24
McMurdo Gulch	REACH 4	23226	2-Year	432.66	6318.33	6321.59		6321.71	0.005523	2.77	157.47	64.35	0.3
McMurdo Gulch	REACH 4	23226	5-Year	734.91	6318.33	6322.78		6322.92	0.004589	3.1	247.72	91.12	0.29
McMurdo Gulch	REACH 4	23226	10-Year	904.93	6318.33	6323.38		6323.52	0.004018	3.14	305.53	101.56	0.28
McMurdo Gulch	REACH 4	23226	25-Year	1392.7	6318.33	6324.93		6325.07	0.002667	3.14	476.79	119.24	0.24
McMurdo Gulch	REACH 4	23226	50-Year	1602.12	6318.33	6325.53		6325.67	0.002311	3.14	555.82	140.58	0.22

McMurdo Gulch	REACH 4	23226	100-Year	2037.43	6318.33	6326.73		6326.86	0.001743	3.07	740.95	169.16	0.2
McMurdo Gulch	REACH 4	23226	500-Year	2885.84	6318.33	6328.87		6328.98	0.001077	2.87	1176.92	238.25	0.16
McMurdo Gulch	REACH 4	23198	2-Year	432.66	6317.82	6321.58		6321.65	0.000786	2.15	208.8	87.31	0.22
McMurdo Gulch	REACH 4	23198	5-Year	734.91	6317.82	6322.77		6322.86	0.000731	2.49	327.16	110.62	0.22
McMurdo Gulch	REACH 4	23198	10-Year	904.93	6317.82	6323.37		6323.47	0.000678	2.59	395.79	117.5	0.22
McMurdo Gulch	REACH 4	23198	25-Year	1392.7	6317.82	6324.92		6325.03	0.00053	2.8	587.8	136.85	0.2
McMurdo Gulch	REACH 4	23198	50-Year	1602.12	6317.82	6325.53		6325.64	0.000488	2.86	677.39	160.16	0.2
McMurdo Gulch	REACH 4	23198	100-Year	2037.43	6317.82	6326.72		6326.83	0.000414	2.94	889.33	196.64	0.19
McMurdo Gulch	REACH 4	23198	500-Year	2885.84	6317.82	6328.85		6328.96	0.000303	2.96	1380.32	250.68	0.17
McMurdo Gulch	REACH 4	23168.61	2-Year	432.66	6317.41	6321.57	6319.23	6321.63	0.000636	1.97	219.17	69.85	0.2
McMurdo Gulch	REACH 4	23168.61	5-Year	734.91	6317.41	6322.75	6319.79	6322.84	0.000672	2.41	305.15	74.47	0.21
McMurdo Gulch	REACH 4	23168.61	10-Year	904.93	6317.41	6323.35	6320.04	6323.45	0.000666	2.59	349.61	86.16	0.21
McMurdo Gulch	REACH 4	23168.61	25-Year	1392.7	6317.41	6324.87	6320.64	6325.01	0.000611	3	464.84	153.65	0.21
McMurdo Gulch	REACH 4	23168.61	50-Year	1602.12	6317.41	6325.47	6320.95	6325.62	0.000593	3.14	509.94	170.57	0.21
McMurdo Gulch	REACH 4	23168.61	100-Year	2037.43	6317.41	6326.63	6321.43	6326.81	0.000565	3.41	597.82	218.33	0.21
McMurdo Gulch	REACH 4	23168.61	500-Year	2885.84	6317.41	6328.71	6322.24	6328.94	0.00052	3.82	755.09	255.68	0.21
McMurdo Gulch	REACH 4	23117.16		Culvert									
McMurdo Gulch	REACH 4	23000.04	2-Year	432.66	6315.87	6318.01	6318.01	6318.61	0.021179	6.2	69.78	56.58	0.98
McMurdo Gulch	REACH 4	23000.04	5-Year	734.91	6315.87	6318.57	6318.57	6319.36	0.019161	7.15	102.84	62.42	0.98
McMurdo Gulch	REACH 4	23000.04	10-Year	904.93	6315.87	6318.82	6318.82	6319.72	0.018776	7.58	119.39	65.31	0.99
McMurdo Gulch	REACH 4	23000.04	25-Year	1392.7	6315.87	6319.48	6319.48	6320.59	0.017508	8.45	164.85	72.65	0.99
McMurdo Gulch	REACH 4	23000.04	50-Year	1602.12	6315.87	6319.71	6319.71	6320.92	0.017332	8.82	181.7	75.5	1
McMurdo Gulch	REACH 4	23000.04	100-Year	2037.43	6315.87	6320.16	6320.16	6321.55	0.016134	9.44	215.82	80.39	0.99
McMurdo Gulch	REACH 4	23000.04	500-Year	2885.84	6315.87	6320.88	6320.88	6322.66	0.015396	10.7	269.72	156.98	1
McMurdo Gulch	REACH 4	22873.43	2-Year	432.66	6311.69	6313.9	6313.74	6314.42	0.015592	5.8	74.57	53.02	0.86
McMurdo Gulch	REACH 4	22873.43	5-Year	734.91	6311.69	6314.34	6314.34	6315.19	0.019947	7.42	99.02	58.5	1.01
McMurdo Gulch	REACH 4	22873.43	10-Year	904.93	6311.69	6314.61	6314.61	6315.57	0.019064	7.84	115.55	61.98	1
McMurdo Gulch	REACH 4	22873.43	25-Year	1392.7	6311.69	6315.29	6315.29	6316.48	0.017369	8.76	160.72	70.75	1
McMurdo Gulch	REACH 4	22873.43	50-Year	1602.12	6311.69	6315.53	6315.53	6316.83	0.016839	9.16	177.84	73.51	0.99
McMurdo Gulch	REACH 4	22873.43	100-Year	2037.43	6311.69	6316	6316	6317.49	0.015588	9.83	213.63	78.65	0.98
McMurdo Gulch	REACH 4	22873.43	500-Year	2885.84	6311.69	6316.79	6316.79	6318.62	0.014317	10.96	278.8	86.63	0.98
McMurdo Gulch	REACH 4	22784.94	2-Year	432.66	6312	6313.16		6313.46	0.01261	4.38	99.29	93.56	0.74

McMurdo Gulch	REACH 4	22784.94	5-Year	734.91	6312	6313.55		6314.01	0.013292	5.42	136.94	98.42	0.8
McMurdo Gulch	REACH 4	22784.94	10-Year	904.93	6312	6313.73		6314.27	0.013587	5.93	154.59	100.21	0.83
McMurdo Gulch	REACH 4	22784.94	25-Year	1392.7	6312	6314.16	6314.01	6314.95	0.014341	7.14	199.03	104.09	0.88
McMurdo Gulch	REACH 4	22784.94	50-Year	1602.12	6312	6314.32	6314.2	6315.21	0.014803	7.62	215.26	104.98	0.91
McMurdo Gulch	REACH 4	22784.94	100-Year	2037.43	6312	6314.59	6314.55	6315.72	0.016204	8.61	243.56	106.5	0.97
McMurdo Gulch	REACH 4	22784.94	500-Year	2885.84	6312	6315.17	6315.17	6316.63	0.015721	9.78	306.94	109.84	0.99
McMurdo Gulch	REACH 4	22745.31	2-Year	432.66	6310.51	6312.31	6312.31	6312.76	0.02474	5.41	79.97	89.58	1.01
McMurdo Gulch	REACH 4	22745.31	5-Year	734.91	6310.51	6312.69	6312.69	6313.32	0.022014	6.35	115.94	96.04	1.01
McMurdo Gulch	REACH 4	22745.31	10-Year	904.93	6310.51	6312.88	6312.88	6313.6	0.020817	6.78	134.48	99.07	1
McMurdo Gulch	REACH 4	22745.31	25-Year	1392.7	6310.51	6313.36	6313.36	6314.29	0.01859	7.76	183.49	106.2	0.99
McMurdo Gulch	REACH 4	22745.31	50-Year	1602.12	6310.51	6313.55	6313.55	6314.56	0.017808	8.09	203.88	109.03	0.99
McMurdo Gulch	REACH 4	22745.31	100-Year	2037.43	6310.51	6313.92	6313.92	6315.07	0.016563	8.69	244.89	114.74	0.98
McMurdo Gulch	REACH 4	22745.31	500-Year	2885.84	6310.51	6314.55	6314.55	6315.96	0.015077	9.66	320.61	125.8	0.97
McMurdo Gulch	REACH 4	22509.23	2-Year	432.66	6306	6308.83		6309.05	0.005411	3.8	113.93	69.23	0.52
McMurdo Gulch	REACH 4	22509.23	5-Year	734.91	6306	6309.44		6309.77	0.00605	4.61	159.6	79.66	0.57
McMurdo Gulch	REACH 4	22509.23	10-Year	904.93	6306	6309.7		6310.09	0.006169	5.01	181.18	84.19	0.59
McMurdo Gulch	REACH 4	22509.23	25-Year	1392.7	6306	6310.38		6310.92	0.00605	5.91	241.04	92.71	0.61
McMurdo Gulch	REACH 4	22509.23	50-Year	1602.12	6306	6310.65		6311.24	0.005904	6.19	266.83	95.59	0.61
McMurdo Gulch	REACH 4	22509.23	100-Year	2037.43	6306	6311.18		6311.87	0.00566	6.71	318.61	101.19	0.61
McMurdo Gulch	REACH 4	22509.23	500-Year	2885.84	6306	6312.13		6312.96	0.005141	7.44	420.26	112.8	0.61
McMurdo Gulch	REACH 4	22408.41	2-Year	432.66	6305.72	6307.87		6308.26	0.01184	4.99	86.78	62.79	0.75
McMurdo Gulch	REACH 4	22408.41	5-Year	734.91	6305.72	6308.61		6309.02	0.009075	5.14	142.97	80.89	0.68
McMurdo Gulch	REACH 4	22408.41	10-Year	904.93	6305.72	6308.93		6309.37	0.008205	5.35	169.03	83.35	0.66
McMurdo Gulch	REACH 4	22408.41	25-Year	1392.7	6305.72	6309.75		6310.27	0.006673	5.8	240.1	89.72	0.63
McMurdo Gulch	REACH 4	22408.41	50-Year	1602.12	6305.72	6310.07		6310.62	0.00621	5.95	269.23	92.04	0.61
McMurdo Gulch	REACH 4	22408.41	100-Year	2037.43	6305.72	6310.68		6311.29	0.005359	6.27	326.19	95.35	0.59
McMurdo Gulch	REACH 4	22408.41	500-Year	2885.84	6305.72	6311.73		6312.45	0.004501	6.83	429.14	101.05	0.56
McMurdo Gulch	REACH 4	22371.4	2-Year	432.66	6304.13	6307.46	6307.02	6307.85	0.009978	5.03	85.99	53.87	0.7
McMurdo Gulch	REACH 4	22371.4	5-Year	734.91	6304.13	6308.1	6307.68	6308.65	0.010321	5.96	123.47	63.28	0.74
McMurdo Gulch	REACH 4	22371.4	10-Year	904.93	6304.13	6308.36	6307.96	6309.01	0.010366	6.49	140.4	65.58	0.76
McMurdo Gulch	REACH 4	22371.4	25-Year	1392.7	6304.13	6308.99	6308.61	6309.92	0.010696	7.76	183.64	71.02	0.8
McMurdo Gulch	REACH 4	22371.4	50-Year	1602.12	6304.13	6309.23	6308.91	6310.27	0.010757	8.21	201.16	73.02	0.82
McMurdo Gulch	REACH 4	22371.4	100-Year	2037.43	6304.13	6309.71	6309.35	6310.95	0.010687	9	237.08	76.96	0.83
McMurdo Gulch	REACH 4	22371.4	500-Year	2885.84	6304.13	6310.55	6310.2	6312.12	0.010387	10.19	304.27	83.25	0.85

McMurdo Gulch	REACH 4	22043.6	2-Year	432.66	6300.85	6302.51	6302.51	6303.22	0.021235	6.75	64.14	45.58	1
McMurdo Gulch	REACH 4	22043.6	5-Year	734.91	6300.85	6303.13	6303.13	6304.09	0.019318	7.87	93.38	49.04	1
McMurdo Gulch	REACH 4	22043.6	10-Year	904.93	6300.85	6303.42	6303.42	6304.52	0.018538	8.41	107.83	50.76	1
McMurdo Gulch	REACH 4	22043.6	25-Year	1392.7	6300.85	6304.17	6304.17	6305.59	0.016371	9.56	147.72	55.05	0.99
McMurdo Gulch	REACH 4	22043.6	50-Year	1602.12	6300.85	6304.46	6304.46	6306	0.015738	9.98	163.72	56.21	0.98
McMurdo Gulch	REACH 4	22043.6	100-Year	2037.43	6300.85	6305	6305	6306.79	0.01489	10.79	194.94	58.4	0.98
McMurdo Gulch	REACH 4	22043.6	500-Year	2885.84	6300.85	6305.96	6305.96	6308.16	0.01372	12.04	252.35	62.26	0.98
McMurdo Gulch	REACH 4	21826.79	2-Year	432.66	6298	6299.87		6300.1	0.005431	3.86	112.03	66.36	0.52
McMurdo Gulch	REACH 4	21826.79	5-Year	734.91	6298	6300.32		6300.74	0.007206	5.14	143.02	68.79	0.63
McMurdo Gulch	REACH 4	21826.79	10-Year	904.93	6298	6300.63		6301.1	0.006972	5.53	164.04	70.06	0.63
McMurdo Gulch	REACH 4	21826.79	25-Year	1392.7	6298	6301.19		6301.93	0.008139	6.88	204.28	72.42	0.7
McMurdo Gulch	REACH 4	21826.79	50-Year	1602.12	6298	6301.39		6302.24	0.00863	7.4	219.01	73.26	0.73
McMurdo Gulch	REACH 4	21826.79	100-Year	2037.43	6298	6301.76		6302.86	0.009654	8.42	246.12	74.79	0.79
McMurdo Gulch	REACH 4	21826.79	500-Year	2885.84	6298	6302.26	6302.06	6303.93	0.012364	10.41	284.14	76.87	0.91
McMurdo Gulch	REACH 4	21777.38	2-Year	432.66	6298	6299.07	6299.07	6299.58	0.023634	5.72	75.63	75.2	1.01
McMurdo Gulch	REACH 4	21777.38	5-Year	734.91	6298	6299.75		6300.26	0.012833	5.75	127.9	79.71	0.8
McMurdo Gulch	REACH 4	21777.38	10-Year	904.93	6298	6299.73	6299.73	6300.52	0.020144	7.15	126.5	79.6	1
McMurdo Gulch	REACH 4	21777.38	25-Year	1392.7	6298	6300.26	6300.26	6301.31	0.018419	8.25	169.24	82.41	1
McMurdo Gulch	REACH 4	21777.38	50-Year	1602.12	6298	6300.47	6300.47	6301.62	0.017735	8.63	186.66	83.49	1
McMurdo Gulch	REACH 4	21777.38	100-Year	2037.43	6298	6300.87	6300.87	6302.22	0.016684	9.32	220.96	85.58	1
McMurdo Gulch	REACH 4	21777.38	500-Year	2885.84	6298	6301.6	6301.6	6303.26	0.014991	10.35	285.2	90.16	0.98
McMurdo Gulch	REACH 4	21417.19	2-Year	432.66	6292	6293.24	6293.24	6293.73	0.02375	5.63	76.92	78.88	1
McMurdo Gulch	REACH 4	21417.19	5-Year	734.91	6292	6293.68	6293.68	6294.33	0.021777	6.47	113.71	90.19	1.01
McMurdo Gulch	REACH 4	21417.19	10-Year	904.93	6292	6293.87	6293.87	6294.61	0.020547	6.9	131.98	97.07	1
McMurdo Gulch	REACH 4	21417.19	25-Year	1392.7	6292	6294.56	6294.56	6295.22	0.011685	6.72	256.75	239.76	0.8
McMurdo Gulch	REACH 4	21417.19	50-Year	1602.12	6292	6294.71	6294.71	6295.4	0.011575	7	293.21	241.96	0.81
McMurdo Gulch	REACH 4	21417.19	100-Year	2037.43	6292	6294.98	6294.98	6295.75	0.011754	7.58	357.25	245.58	0.83
McMurdo Gulch	REACH 4	21417.19	500-Year	2885.84	6292	6295.41	6295.41	6296.33	0.012098	8.52	464.17	251.5	0.86
McMurdo Gulch	REACH 4	21370.41	2-Year	432.66	6290.52	6292.4	6292.25	6292.77	0.015871	4.9	88.25	82.2	0.83
McMurdo Gulch	REACH 4	21370.41	5-Year	734.91	6290.52	6292.82	6292.72	6293.34	0.016217	5.83	129.35	124.84	0.88
McMurdo Gulch	REACH 4	21370.41	10-Year	904.93	6290.52	6292.93	6292.93	6293.6	0.01863	6.59	143.87	131.51	0.95
McMurdo Gulch	REACH 4	21370.41	25-Year	1392.7	6290.52	6293.43	6293.43	6294.22	0.015502	7.29	216.96	162	0.91
McMurdo Gulch	REACH 4	21370.41	50-Year	1602.12	6290.52	6293.61	6293.61	6294.44	0.014889	7.56	246.54	171.89	0.91

McMurdo Gulch	REACH 4	21370.41	100-Year	2037.43	6290.52	6293.93	6293.93	6294.86	0.014072	8.07	304.93	186.17	0.9
McMurdo Gulch	REACH 4	21370.41	500-Year	2885.84	6290.52	6294.48	6294.48	6295.52	0.012749	8.77	417.22	212.12	0.89
McMurdo Gulch	REACH 4	21133.42	2-Year	432.66	6288	6289.23		6289.48	0.012015	3.95	109.55	116.73	0.71
McMurdo Gulch	REACH 4	21133.42	5-Year	734.91	6288	6289.58		6289.95	0.012423	4.92	152.16	132.75	0.76
McMurdo Gulch	REACH 4	21133.42	10-Year	904.93	6288	6289.74		6290.18	0.01244	5.34	174.97	139.49	0.78
McMurdo Gulch	REACH 4	21133.42	25-Year	1392.7	6288	6290.15	6289.96	6290.76	0.012485	6.31	234.7	150.36	0.81
McMurdo Gulch	REACH 4	21133.42	50-Year	1602.12	6288	6290.31	6290.13	6290.98	0.012557	6.67	257.7	152.54	0.83
McMurdo Gulch	REACH 4	21133.42	100-Year	2037.43	6288	6290.59	6290.43	6291.39	0.012741	7.33	301.85	156.59	0.85
McMurdo Gulch	REACH 4	21133.42	500-Year	2885.84	6288	6291.06	6290.94	6292.11	0.013296	8.47	376.64	163.22	0.9
McMurdo Gulch	REACH 4	21063.55	2-Year	432.66	6286	6287.77	6287.77	6288.31	0.023497	5.86	73.83	70.61	1.01
McMurdo Gulch	REACH 4	21063.55	5-Year	734.91	6286	6288.3	6288.3	6288.9	0.017726	6.28	125.96	126.1	0.92
McMurdo Gulch	REACH 4	21063.55	10-Year	904.93	6286	6288.5	6288.5	6289.16	0.016661	6.64	152.11	135.68	0.92
McMurdo Gulch	REACH 4	21063.55	25-Year	1392.7	6286	6288.97	6288.97	6289.77	0.015065	7.49	222.13	158.44	0.91
McMurdo Gulch	REACH 4	21063.55	50-Year	1602.12	6286	6289.15	6289.15	6290	0.014621	7.79	251.07	167.2	0.91
McMurdo Gulch	REACH 4	21063.55	100-Year	2037.43	6286	6289.47	6289.47	6290.43	0.014127	8.36	307.9	183.01	0.91
McMurdo Gulch	REACH 4	21063.55	500-Year	2885.84	6286	6289.99	6289.99	6291.13	0.013946	9.37	408.75	210.04	0.93
McMurdo Gulch	REACH 4	20884.87	2-Year	432.66	6282	6284.59	6284.11	6284.86	0.005991	4.24	118.14	170.59	0.56
McMurdo Gulch	REACH 4	20884.87	5-Year	734.91	6282	6285.17	6284.68	6285.4	0.004388	4.37	269.72	267.49	0.5
McMurdo Gulch	REACH 4	20884.87	10-Year	904.93	6282	6284.97	6284.94	6285.65	0.012408	6.94	163.73	232.27	0.83
McMurdo Gulch	REACH 4	20884.87	25-Year	1392.7	6282	6285.45	6285.39	6285.94	0.008704	6.63	347.62	279.59	0.72
McMurdo Gulch	REACH 4	20884.87	50-Year	1602.12	6282	6285.55	6285.49	6286.1	0.009473	7.09	376.36	283.55	0.75
McMurdo Gulch	REACH 4	20884.87	100-Year	2037.43	6282	6285.8	6285.74	6286.4	0.009896	7.67	447.14	292.76	0.78
McMurdo Gulch	REACH 4	20884.87	500-Year	2885.84	6282	6286.22	6286.13	6286.92	0.010221	8.51	573.77	304.72	0.81
McMurdo Gulch	REACH 4	20842.12	2-Year	432.66	6282	6283.98	6283.8	6284.47	0.014046	5.58	77.59	54.2	0.82
McMurdo Gulch	REACH 4	20842.12	5-Year	734.91	6282	6284.5	6284.47	6285.08	0.01224	6.38	143.95	255.52	0.81
McMurdo Gulch	REACH 4	20842.12	10-Year	904.93	6282	6284.72	6284.72	6285.14	0.009138	5.92	245.85	278.81	0.71
McMurdo Gulch	REACH 4	20842.12	25-Year	1392.7	6282	6285.02	6285.02	6285.56	0.010703	6.99	331.12	284.54	0.79
McMurdo Gulch	REACH 4	20842.12	50-Year	1602.12	6282	6285.16	6285.14	6285.71	0.010486	7.19	372.58	287.28	0.78
McMurdo Gulch	REACH 4	20842.12	100-Year	2037.43	6282	6285.45	6285.37	6286.01	0.009903	7.49	456.11	292.59	0.78
McMurdo Gulch	REACH 4	20842.12	500-Year	2885.84	6282	6285.88	6285.69	6286.52	0.010094	8.28	582.06	300.24	0.8
McMurdo Gulch	REACH 4	20645.9	2-Year	432.66	6280	6282.02	6281.6	6282.28	0.008527	4.12	104.98	79.55	0.63
McMurdo Gulch	REACH 4	20645.9	5-Year	734.91	6280	6282.49	6282.12	6282.88	0.01008	4.98	151.45	178.25	0.71
McMurdo Gulch	REACH 4	20645.9	10-Year	904.93	6280	6282.64	6282.35	6283.11	0.011028	5.54	174.56	220.15	0.75

McMurdo Gulch	REACH 4	20645.9	25-Year	1392.7	6280	6283.04	6282.98	6283.57	0.010394	6.19	293.65	271.01	0.75
McMurdo Gulch	REACH 4	20645.9	50-Year	1602.12	6280	6283.14	6283.14	6283.74	0.0112	6.63	320.89	273.16	0.79
McMurdo Gulch	REACH 4	20645.9	100-Year	2037.43	6280	6283.35	6283.35	6284.05	0.012016	7.31	379.79	277.58	0.83
McMurdo Gulch	REACH 4	20645.9	500-Year	2885.84	6280	6283.77	6283.76	6284.58	0.011983	8.12	496.89	285.22	0.85

Proposed Mixed Flow Detailed Results Table													
River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Trib 4	Trib 4	533.553	2-Year	32.79	6339.1	6341.55	6340.09	6341.56	0.000311	0.7	47.05	42.13	0.12
Trib 4	Trib 4	533.553	5-Year	89.8	6339.1	6343.41	6340.71	6343.41	0.000084	0.56	161.23	76.04	0.07
Trib 4	Trib 4	533.553	10-Year	121.08	6339.1	6344.26	6340.9	6344.27	0.000055	0.53	230.51	85.98	0.06
Trib 4	Trib 4	533.553	25-Year	232.46	6339.1	6347.75	6341.37	6347.76	0.000012	0.41	592.16	121.59	0.03
Trib 4	Trib 4	533.553	50-Year	292.11	6339.1	6350.83	6341.6	6350.83	0.000004	0.32	1029.22	165.29	0.02
Trib 4	Trib 4	533.553	100-Year	409.47	6339.1	6353.37	6341.9	6353.37	0.000003	0.33	1500.61	208.79	0.02
Trib 4	Trib 4	533.553	500-Year	579.79	6339.1	6353.93	6342.26	6353.93	0.000005	0.45	1621.31	218.65	0.02
Trib 4	Trib 4	473.1134	Culvert										
Trib 4	Trib 4	360.7572	2-Year	32.79	6332.02	6332.68	6332.68	6332.93	0.030199	3.98	8.23	16.87	1.01
Trib 4	Trib 4	360.7572	5-Year	89.8	6332.02	6333.16	6333.16	6333.58	0.025424	5.17	17.36	21.04	1
Trib 4	Trib 4	360.7572	10-Year	121.08	6332.02	6333.36	6333.36	6333.85	0.024041	5.59	21.66	22.37	1
Trib 4	Trib 4	360.7572	25-Year	232.46	6332.02	6333.92	6333.92	6334.6	0.021826	6.61	35.14	26.12	1.01
Trib 4	Trib 4	360.7572	50-Year	292.11	6332.02	6334.16	6334.16	6334.92	0.021109	7	41.75	27.77	1.01
Trib 4	Trib 4	360.7572	100-Year	409.47	6332.02	6334.55	6334.55	6335.49	0.019233	7.76	53.12	30.16	1
Trib 4	Trib 4	360.7572	500-Year	579.79	6332.02	6335.06	6335.06	6336.2	0.017113	8.59	69.31	33.23	0.98
Trib 4	Trib 4	246.5842	2-Year	32.79	6328	6329.02	6328.64	6329.08	0.004427	1.99	16.49	22.7	0.41
Trib 4	Trib 4	246.5842	5-Year	89.8	6328	6329.61	6329.08	6329.74	0.005161	2.84	31.61	28.5	0.48
Trib 4	Trib 4	246.5842	10-Year	121.08	6328	6329.85	6329.27	6330	0.005226	3.14	38.59	30.91	0.49
Trib 4	Trib 4	246.5842	25-Year	232.46	6328	6330.48	6329.79	6330.72	0.005028	3.99	60.25	38.09	0.51
Trib 4	Trib 4	246.5842	50-Year	292.11	6328	6330.7	6330.01	6331	0.005346	4.44	69.24	40.84	0.54
Trib 4	Trib 4	246.5842	100-Year	409.47	6328	6329.8	6330.38	6331.68	0.066164	11	37.27	30.46	1.74
Trib 4	Trib 4	246.5842	500-Year	579.79	6328	6330.08	6330.86	6332.57	0.069573	12.67	46.12	33.5	1.83
Trib 4	Trib 4	216.99	2-Year	32.79	6328	6328.56	6328.56	6328.79	0.030173	3.87	8.47	18.12	1
Trib 4	Trib 4	216.99	5-Year	89.8	6328	6329.01	6329.01	6329.42	0.025532	5.1	17.62	21.89	1
Trib 4	Trib 4	216.99	10-Year	121.08	6328	6329.2	6329.2	6329.68	0.024566	5.53	21.9	23.39	1.01
Trib 4	Trib 4	216.99	25-Year	232.46	6328	6329.74	6329.74	6330.41	0.021437	6.58	35.54	28.78	1
Trib 4	Trib 4	216.99	50-Year	292.11	6328	6330.1	6330.1	6330.73	0.014631	6.38	50.52	59.95	0.86
Trib 4	Trib 4	216.99	100-Year	409.47	6328	6330.48	6330.48	6331.15	0.012839	6.83	74.7	67.01	0.83
Trib 4	Trib 4	216.99	500-Year	579.79	6328	6330.88	6330.88	6331.65	0.012553	7.57	102.24	74.09	0.85
Trib 4	Trib 4	44.46692	2-Year	32.79	6323.91	6325.2	6324.55	6325.23	0.001691	1.35	24.38	29.33	0.26

Trib 4	Trib 4	44.46692	5-Year	89.8	6323.91	6326.08	6325	6326.11	0.001376	1.47	60.99	54.88	0.25
Trib 4	Trib 4	44.46692	10-Year	121.08	6323.91	6326.49	6325.17	6326.52	0.00096	1.43	84.4	60.25	0.21
Trib 4	Trib 4	44.46692	25-Year	232.46	6323.91	6327.55	6325.71	6327.59	0.000609	1.49	156.33	75.15	0.18
Trib 4	Trib 4	44.46692	50-Year	292.11	6323.91	6327.96	6325.9	6328	0.000573	1.55	188.8	85.02	0.18
Trib 4	Trib 4	44.46692	100-Year	409.47	6323.91	6328.55	6326.17	6328.59	0.000517	1.71	254.37	123.07	0.18
Trib 4	Trib 4	44.46692	500-Year	579.79	6323.91	6329.47	6326.5	6329.51	0.000378	1.75	383.08	155.98	0.16
McMurdo Gulch	REACH 3	24245.75	2-Year	398.78	6336	6337.72	6337.47	6338.11	0.012405	5	79.96	60.93	0.76
McMurdo Gulch	REACH 3	24245.75	5-Year	678.02	6336	6338.2	6337.98	6338.8	0.012916	6.22	110.68	67.16	0.82
McMurdo Gulch	REACH 3	24245.75	10-Year	838.12	6336	6337.99	6338.22	6339.17	0.030006	8.73	96.84	64.6	1.22
McMurdo Gulch	REACH 3	24245.75	25-Year	1280.81	6336	6338.44	6338.82	6340.08	0.030008	10.32	127.2	69.21	1.27
McMurdo Gulch	REACH 3	24245.75	50-Year	1473.52	6336	6338.61	6339.05	6340.44	0.030003	10.9	139.42	70.68	1.29
McMurdo Gulch	REACH 3	24245.75	100-Year	1820.75	6336	6338.91	6339.45	6341.05	0.030001	11.83	160.35	73.14	1.32
McMurdo Gulch	REACH 3	24245.75	500-Year	2386.95	6336	6339.33	6340.03	6341.95	0.030011	13.14	192.22	76.71	1.35
McMurdo Gulch	REACH 3	24054.91	2-Year	398.78	6332.09	6334.34	6334.34	6335.01	0.021675	6.56	60.93	47.71	1.01
McMurdo Gulch	REACH 3	24054.91	5-Year	678.02	6332.09	6334.92	6334.92	6335.84	0.018517	7.72	89.85	52.76	0.99
McMurdo Gulch	REACH 3	24054.91	10-Year	838.12	6332.09	6335.21	6335.21	6336.25	0.017301	8.21	105.75	55.38	0.98
McMurdo Gulch	REACH 3	24054.91	25-Year	1280.81	6332.09	6335.92	6335.92	6337.23	0.015267	9.31	147.32	61.45	0.96
McMurdo Gulch	REACH 3	24054.91	50-Year	1473.52	6332.09	6336.19	6336.19	6337.61	0.014798	9.72	164.18	63.65	0.96
McMurdo Gulch	REACH 3	24054.91	100-Year	1820.75	6332.09	6336.65	6336.65	6338.24	0.013984	10.34	194.38	67.36	0.96
McMurdo Gulch	REACH 3	24054.91	500-Year	2386.95	6332.09	6337.32	6337.32	6339.16	0.013137	11.22	241.37	73.13	0.95
McMurdo Gulch	REACH 3	24006.77	2-Year	398.78	6330.11	6333	6332.41	6333.4	0.007566	5.04	79.3	41.23	0.63
McMurdo Gulch	REACH 3	24006.77	5-Year	678.02	6330.11	6332.57	6333.1	6334.42	0.045182	10.91	62.15	37.79	1.5
McMurdo Gulch	REACH 3	24006.77	10-Year	838.12	6330.11	6332.85	6333.43	6334.9	0.04305	11.49	72.98	39.96	1.49
McMurdo Gulch	REACH 3	24006.77	25-Year	1280.81	6330.11	6333.52	6334.23	6336.02	0.036674	12.7	101.96	45.51	1.44
McMurdo Gulch	REACH 3	24006.77	50-Year	1473.52	6330.11	6333.8	6334.55	6336.45	0.033914	13.11	114.61	48.05	1.41
McMurdo Gulch	REACH 3	24006.77	100-Year	1820.75	6330.11	6334.26	6335.09	6337.16	0.030179	13.74	137.87	52.95	1.36
McMurdo Gulch	REACH 3	24006.77	500-Year	2386.95	6330.11	6334.94	6335.86	6338.16	0.026161	14.58	177	61.76	1.31
McMurdo Gulch	REACH 3	23726.41	2-Year	398.78	6326.27	6329.24	6329.24	6330.06	0.02063	7.29	54.7	33.84	1.01
McMurdo Gulch	REACH 3	23726.41	5-Year	678.02	6326.27	6329.96	6329.97	6331.05	0.017847	8.39	82.16	41.7	0.99
McMurdo Gulch	REACH 3	23726.41	10-Year	838.12	6326.27	6330.33	6330.33	6331.54	0.016317	8.87	98.05	46.17	0.97
McMurdo Gulch	REACH 3	23726.41	25-Year	1280.81	6326.27	6331.2	6331.2	6332.66	0.013763	9.87	143.21	57.77	0.93
McMurdo Gulch	REACH 3	23726.41	50-Year	1473.52	6326.27	6331.53	6331.53	6333.08	0.013028	10.21	163.28	62.22	0.92
McMurdo Gulch	REACH 3	23726.41	100-Year	1820.75	6326.27	6332.09	6332.09	6333.75	0.011927	10.71	200.1	69.11	0.9
McMurdo Gulch	REACH 3	23726.41	500-Year	2386.95	6326.27	6332.81	6332.81	6334.7	0.01138	11.59	252.41	75.39	0.91

McMurdo Gulch	REACH 3	23417.48	2-Year	398.78	6322.16	6325.24	6324.39	6325.48	0.004485	3.87	103.05	52.54	0.49
McMurdo Gulch	REACH 3	23417.48	5-Year	678.02	6322.16	6326.06	6324.98	6326.39	0.004471	4.56	148.65	58.94	0.51
McMurdo Gulch	REACH 3	23417.48	10-Year	838.12	6322.16	6326.47	6325.27	6326.83	0.004496	4.83	173.35	63.24	0.51
McMurdo Gulch	REACH 3	23417.48	25-Year	1280.81	6322.16	6327.47	6325.97	6327.92	0.003744	5.36	242.94	75.94	0.49
McMurdo Gulch	REACH 3	23417.48	50-Year	1473.52	6322.16	6327.85	6326.24	6328.33	0.003544	5.57	272.64	80.82	0.49
McMurdo Gulch	REACH 3	23417.48	100-Year	1820.75	6322.16	6328.28	6326.69	6328.87	0.003813	6.18	308.94	87.27	0.51
McMurdo Gulch	REACH 3	23417.48	500-Year	2386.95	6322.16	6329.12	6327.29	6329.8	0.003588	6.72	387.5	101.18	0.51
McMurdo Gulch	REACH 4	23326.28	2-Year	432.66	6322.41	6324.51		6324.91	0.007487	5.23	90.99	52.09	0.64
McMurdo Gulch	REACH 4	23326.28	5-Year	734.91	6322.41	6325.14		6325.78	0.008526	6.65	125.43	57.88	0.71
McMurdo Gulch	REACH 4	23326.28	10-Year	904.93	6322.41	6325.35	6324.96	6326.17	0.009925	7.55	137.94	61.02	0.78
McMurdo Gulch	REACH 4	23326.28	25-Year	1392.7	6322.41	6325.91	6325.72	6327.22	0.012716	9.61	176.55	78.13	0.91
McMurdo Gulch	REACH 4	23326.28	50-Year	1602.12	6322.41	6326.16	6326.1	6327.63	0.013187	10.24	197.3	90.3	0.94
McMurdo Gulch	REACH 4	23326.28	100-Year	2037.43	6322.41	6327.44	6326.92	6328.37	0.006231	8.58	351.52	142.97	0.68
McMurdo Gulch	REACH 4	23326.28	500-Year	2885.84	6322.41	6328.11	6327.79	6329.27	0.007071	9.93	451.82	159.8	0.73
McMurdo Gulch	REACH 4	23305.21	2-Year	432.66	6322.26	6324.24	6323.84	6324.65	0.028902	5.3	84.73	50.78	0.66
McMurdo Gulch	REACH 4	23305.21	5-Year	734.91	6322.26	6324.87	6324.46	6325.48	0.030174	6.51	118.47	55.9	0.71
McMurdo Gulch	REACH 4	23305.21	10-Year	904.93	6322.26	6325.03		6325.83	0.03694	7.49	127.19	57.1	0.79
McMurdo Gulch	REACH 4	23305.21	25-Year	1392.7	6322.26	6325.5	6325.5	6326.78	0.048364	9.52	155.16	60.92	0.93
McMurdo Gulch	REACH 4	23305.21	50-Year	1602.12	6322.26	6325.78	6325.78	6327.16	0.046734	9.9	172.64	63.33	0.93
McMurdo Gulch	REACH 4	23305.21	100-Year	2037.43	6322.26	6326.24	6326.13	6327.9	0.050221	11.14	203.81	74.59	0.99
McMurdo Gulch	REACH 4	23305.21	500-Year	2885.84	6322.26	6328.01	6327.57	6328.98	0.021036	9.21	404.42	153.25	0.68
McMurdo Gulch	REACH 4	23252.76	2-Year	432.66	6319.94	6321.54	6321.54	6322.23	0.075282	6.66	64.95	47.49	1
McMurdo Gulch	REACH 4	23252.76	5-Year	734.91	6319.94	6322.16	6322.16	6323.08	0.068539	7.69	95.53	52.35	1
McMurdo Gulch	REACH 4	23252.76	10-Year	904.93	6319.94	6322.61	6322.45	6323.49	0.052322	7.54	120.37	59.57	0.9
McMurdo Gulch	REACH 4	23252.76	25-Year	1392.7	6319.94	6323.99	6323.22	6324.67	0.023839	6.7	215.29	78.82	0.65
McMurdo Gulch	REACH 4	23252.76	50-Year	1602.12	6319.94	6324.56	6323.51	6325.17	0.018191	6.37	263.36	87.68	0.58
McMurdo Gulch	REACH 4	23252.76	100-Year	2037.43	6319.94	6325.73		6326.21	0.011109	5.77	377.04	110.58	0.47
McMurdo Gulch	REACH 4	23252.76	500-Year	2885.84	6319.94	6327.87		6328.18	0.004695	4.82	681.83	172.96	0.33
McMurdo Gulch	REACH 4	23226	2-Year	432.66	6318.33	6320.65	6319.92	6320.93	0.019618	4.24	102.07	53.49	0.54
McMurdo Gulch	REACH 4	23226	5-Year	734.91	6318.33	6321.79	6320.53	6322.08	0.012682	4.36	170.18	66.42	0.46
McMurdo Gulch	REACH 4	23226	10-Year	904.93	6318.33	6322.37		6322.66	0.010344	4.37	212.34	80.6	0.43
McMurdo Gulch	REACH 4	23226	25-Year	1392.7	6318.33	6323.92		6324.16	0.005974	4.1	362.14	108.01	0.34
McMurdo Gulch	REACH 4	23226	50-Year	1602.12	6318.33	6324.53		6324.76	0.004768	4	430.1	114.5	0.31

McMurdo Gulch	REACH 4	23226	100-Year	2037.43	6318.33	6325.72		6325.93	0.003302	3.83	582.34	145.32	0.27
McMurdo Gulch	REACH 4	23226	500-Year	2885.84	6318.33	6327.87		6328.03	0.00182	3.46	955.24	205.98	0.21
McMurdo Gulch	REACH 4	23198	2-Year	432.66	6317.82	6320.58		6320.74	0.002657	3.2	135.14	61.87	0.38
McMurdo Gulch	REACH 4	23198	5-Year	734.91	6317.82	6321.76		6321.94	0.001881	3.43	224.58	90.85	0.34
McMurdo Gulch	REACH 4	23198	10-Year	904.93	6317.82	6322.35		6322.53	0.001602	3.48	282.25	102.74	0.32
McMurdo Gulch	REACH 4	23198	25-Year	1392.7	6317.82	6323.91		6324.08	0.001054	3.49	459.66	121.35	0.28
McMurdo Gulch	REACH 4	23198	50-Year	1602.12	6317.82	6324.52		6324.69	0.000907	3.49	535.01	125.69	0.26
McMurdo Gulch	REACH 4	23198	100-Year	2037.43	6317.82	6325.71		6325.88	0.000711	3.52	706.91	165.72	0.24
McMurdo Gulch	REACH 4	23198	500-Year	2885.84	6317.82	6327.85		6328	0.000479	3.47	1134.11	234.67	0.2
McMurdo Gulch	REACH 4	23168.61	2-Year	432.66	6317.41	6320.53	6319.23	6320.66	0.002066	2.9	149.3	65.44	0.34
McMurdo Gulch	REACH 4	23168.61	5-Year	734.91	6317.41	6321.72	6319.79	6321.88	0.001584	3.19	230.07	70.53	0.31
McMurdo Gulch	REACH 4	23168.61	10-Year	904.93	6317.41	6322.32	6320.04	6322.49	0.001439	3.32	272.79	73.15	0.3
McMurdo Gulch	REACH 4	23168.61	25-Year	1392.7	6317.41	6323.85	6320.64	6324.05	0.001121	3.59	387.4	104.66	0.28
McMurdo Gulch	REACH 4	23168.61	50-Year	1602.12	6317.41	6324.44	6320.95	6324.66	0.001026	3.7	432.65	140.36	0.27
McMurdo Gulch	REACH 4	23168.61	100-Year	2037.43	6317.41	6325.61	6321.43	6325.85	0.000895	3.91	520.76	174.93	0.26
McMurdo Gulch	REACH 4	23168.61	500-Year	2885.84	6317.41	6327.69	6322.24	6327.97	0.000744	4.26	678.21	247.02	0.25
McMurdo Gulch	REACH 4	23117.16		Culvert									
McMurdo Gulch	REACH 4	23000.04	2-Year	432.66	6315.87	6318.01	6318.01	6318.61	0.021179	6.2	69.78	56.58	0.98
McMurdo Gulch	REACH 4	23000.04	5-Year	734.91	6315.87	6318.57	6318.57	6319.36	0.019161	7.15	102.84	62.42	0.98
McMurdo Gulch	REACH 4	23000.04	10-Year	904.93	6315.87	6318.82	6318.82	6319.72	0.018776	7.58	119.39	65.31	0.99
McMurdo Gulch	REACH 4	23000.04	25-Year	1392.7	6315.87	6319.48	6319.48	6320.59	0.017508	8.45	164.85	72.65	0.99
McMurdo Gulch	REACH 4	23000.04	50-Year	1602.12	6315.87	6319.71	6319.71	6320.92	0.017332	8.82	181.7	75.5	1
McMurdo Gulch	REACH 4	23000.04	100-Year	2037.43	6315.87	6320.16	6320.16	6321.55	0.016134	9.44	215.82	80.39	0.99
McMurdo Gulch	REACH 4	23000.04	500-Year	2885.84	6315.87	6320.88	6320.88	6322.66	0.015396	10.7	269.72	156.98	1
McMurdo Gulch	REACH 4	22873.43	2-Year	432.66	6311.69	6313.4	6313.74	6314.58	0.051015	8.74	49.5	46.35	1.49
McMurdo Gulch	REACH 4	22873.43	5-Year	734.91	6311.69	6313.83	6314.34	6315.5	0.052331	10.4	70.7	51.98	1.57
McMurdo Gulch	REACH 4	22873.43	10-Year	904.93	6311.69	6314.04	6314.61	6315.92	0.051527	11	82.27	54.91	1.58
McMurdo Gulch	REACH 4	22873.43	25-Year	1392.7	6311.69	6314.55	6315.29	6316.97	0.04983	12.47	111.76	61.16	1.61
McMurdo Gulch	REACH 4	22873.43	50-Year	1602.12	6311.69	6314.75	6315.53	6317.35	0.048373	12.93	124.28	63.95	1.61
McMurdo Gulch	REACH 4	22873.43	100-Year	2037.43	6311.69	6315.1	6316	6318.12	0.047823	13.95	147.17	68.3	1.63
McMurdo Gulch	REACH 4	22873.43	500-Year	2885.84	6311.69	6315.7	6316.79	6319.39	0.044006	15.45	190.79	75.44	1.62
McMurdo Gulch	REACH 4	22784.94	2-Year	432.66	6312	6313.16	6312.96	6313.46	0.01261	4.38	99.29	93.56	0.74

McMurdo Gulch	REACH 4	22784.94	5-Year	734.91	6312	6313.55	6313.35	6314.01	0.013292	5.42	136.94	98.42	0.8
McMurdo Gulch	REACH 4	22784.94	10-Year	904.93	6312	6313.73	6313.54	6314.27	0.013587	5.93	154.59	100.21	0.83
McMurdo Gulch	REACH 4	22784.94	25-Year	1392.7	6312	6314.16	6314.01	6314.95	0.014341	7.14	199.03	104.09	0.88
McMurdo Gulch	REACH 4	22784.94	50-Year	1602.12	6312	6314.32	6314.2	6315.21	0.014803	7.62	215.26	104.98	0.91
McMurdo Gulch	REACH 4	22784.94	100-Year	2037.43	6312	6314.46	6314.55	6315.73	0.019532	9.11	229.57	105.75	1.05
McMurdo Gulch	REACH 4	22784.94	500-Year	2885.84	6312	6314.75	6315.17	6316.75	0.026159	11.42	260.95	107.43	1.24
McMurdo Gulch	REACH 4	22745.31	2-Year	432.66	6310.51	6312.31	6312.31	6312.76	0.02474	5.41	79.97	89.58	1.01
McMurdo Gulch	REACH 4	22745.31	5-Year	734.91	6310.51	6312.69	6312.69	6313.32	0.022014	6.35	115.94	96.04	1.01
McMurdo Gulch	REACH 4	22745.31	10-Year	904.93	6310.51	6312.88	6312.88	6313.6	0.020817	6.78	134.48	99.07	1
McMurdo Gulch	REACH 4	22745.31	25-Year	1392.7	6310.51	6313.36	6313.36	6314.29	0.01859	7.76	183.49	106.2	0.99
McMurdo Gulch	REACH 4	22745.31	50-Year	1602.12	6310.51	6313.55	6313.55	6314.56	0.017808	8.09	203.88	109.03	0.99
McMurdo Gulch	REACH 4	22745.31	100-Year	2037.43	6310.51	6313.83	6313.92	6315.08	0.018823	9.04	234.65	113.27	1.04
McMurdo Gulch	REACH 4	22745.31	500-Year	2885.84	6310.51	6314.55	6314.55	6315.96	0.015077	9.66	320.61	125.8	0.97
McMurdo Gulch	REACH 4	22509.23	2-Year	432.66	6306	6308.83	6308.1	6309.05	0.005411	3.8	113.93	69.23	0.52
McMurdo Gulch	REACH 4	22509.23	5-Year	734.91	6306	6309.44	6308.66	6309.77	0.00605	4.61	159.6	79.66	0.57
McMurdo Gulch	REACH 4	22509.23	10-Year	904.93	6306	6309.7	6308.93	6310.09	0.006169	5.01	181.18	84.19	0.59
McMurdo Gulch	REACH 4	22509.23	25-Year	1392.7	6306	6310.38	6309.54	6310.92	0.00605	5.91	241.04	92.71	0.61
McMurdo Gulch	REACH 4	22509.23	50-Year	1602.12	6306	6310.65	6309.76	6311.24	0.005904	6.19	266.83	95.59	0.61
McMurdo Gulch	REACH 4	22509.23	100-Year	2037.43	6306	6311.18	6310.18	6311.87	0.00566	6.71	318.61	101.19	0.61
McMurdo Gulch	REACH 4	22509.23	500-Year	2885.84	6306	6312.13	6310.91	6312.96	0.005141	7.44	420.26	112.8	0.61
McMurdo Gulch	REACH 4	22408.41	2-Year	432.66	6305.72	6307.87		6308.26	0.01184	4.99	86.78	62.79	0.75
McMurdo Gulch	REACH 4	22408.41	5-Year	734.91	6305.72	6308.61		6309.02	0.009075	5.14	142.97	80.89	0.68
McMurdo Gulch	REACH 4	22408.41	10-Year	904.93	6305.72	6308.93		6309.37	0.008205	5.35	169.03	83.35	0.66
McMurdo Gulch	REACH 4	22408.41	25-Year	1392.7	6305.72	6309.75		6310.27	0.006673	5.8	240.1	89.72	0.63
McMurdo Gulch	REACH 4	22408.41	50-Year	1602.12	6305.72	6310.07		6310.62	0.00621	5.95	269.23	92.04	0.61
McMurdo Gulch	REACH 4	22408.41	100-Year	2037.43	6305.72	6310.68		6311.29	0.005359	6.27	326.19	95.35	0.59
McMurdo Gulch	REACH 4	22408.41	500-Year	2885.84	6305.72	6311.73		6312.45	0.004501	6.83	429.14	101.05	0.56
McMurdo Gulch	REACH 4	22371.4	2-Year	432.66	6304.13	6307.46	6307.02	6307.85	0.009978	5.03	85.99	53.87	0.7
McMurdo Gulch	REACH 4	22371.4	5-Year	734.91	6304.13	6308.1	6307.68	6308.65	0.010321	5.96	123.47	63.28	0.74
McMurdo Gulch	REACH 4	22371.4	10-Year	904.93	6304.13	6308.36	6307.96	6309.01	0.010366	6.49	140.4	65.58	0.76
McMurdo Gulch	REACH 4	22371.4	25-Year	1392.7	6304.13	6308.99	6308.61	6309.92	0.010696	7.76	183.64	71.02	0.8
McMurdo Gulch	REACH 4	22371.4	50-Year	1602.12	6304.13	6309.23	6308.91	6310.27	0.010757	8.21	201.16	73.02	0.82
McMurdo Gulch	REACH 4	22371.4	100-Year	2037.43	6304.13	6309.71	6309.35	6310.95	0.010687	9	237.08	76.96	0.83
McMurdo Gulch	REACH 4	22371.4	500-Year	2885.84	6304.13	6310.55	6310.2	6312.12	0.010387	10.19	304.27	83.25	0.85

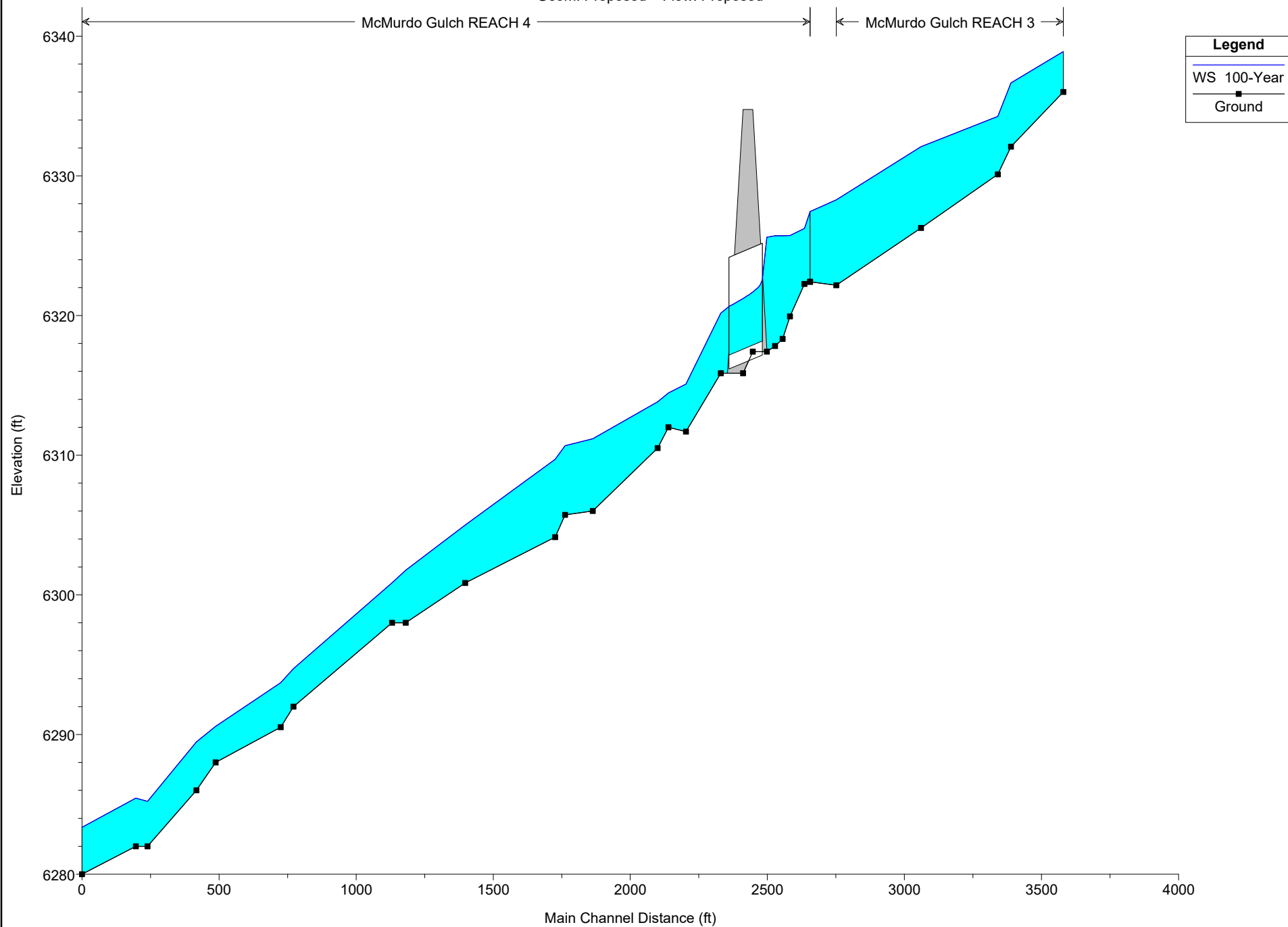
McMurdo Gulch	REACH 4	22043.6	2-Year	432.66	6300.85	6302.51	6302.51	6303.22	0.021235	6.75	64.14	45.58	1
McMurdo Gulch	REACH 4	22043.6	5-Year	734.91	6300.85	6303.13	6303.13	6304.09	0.019318	7.87	93.38	49.04	1
McMurdo Gulch	REACH 4	22043.6	10-Year	904.93	6300.85	6303.42	6303.42	6304.52	0.018538	8.41	107.83	50.76	1
McMurdo Gulch	REACH 4	22043.6	25-Year	1392.7	6300.85	6304.17	6304.17	6305.59	0.016371	9.56	147.72	55.05	0.99
McMurdo Gulch	REACH 4	22043.6	50-Year	1602.12	6300.85	6304.46	6304.46	6306	0.015738	9.98	163.72	56.21	0.98
McMurdo Gulch	REACH 4	22043.6	100-Year	2037.43	6300.85	6305	6305	6306.79	0.01489	10.79	194.94	58.4	0.98
McMurdo Gulch	REACH 4	22043.6	500-Year	2885.84	6300.85	6305.96	6305.96	6308.16	0.01372	12.04	252.35	62.26	0.98
McMurdo Gulch	REACH 4	21826.79	2-Year	432.66	6298	6299.87	6299.24	6300.1	0.005431	3.86	112.03	66.36	0.52
McMurdo Gulch	REACH 4	21826.79	5-Year	734.91	6298	6300.32	6299.73	6300.74	0.007206	5.14	143.02	68.79	0.63
McMurdo Gulch	REACH 4	21826.79	10-Year	904.93	6298	6300.63	6299.98	6301.1	0.006972	5.53	164.04	70.06	0.63
McMurdo Gulch	REACH 4	21826.79	25-Year	1392.7	6298	6301.19	6300.57	6301.93	0.008139	6.88	204.28	72.42	0.7
McMurdo Gulch	REACH 4	21826.79	50-Year	1602.12	6298	6301.39	6300.8	6302.24	0.00863	7.4	219.01	73.26	0.73
McMurdo Gulch	REACH 4	21826.79	100-Year	2037.43	6298	6301.76	6301.26	6302.86	0.009654	8.42	246.12	74.79	0.79
McMurdo Gulch	REACH 4	21826.79	500-Year	2885.84	6298	6301.45	6302.06	6304.11	0.026366	13.1	223.2	73.5	1.29
McMurdo Gulch	REACH 4	21777.38	2-Year	432.66	6298	6299.07	6299.07	6299.58	0.023634	5.72	75.63	75.2	1.01
McMurdo Gulch	REACH 4	21777.38	5-Year	734.91	6298	6299.75		6300.26	0.012833	5.75	127.9	79.71	0.8
McMurdo Gulch	REACH 4	21777.38	10-Year	904.93	6298	6299.73	6299.73	6300.52	0.020144	7.15	126.5	79.6	1
McMurdo Gulch	REACH 4	21777.38	25-Year	1392.7	6298	6300.26	6300.26	6301.31	0.018419	8.25	169.24	82.41	1
McMurdo Gulch	REACH 4	21777.38	50-Year	1602.12	6298	6300.47	6300.47	6301.62	0.017735	8.63	186.66	83.49	1
McMurdo Gulch	REACH 4	21777.38	100-Year	2037.43	6298	6300.87	6300.87	6302.22	0.016684	9.32	220.96	85.58	1
McMurdo Gulch	REACH 4	21777.38	500-Year	2885.84	6298	6301.6	6301.6	6303.26	0.014991	10.35	285.2	90.16	0.98
McMurdo Gulch	REACH 4	21417.19	2-Year	432.66	6292	6293.24	6293.24	6293.73	0.02375	5.63	76.92	78.88	1
McMurdo Gulch	REACH 4	21417.19	5-Year	734.91	6292	6293.68	6293.68	6294.33	0.021777	6.47	113.71	90.19	1.01
McMurdo Gulch	REACH 4	21417.19	10-Year	904.93	6292	6293.87	6293.87	6294.61	0.020547	6.9	131.98	97.07	1
McMurdo Gulch	REACH 4	21417.19	25-Year	1392.7	6292	6294.43	6294.56	6295.23	0.015119	7.34	226	237.29	0.91
McMurdo Gulch	REACH 4	21417.19	50-Year	1602.12	6292	6294.54	6294.71	6295.44	0.016177	7.86	251.25	239.33	0.95
McMurdo Gulch	REACH 4	21417.19	100-Year	2037.43	6292	6294.72	6294.98	6295.82	0.018383	8.85	295.57	242.1	1.02
McMurdo Gulch	REACH 4	21417.19	500-Year	2885.84	6292	6294.98	6295.41	6296.52	0.023503	10.72	357.73	245.61	1.18
McMurdo Gulch	REACH 4	21370.41	2-Year	432.66	6290.52	6292.4	6292.25	6292.77	0.015871	4.9	88.25	82.2	0.83
McMurdo Gulch	REACH 4	21370.41	5-Year	734.91	6290.52	6292.82	6292.72	6293.34	0.016217	5.83	129.35	124.84	0.88
McMurdo Gulch	REACH 4	21370.41	10-Year	904.93	6290.52	6292.86	6292.93	6293.61	0.022327	6.97	134.21	127.09	1.04
McMurdo Gulch	REACH 4	21370.41	25-Year	1392.7	6290.52	6293.17	6293.43	6294.29	0.026083	8.6	176.55	146.13	1.16
McMurdo Gulch	REACH 4	21370.41	50-Year	1602.12	6290.52	6293.36	6293.6	6294.5	0.02356	8.76	205.33	157.73	1.12

McMurdo Gulch	REACH 4	21370.41	100-Year	2037.43	6290.52	6293.71	6293.93	6294.9	0.020195	9.08	264.43	176.99	1.07
McMurdo Gulch	REACH 4	21370.41	500-Year	2885.84	6290.52	6294.36	6294.48	6295.53	0.01493	9.25	392.78	210.29	0.96
McMurdo Gulch	REACH 4	21133.42	2-Year	432.66	6288	6289.23		6289.48	0.012015	3.95	109.55	116.73	0.71
McMurdo Gulch	REACH 4	21133.42	5-Year	734.91	6288	6289.58		6289.95	0.012423	4.92	152.16	132.75	0.76
McMurdo Gulch	REACH 4	21133.42	10-Year	904.93	6288	6289.74	6289.53	6290.18	0.01244	5.34	174.97	139.49	0.78
McMurdo Gulch	REACH 4	21133.42	25-Year	1392.7	6288	6290.15	6289.96	6290.76	0.012485	6.31	234.7	150.36	0.81
McMurdo Gulch	REACH 4	21133.42	50-Year	1602.12	6288	6290.31	6290.13	6290.98	0.012557	6.67	257.7	152.54	0.83
McMurdo Gulch	REACH 4	21133.42	100-Year	2037.43	6288	6290.59	6290.43	6291.39	0.012741	7.33	301.85	156.59	0.85
McMurdo Gulch	REACH 4	21133.42	500-Year	2885.84	6288	6291.06	6290.94	6292.11	0.013296	8.47	376.64	163.22	0.9
McMurdo Gulch	REACH 4	21063.55	2-Year	432.66	6286	6287.77	6287.77	6288.31	0.023497	5.86	73.83	70.61	1.01
McMurdo Gulch	REACH 4	21063.55	5-Year	734.91	6286	6288.3	6288.3	6288.9	0.017726	6.28	125.96	126.1	0.92
McMurdo Gulch	REACH 4	21063.55	10-Year	904.93	6286	6288.5	6288.5	6289.16	0.016661	6.64	152.11	135.68	0.92
McMurdo Gulch	REACH 4	21063.55	25-Year	1392.7	6286	6288.97	6288.97	6289.77	0.015065	7.49	222.13	158.44	0.91
McMurdo Gulch	REACH 4	21063.55	50-Year	1602.12	6286	6289.15	6289.15	6290	0.014621	7.79	251.07	167.2	0.91
McMurdo Gulch	REACH 4	21063.55	100-Year	2037.43	6286	6289.47	6289.47	6290.43	0.014127	8.36	307.9	183.01	0.91
McMurdo Gulch	REACH 4	21063.55	500-Year	2885.84	6286	6289.99	6289.99	6291.13	0.013946	9.37	408.75	210.04	0.93
McMurdo Gulch	REACH 4	20884.87	2-Year	432.66	6282	6284.59	6284.11	6284.86	0.005991	4.24	118.14	170.59	0.56
McMurdo Gulch	REACH 4	20884.87	5-Year	734.91	6282	6285.17	6284.68	6285.4	0.004388	4.37	269.72	267.49	0.5
McMurdo Gulch	REACH 4	20884.87	10-Year	904.93	6282	6284.67	6284.94	6285.71	0.022361	8.42	126.54	179.7	1.08
McMurdo Gulch	REACH 4	20884.87	25-Year	1392.7	6282	6285.45	6285.39	6285.94	0.008704	6.63	347.62	279.59	0.72
McMurdo Gulch	REACH 4	20884.87	50-Year	1602.12	6282	6285.55	6285.49	6286.1	0.009491	7.1	376.08	283.51	0.75
McMurdo Gulch	REACH 4	20884.87	100-Year	2037.43	6282	6285.21	6285.74	6286.83	0.030591	11.67	281.65	269.49	1.32
McMurdo Gulch	REACH 4	20884.87	500-Year	2885.84	6282	6285.5	6286.13	6287.42	0.03387	13.24	361.87	281.56	1.42
McMurdo Gulch	REACH 4	20842.12	2-Year	432.66	6282	6283.98	6283.8	6284.47	0.014046	5.58	77.59	54.2	0.82
McMurdo Gulch	REACH 4	20842.12	5-Year	734.91	6282	6284.5	6284.47	6285.08	0.01224	6.38	143.95	255.52	0.81
McMurdo Gulch	REACH 4	20842.12	10-Year	904.93	6282	6284.72	6284.72	6285.14	0.009138	5.92	245.85	278.81	0.71
McMurdo Gulch	REACH 4	20842.12	25-Year	1392.7	6282	6285.02	6285.02	6285.56	0.010703	6.99	331.12	284.54	0.79
McMurdo Gulch	REACH 4	20842.12	50-Year	1602.12	6282	6285.16	6285.14	6285.71	0.010475	7.19	372.72	287.29	0.78
McMurdo Gulch	REACH 4	20842.12	100-Year	2037.43	6282	6285.45	6285.37	6286.01	0.009903	7.49	456.11	292.59	0.78
McMurdo Gulch	REACH 4	20842.12	500-Year	2885.84	6282	6285.88	6285.69	6286.52	0.010094	8.28	582.06	300.24	0.8
McMurdo Gulch	REACH 4	20645.9	2-Year	432.66	6280	6282.02	6281.6	6282.28	0.008527	4.12	104.98	79.55	0.63
McMurdo Gulch	REACH 4	20645.9	5-Year	734.91	6280	6282.49	6282.12	6282.88	0.01008	4.98	151.45	178.25	0.71
McMurdo Gulch	REACH 4	20645.9	10-Year	904.93	6280	6282.64	6282.35	6283.11	0.011028	5.54	174.56	220.15	0.75

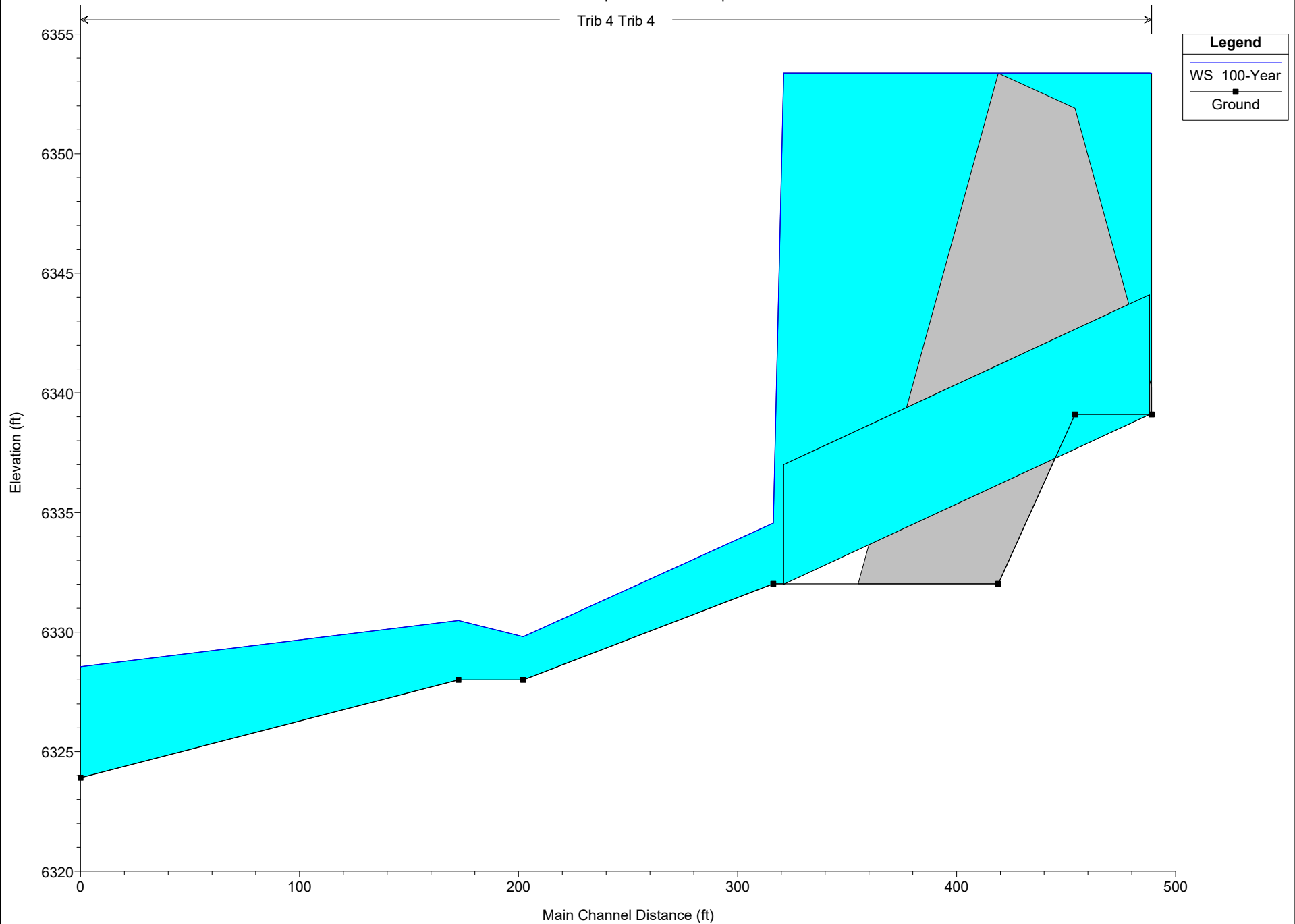
McMurdo Gulch	REACH 4	20645.9	25-Year	1392.7	6280	6283.04	6282.98	6283.57	0.010394	6.19	293.65	271.01	0.75
McMurdo Gulch	REACH 4	20645.9	50-Year	1602.12	6280	6283.14	6283.14	6283.74	0.0112	6.63	320.89	273.16	0.79
McMurdo Gulch	REACH 4	20645.9	100-Year	2037.43	6280	6283.35	6283.35	6284.05	0.012016	7.31	379.79	277.58	0.83
McMurdo Gulch	REACH 4	20645.9	500-Year	2885.84	6280	6283.77	6283.76	6284.58	0.011983	8.12	496.89	285.22	0.85

TerrainNorthBasin_Ph2_FMS Plan: Proposed 2/3/2023

Geom: Proposed Flow: Proposed



Trib 4 Trib 4





HEC RAS ANALYSIS - WATER SURFACE ELEVATION COMPARISON TABLE											
River Sta				100-Year WSEL				Δ WSEL			
Duplicate	Corrected	Existing	Proposed	Duplicate	Corrected	Existing	Proposed	Proposed - Duplicate	Proposed - Corrected	Proposed - Existing	
533.553	533.553	533.553	533.553	6353.37	6353.37	6353.37	6353.37	0.0000	0	0	
473.1134	473.1134	473.1134	473.1134					0.0000	0	0	
360.7572	360.7572	360.7572	360.7572	6334.55	6334.55	6339.38	6334.55	0.0000	0	-4.83	
246.5842	246.5842	246.5842	246.5842	6331	6331	6339.39	6331	0.0000	0	-8.39	
216.99	216.99	216.99	216.99	6330.48	6330.48	6339.39	6330.48	0.0000	0	-8.91	
44.46692	44.46692	44.46692	44.46692	6329.42	6329.61	6339.39	6328.54	-0.8800	-1.07	-10.85	
24245.75	24245.75	24245.75	24245.75	6339.59	6339.59	6339.45	6339.59	0.0000	0	0.14	
24054.91	24054.91	24054.91	24054.91	6336.65	6336.65	6339.27	6336.65	0.0000	0	-2.62	
24006.77	24006.77	24006.77	24006.77	6335.41	6335.41	6339.35	6335.41	0.0000	0	-3.94	
23726.41	23726.41	23726.41	23726.41	6332.09	6332.09	6339.34	6332.09	0.0000	0	-7.25	
23417.48	23417.48	23417.48	23417.48	6329.56	6329.31	6339.38	6328.32	-1.2400	-0.99	-11.06	
23258.4	23304	23304	23326.28	6328.19	6329.08	6339.38	6327.07	-1.1200	-2.01	-12.31	
23225.16	23294	23294	23305.21	6325.3	6327.94	6339.38	6326.85	1.5500	-1.09	-12.53	
23055.63	23275.85	23275.85	23252.76	6321.9			6326.73	4.8300			
23022.87	23236.81	23236.81	23226	6320.95	6325.68	6339.37	6326.73	5.7800	1.05	-12.64	
	23186.5	23186.5	23198		6323.83	6339.37	6326.72		2.89	-12.65	
	23055.63	23055.63	23168.61		6321.9	6338.36	6326.63		4.73	-11.73	
	23022.87	23022.87	23117.16		6320.95	6331.41					
			23000.04				6320.16				
			22873.43				6316				
22784.94	22784.94	22784.94	22784.94	6314.59	6314.59	6314.59	6314.59	0.0000	0	0	
22745.31	22745.31	22745.31	22745.31	6313.92	6313.92	6313.92	6313.92	0.0000	0	0	
22509.23	22509.23	22509.23	22509.23	6311.18	6311.18	6311.18	6311.18	0.0000	0	0	
22408.41	22408.41	22408.41	22408.41	6310.68	6310.68	6310.68	6310.68	0.0000	0	0	
22371.4	22371.4	22371.4	22371.4	6309.71	6309.71	6309.71	6309.71	0.0000	0	0	
22043.6	22043.6	22043.6	22043.6	6305	6305	6305	6305	0.0000	0	0	



21826.79	21826.79	21826.79	21826.79	6301.76	6301.76	6301.76	6301.76	0.0000	0	0
21777.38	21777.38	21777.38	21777.38	6300.87	6300.87	6300.87	6300.87	0.0000	0	0
21417.19	21417.19	21417.19	21417.19	6294.98	6294.98	6294.98	6294.98	0.0000	0	0
21370.41	21370.41	21370.41	21370.41	6293.93	6293.93	6293.93	6293.93	0.0000	0	0
21133.42	21133.42	21133.42	21133.42	6290.59	6290.59	6290.59	6290.59	0.0000	0	0
21063.55	21063.55	21063.55	21063.55	6289.47	6289.47	6289.47	6289.47	0.0000	0	0
20884.87	20884.87	20884.87	20884.87	6285.8	6285.8	6285.8	6285.8	0.0000	0	0
20842.12	20842.12	20842.12	20842.12	6285.45	6285.45	6285.45	6285.45	0.0000	0	0
20645.9	20645.9	20645.9	20645.9	6283.35	6283.35	6283.35	6283.35	0.0000	0	0

Appendix C

Reference Materials



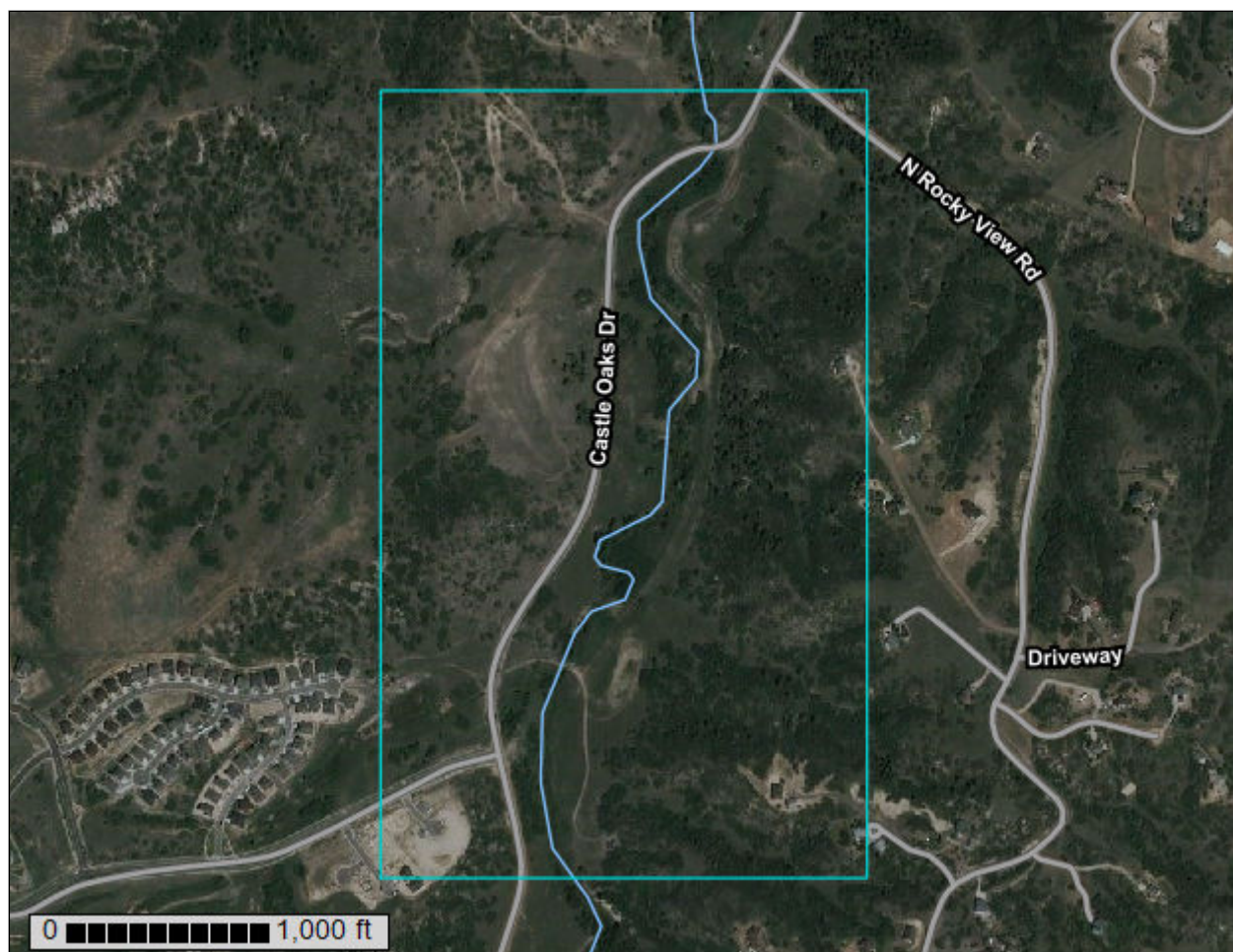
United States
Department of
Agriculture

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 **Castle Rock Area, Colorado**



March 11, 2022

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

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface	2
How Soil Surveys Are Made	5
Soil Map	8
Soil Map.....	9
Legend.....	10
Map Unit Legend.....	11
Map Unit Descriptions.....	11
Castle Rock Area, Colorado.....	13
Fu—Fondis-Kutch association.....	13
Hg—Hilly gravelly land.....	15
PpE—Peyton-Pring-Crowfoot sandy loams, 5 to 25 percent slopes.....	16
Sd—Sandy alluvial land.....	19
Soil Information for All Uses	21
Soil Properties and Qualities.....	21
Soil Qualities and Features.....	21
Hydrologic Soil Group.....	21
References	26

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

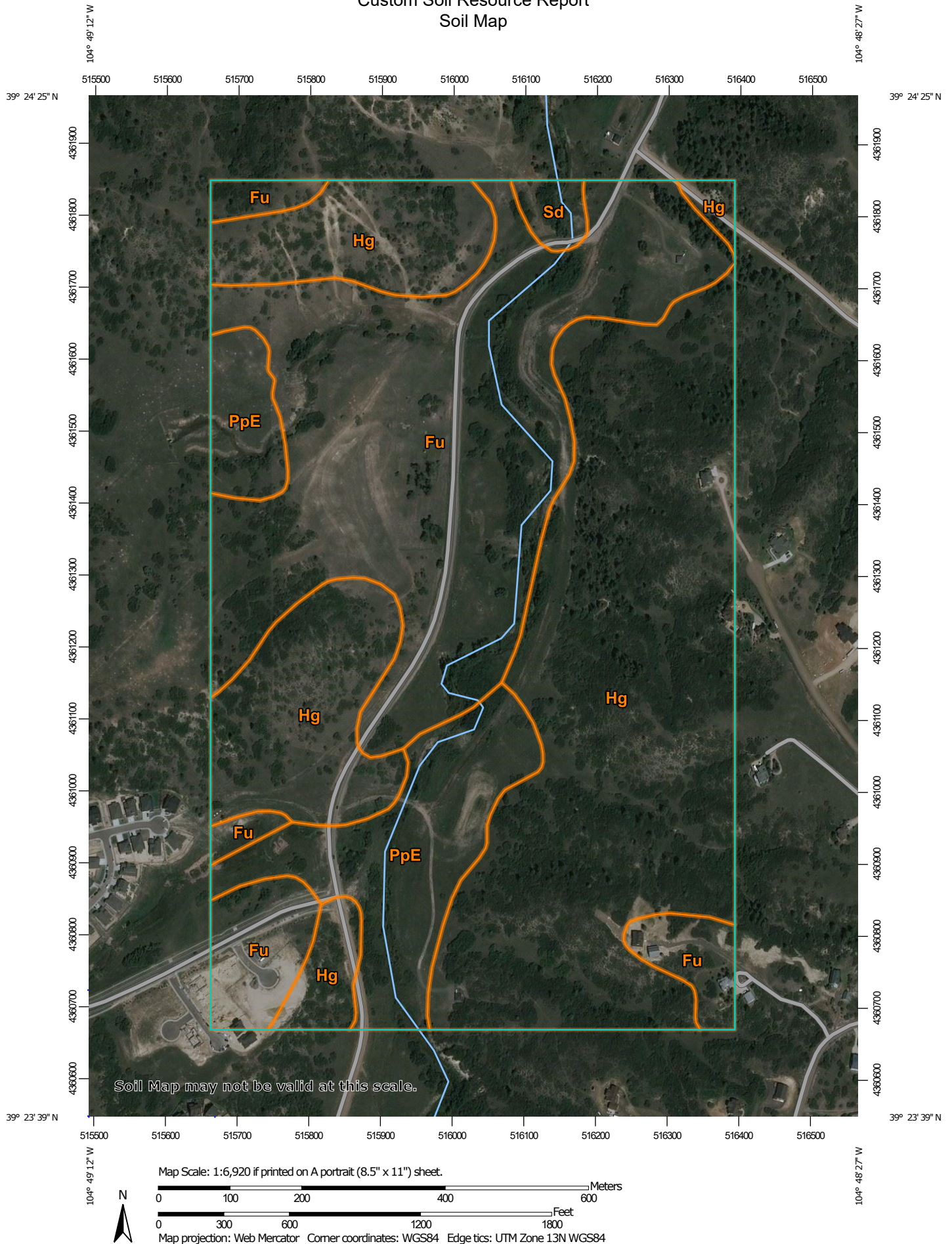
Custom Soil Resource Report

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



Custom Soil Resource Report

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 1:20,000.

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: Castle Rock Area, Colorado
Survey Area Data: Version 14, Aug 31, 2021

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

Date(s) aerial images were photographed: Jul 24, 2018—Nov 19, 2018

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
Fu	Fondis-Kutch association	80.3	37.5%
Hg	Hilly gravelly land	107.0	50.0%
PpE	Peyton-Pring-Crowfoot sandy loams, 5 to 25 percent slopes	24.9	11.6%
Sd	Sandy alluvial land	2.0	0.9%
Totals for Area of Interest		214.2	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.

Castle Rock Area, Colorado

Fu—Fondis-Kutch association

Map Unit Setting

National map unit symbol: jqyq
Elevation: 5,500 to 6,800 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Fondis and similar soils: 50 percent
Kutch and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fondis

Setting

Landform: Valley sides, draws
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits over coarse-silty outwash derived from arkose

Typical profile

H1 - 0 to 7 inches: loam
H2 - 7 to 24 inches: clay
H3 - 24 to 60 inches: sandy clay loam

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Description of Kutch

Setting

Down-slope shape: Linear

Custom Soil Resource Report

Across-slope shape: Linear

Parent material: Fine-textured residuum weathered from calcareous shale

Typical profile

H1 - 0 to 6 inches: sandy loam

H2 - 6 to 32 inches: clay

H3 - 32 to 36 inches: weathered bedrock

Properties and qualities

Slope: 5 to 40 percent

Depth to restrictive feature: 20 to 40 inches to paralithic bedrock

Drainage class: Well drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 15 percent

Gypsum, maximum content: 2 percent

Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: D

Ecological site: R049XB208CO - Clayey Foothill

Hydric soil rating: No

Minor Components

Bresser

Percent of map unit: 5 percent

Hydric soil rating: No

Newlin

Percent of map unit: 5 percent

Hydric soil rating: No

Hilly gravelly land

Percent of map unit: 4 percent

Hydric soil rating: No

Aquic haplustolls

Percent of map unit: 1 percent

Landform: Swales

Hydric soil rating: Yes

Hg—Hilly gravelly land

Map Unit Setting

National map unit symbol: jqyw

Elevation: 5,500 to 6,600 feet

Mean annual precipitation: 15 to 18 inches

Mean annual air temperature: 48 to 51 degrees F

Frost-free period: 120 to 135 days

Farmland classification: Not prime farmland

Map Unit Composition

Hilly gravelly land: 80 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hilly Gravelly Land

Setting

Landform: Hills

Landform position (three-dimensional): Side slope, base slope, crest

Down-slope shape: Linear

Across-slope shape: Linear

Typical profile

H1 - 0 to 7 inches: cobbly sandy loam

H2 - 7 to 24 inches: cobbly clay loam

H3 - 24 to 28 inches: weathered bedrock

Properties and qualities

Slope: 5 to 50 percent

Depth to restrictive feature: 20 to 40 inches to paralithic bedrock

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high
(0.06 to 2.00 in/hr)

Calcium carbonate, maximum content: 5 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: D

Ecological site: R049XY213CO - Cobbly Foothill

Hydric soil rating: No

Minor Components

Kutch

Percent of map unit: 4 percent

Hydric soil rating: No

Newlin

Percent of map unit: 4 percent

Hydric soil rating: No

Fondis

Percent of map unit: 4 percent

Hydric soil rating: No

Bresser

Percent of map unit: 4 percent

Hydric soil rating: No

Truckton

Percent of map unit: 3 percent

Hydric soil rating: No

Aquic haplustolls

Percent of map unit: 1 percent

Landform: Swales

Hydric soil rating: Yes

PpE—Peyton-Pring-Crowfoot sandy loams, 5 to 25 percent slopes

Map Unit Setting

National map unit symbol: jqzn

Elevation: 6,500 to 8,000 feet

Mean annual precipitation: 15 to 18 inches

Mean annual air temperature: 44 to 46 degrees F

Frost-free period: 115 to 120 days

Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 40 percent

Pring and similar soils: 25 percent

Crowfoot and similar soils: 25 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

Setting

Landform: Ridges, valley sides

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Weathered alluvium derived from arkose

Typical profile

H1 - 0 to 11 inches: sandy loam
H2 - 11 to 30 inches: sandy clay loam
H3 - 30 to 40 inches: sandy loam
H4 - 40 to 60 inches: sandy loam

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
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
Available water supply, 0 to 60 inches: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Description of Pring

Setting

Landform: Hills
Landform position (three-dimensional): Base slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkosic sedimentary rock

Typical profile

H1 - 0 to 12 inches: sandy loam
H2 - 12 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 5 to 25 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 to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Description of Crowfoot

Setting

Landform: Ridges, valley sides

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Residuum weathered from arkosic sedimentary rock

Typical profile

H1 - 0 to 6 inches: sandy loam

H2 - 6 to 19 inches: loamy sand

H3 - 19 to 32 inches: gravelly sandy clay loam

H4 - 32 to 43 inches: gravelly sandy loam

H5 - 43 to 60 inches: coarse sand

Properties and qualities

Slope: 5 to 15 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.20 to 2.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: B

Ecological site: R049XY216CO - Sandy Divide

Hydric soil rating: No

Minor Components

Brussett

Percent of map unit: 3 percent

Hydric soil rating: No

Tomah

Percent of map unit: 3 percent

Hydric soil rating: No

Jarre

Percent of map unit: 3 percent

Hydric soil rating: No

Aquic haploborolls

Percent of map unit: 1 percent

Landform: Swales

Hydric soil rating: Yes

Sd—Sandy alluvial land

Map Unit Setting

National map unit symbol: jr03
Elevation: 5,500 to 6,600 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Sandy alluvial land: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sandy Alluvial Land

Setting

Landform: Drainageways, swales
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Weathered alluvium derived from arkose

Typical profile

H1 - 0 to 20 inches: loamy sand
H2 - 20 to 60 inches: stratified sand to sandy loam

Properties and qualities

Slope: 1 to 5 percent
Drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)
Depth to water table: About 60 inches
Frequency of flooding: FrequentNone
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
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
Hydric soil rating: No

Minor Components

Loamy alluvial land, dark surface

Percent of map unit: 8 percent

Hydric soil rating: No

Loamy alluvial land

Percent of map unit: 8 percent

Hydric soil rating: No

Bresser

Percent of map unit: 4 percent

Hydric soil rating: No

Truckton

Percent of map unit: 4 percent

Hydric soil rating: No

Fluvaquentic haplustolls

Percent of map unit: 1 percent

Landform: Terraces

Hydric soil rating: Yes

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

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.

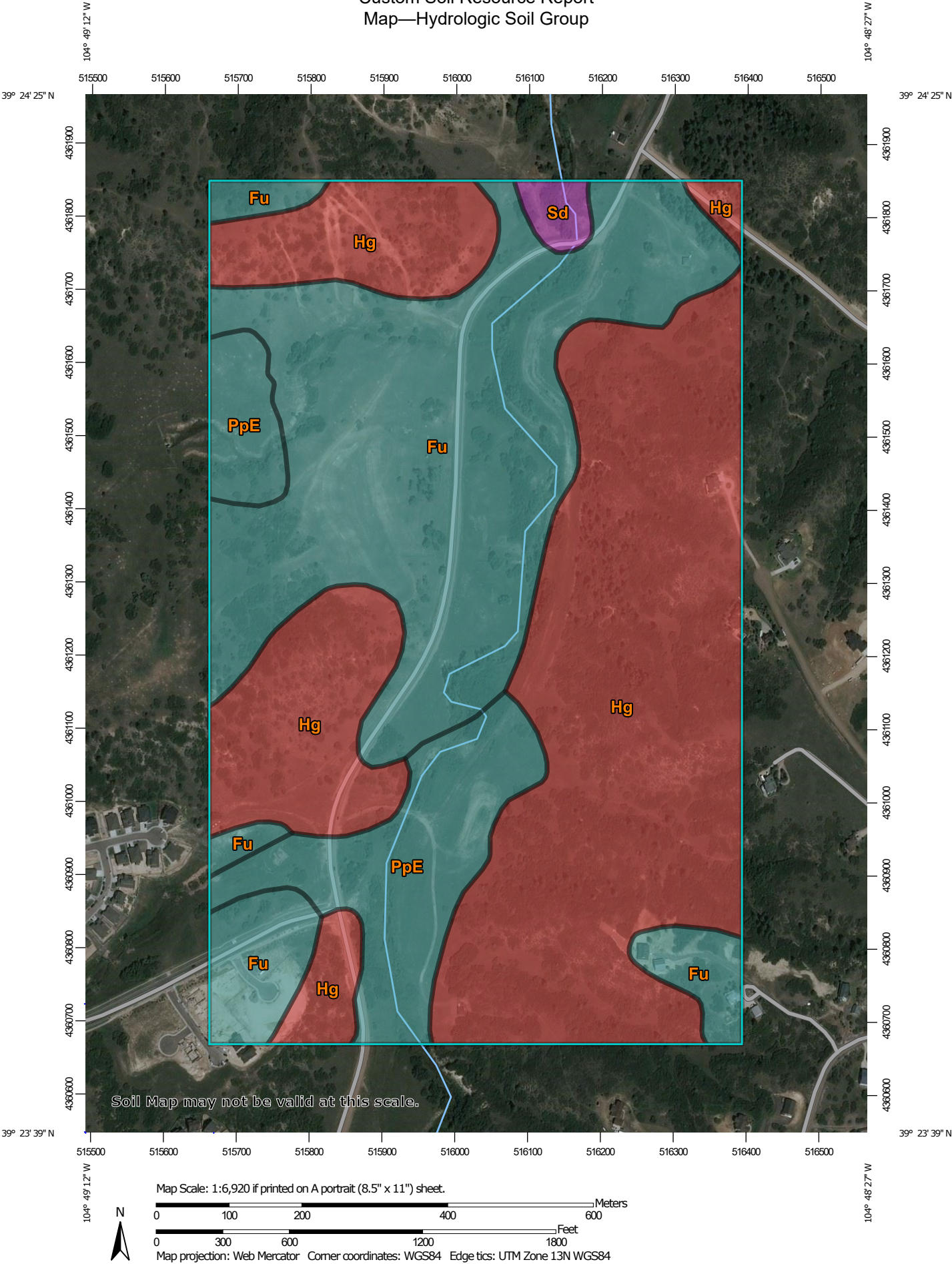
Custom Soil Resource Report

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.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report
Map—Hydrologic Soil Group



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

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 1:20,000.

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: Castle Rock Area, Colorado
Survey Area Data: Version 14, Aug 31, 2021

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

Date(s) aerial images were photographed: Jul 24, 2018—Nov 19, 2018

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.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Fu	Fondis-Kutch association	C	80.3	37.5%
Hg	Hilly gravelly land	D	107.0	50.0%
PpE	Peyton-Pring-Crowfoot sandy loams, 5 to 25 percent slopes	C	24.9	11.6%
Sd	Sandy alluvial land	A	2.0	0.9%
Totals for Area of Interest			214.2	100.0%

Rating Options—Hydrologic Soil Group*Aggregation Method:* Dominant Condition*Component Percent Cutoff:* None Specified*Tie-break Rule:* Higher

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>

Custom Soil Resource Report

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



March 31, 2020

Roger Hollard
Stratus Terrain, LLC
8480 E. Orchard Road, Suite 1100
Greenwood Village, CO 80111
CORE Consultants Project Number 14-001

**RE: Threatened and Endangered Species Review
Terrain North Basin
Douglas County, Colorado**

Dear Mr. Hollard,

On behalf of Stratus Terrain, LLC ("Applicant"), CORE Consultants, Inc. (CORE) presents this memo, summarizing a review of the potential for occurrence of federally threatened and endangered species (TES) within the Terrain North Basin residential development (North Basin or "Project") in the town of Castle Rock, Douglas County, Colorado (Attachment I). CORE reviewed federal TES and associated designated critical habitats and general habitat requirements for those species. This review was conducted in accordance with Endangered Species Act (ESA) requirements for Section 7 consultation (Section 7(a)(2) of the ESA) in association with a Section 404 permit application to the U.S. Army Corps of Engineers (USACE).

The Project encompasses approximately 381 acres in eastern Douglas County, Colorado, northeast of the intersection of State Highway (SH) 86 and Founders Parkway (Attachment I). Proposed Project infrastructure includes single family residential units, access roads, utility lines, and other associated infrastructure. The Project area is located in Section 6 of Township 8 South, Range 66 West and Sections 29, 30, 31, and 32 of Township 7 South, Range 66 West on the U.S. Geological Survey 7.5-minute Castle Rock North quadrangle map (USGS 2016). SH 86 is located to the south and east, Autumn Sage Street to the north, and existing Terrain residential developments along Autumn Sage Street exist to the west. Overall, the region is undergoing increasing urbanization and residential development.

ENVIRONMENTAL SETTING

Broadly speaking, the Project area is located within the Level III Southwestern Tablelands ecoregion of Colorado, which represents a transitional zone between the High Plains to the east and the Southern Rocky Mountains to the west. The dissected plains and hills of this region support pine-oak woodlands and native grasslands. Much of the region is managed pasture and rangeland, with less agricultural use than the adjacent High Plains region. Located within the Level IV Pine-Oak Woodlands ecoregion of the Southwestern Tablelands physiographic region (Chapman et al. 2006), the Project Area supports a mix of grasslands, isolated shrublands, and riparian vegetation. The Project ranges in elevation from 6,200 to 6,500 feet above sea level.

Typical vegetation includes oak-scrub woodlands interspersed with foothill grasslands. Dominant plant species include mountain mahogany (*Cercocarpus montanus*), Gambel oak (*Quercus gambelii*), snowberry (*Symphoricarpos albus*), fringed sage (*Artemisia frigida*), soapweed yucca (*Yucca glauca*), needle-and-thread (*Hesperostipa comata*), blue grama (*Bouteloua gracilis*), buffalograss (*Bouteloua dactyloides*), winterfat (*Ceratoides lanata*), and squirrel tail (*Elymus elymoides*).

Soils were mainly formed from weathered sandstone and shale (Chapman et al. 2006). The Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) data for the Project area indicate the Project is composed predominantly of the Fondis-Kutch and Fondis clay-loam soil complexes. The majority of the acreage includes the following soil units: Fondis-Kutch association; Fondis clay loam, 3 to 9 percent slopes; hilly gravelly land; Peyton-Pring-Crowfoot sandy loams, 5 to 25 percent slopes; and gravel pits. The dominant soil series are classified by the NRCS as hydric soils in the Castle Rock area.

PREVIOUS ESA CONSULTATION

Correspondence with multiple agencies including USFWS was conducted during prior phases of the Terrain project. All prior agency determinations concurred that various phases of Terrain would not impact federal TES, particularly Preble's meadow jumping mouse (*Zapus hudsonius preblei*; Preble's or PMJM) and its habitat. The correspondence is summarized below.

- May 29, 2014: The USFWS concurred that the Autumn Sage and SH 86 Intersection Project was not likely to adversely affect PMJM (Reference no. 06E24000-2014-TA-0651).
- November 11, 2014: The USFWS determined "No Concerns" for TES associated with the Federal Emergency Management Agency (FEMA) Conditional Letter of Map Revision (CLOMR) report supporting the FEMA application for the Terrain project.
- December 29, 2014: The U.S. Army Corps of Engineers (USACE) issued a Nationwide Permit Verification (NWP) 29 (Action No. NOW-2014-02440-DEN) for the Terrain Residential Development Phase I and Phase II Sanitary Sewer Line Construction. Sanitary sewer line development would impact jurisdictional wetlands within the McMurdo Gulch drainage. As such, a review for TES including PMJM was submitted as part of the NWP application. The TES review determined that sanitary sewer line development and construction would not impact PMJM nor its habitat.
- January 9, 2018: The USFWS issued a determination of "No Concerns" regarding PMJM for the Sunstone Village portion of the Terrain Development, which is located south of SH 86. USFWS cited a lack of shrub cover and other habitat components, as well as negative results from PMJM trapping studies further downstream in McMurdo Gulch as the primary reasons for this determination (Reference no. 2018-TA-0378).

CORE initiated consultation with the USFWS in 2014 regarding potential impacts to potentially suitable TES habitats within this and other portions of McMurdo Gulch, which is a tributary to Cherry Creek (Attachment II). The USFWS has designated critical habitat for PMJM along Cherry Creek, approximately six miles upstream from the confluence with McMurdo Gulch (USFWS 2020b). McMurdo Gulch converges with Cherry Creek approximately three miles downstream (northeast) from the northern boundary of the North Basin Project area, and Colorado Parks and Wildlife's (CPW) estimated occupied range (EOR) for PMJM extends upstream along McMurdo Gulch approximately one mile from its confluence with Cherry Creek. Neither USFWS-designated Critical Habitat nor CPW EOR extend into the Project area.

The proximity and connectivity of McMurdo Gulch to designated PMJM habitats warranted a detailed habitat assessment in July 2015 to determine potential for PMJM. The USFWS PMJM survey protocol references studies which indicated PMJM presence at 330 feet from the edge of the FEMA 100-year floodplain (USFWS 2004). Therefore, potential habitat was surveyed up to 330 feet from the 100-year floodplain line in during the 2015 site visit.

An updated habitat assessment for PMJM was conducted on November 19 and 20 and December 13, 2019 during a site visit for the wetland delineation, as the previous assessment was outdated. Results of both the July 2015 and fall 2019 PMJM habitat assessments are described in the Site Reconnaissance section below.

ESA COMPLIANCE REVIEW

Federal Threatened and Endangered Species

The USFWS' Information for Planning and Conservation (IPaC) online portal (USFWS 2020a) was reviewed to identify federal TES that have the potential to occur within the Project area. No designated critical habitat is located in the Project area (USFWS 2020b). The federal TES with potential to occur and/or be impacted by Project development are discussed below.

Ute Ladies'-tresses Orchid

Ute ladies'-tresses orchid (*Spiranthes diluvialis*; ULTO) is a perennial orchid listed as federally threatened. This forb has ivory flower clusters arranged in a spike, which grow approximately 8 to 20 inches tall. ULTO is known to occur in parts of Colorado, Wyoming, Idaho, Montana, Nebraska, Utah, and Washington. The plant typically occurs within features associated with major river floodplains, including riparian edges, gravel bars, old oxbows, high flow channels, and moist to wet meadows associated with perennial streams. It is found under 6,500 feet above sea level in Colorado (USFWS 2014). Surveys have indicated that this species may also inhabit groundwater-fed springs or sub-irrigated meadows, seeps, and human-influenced riparian habitats that receive reliable and stable spring inundation (Fertig et al. 2005 and NRCS 2009). Soils in areas of suitable habitat have a high micronutrient and organic matter content, and display gley features when sampled (NRCS 2009).

A rare plant survey was completed in August 2015 to map and survey potential ULTO habitat in the Project area (AEC 2015). The survey area for rare plants covered a 77-acre portion within the Project area. Habitat areas were mapped and designated as high, moderate, or low quality based on the openness of the canopy, density and diversity of herbaceous species, abundance of weeds, and soil moisture. No ULTO were found during the rare plant survey. Most of the survey area was located along flowing channels with well-developed wetland vegetation. The Project contained several areas that are potential ULTO habitat, though the majority of habitat was of low to moderate quality (quality was determined relative to the habitat available in the survey area). Small areas of high quality habitat were found, based on the presence of suitable hydrology for ULTO and open, herbaceous vegetation. Much of the existing, high quality habitat in the survey area was weedy or heavily grazed, potentially reducing the likelihood of occurrence of ULTO. Since surveys can only reliably be conducted during the periods when the species is flowering, a follow-up survey will be conducted in late July or August 2020 when the species will be in bloom to obtain updated information about the likelihood of ULTO occurrence.

Preble's Meadow Jumping Mouse

Preble's is a small, long-tailed rodent that occurs in a limited range along stream corridors of the Front Range from southern Wyoming to central Colorado, including Douglas County. PMJM is federally-listed as a threatened species and is a state threatened species in Colorado. Preferred habitat is composed of well-developed riparian corridors with gentle slopes and adjacent grasslands, which allow for movement along the stream channel (Bakeman 1997 and Trainor et al. 2007). Shrubby willows (*Salix* spp.), chokecherry (*Prunus virginiana*), snowberry, three-leaf sumac (*Rhus trilobata*), and cottonwood (*Populus* spp.) saplings are the predominant plant species within PMJM preferred habitat (Bakeman 1997). Thinleaf alder (*Alnus incana tenuifolia*), red-osier dogwood (*Cornus sericea*), hawthorn (*Crataegus* spp.), and Russian olive (*Elaeagnus angustifolia*) are also common riparian shrubs indicative of suitable PMJM habitat.

PMJM hibernates for much of the year, entering dormancy in September or October and emerging the following May. Hibernation occurs outside of the active stream channel and alluvial floor in adjacent upland areas, though mice have also been found hibernating in the 100-year floodplain (Shenk and Silvert 1999 and Schorr 2001). Upland habitats provide refuge and forage for Preble's during flood events, which are infrequently necessary to maintain the preferred shrubby vegetation canopy. PMJM constructs nests using forbs, grasses, and other available plant material, sometimes building multiple nests (Ryon 2001). Nests are typically located under clumps of vegetation or well-developed shrubs, including chokecherry, three-leaf sumac, and Gambel oak (Grunau et al. 1999). PMJM high-use areas along riparian corridors have been measured to have wetland shrub cover of at least 70% and wetland grass cover of more than 60% (Schorr 2001 and Trainor et al. 2007), and preferred habitat may have nearly 100% aerial vegetative cover (CPW 2016). PMJM occurrence may also be positively-correlated to species richness (Schorr 2001).

PMJM has been documented using upland habitat approximately 30% of the time (Grunau et al. 1999). Although PMJM occurrence in uplands is not strictly limited to particular plant species, some of the common upland shrubs include Gambel oak, chokecherry, three-leaf sumac, snowberry, and ponderosa pine (*Pinus ponderosa*). Grasses may include big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), western wheatgrass (*Pascopyrum smithii*), and gramas (*Bouteloua* spp.). Decreased grass cover in upland and riparian habitats, associated with cattle and other livestock grazing, has been shown to be negatively-correlated with jumping mouse abundance (Schulz and Leininger 1991). In some instances, livestock grazing has been identified as the greatest threat to meadow jumping mice, resulting in local extirpations (Frey 2011). Few PMJM dispersal studies have been conducted, and success of these studies is limited (Schorr 2001); however, home range of this species has been estimated at 2.38 acres (Harrington et al. 1996), and individuals have moved over 0.6 miles along a stream in a 24-hour period (USFWS 2018). PMJM population density has been calculated to be between three and 108 individuals per mile, with a mean of 53 mice per mile (White and Shenk 2001). Their population has declined due to habitat fragmentation and degradation resulting from urban development in riparian areas (USFWS 2004).

Atwell, LLC (Atwell) conducted a PMJM habitat assessment for the entire Terrain development, including North Basin, in May 2014. Prior to the Atwell survey, the last trapping study in the area was conducted in 2001 within the North Basin Project area (USFWS *pers. comm.*). The Atwell habitat assessment determined that McMurdo Gulch did not support suitable PMJM habitat due to human impoundments and degraded habitat downstream that precluded PMJM presence in the Project area.

Potential for Additional TES in the Project

Three federally endangered species—two birds and one fish—were identified by the IPaC query, but have very low likelihood of occurrence within the Project area (Table 1). Least tern (*Sternula antillarum*) is primarily distributed along U.S. coastlines, but has scattered, interior breeding populations where suitable habitat exists, especially along major rivers (Thompson et al. 1997). Least terns have been documented at Cherry Creek Reservoir and Chatfield Reservoir, 16 miles north and northwest of the Project, respectively (Sullivan et al. 2009); however, documentation of least tern at these locations is limited to single birds on four occasions, most recently in 2009 (Sullivan et al. 2009). Whooping crane (*Grus americana*) is also very unlikely to occur, given the lack of preferred palustrine wetland or cropland habitats for stopover during migration and the fact that the Project area is 215 miles from the 95% whooping crane migration corridor (Urbanek and Lewis 2015). The nearest occurrence of whooping crane to the Project area was 35 miles north of the Project in 1984 (Sullivan et al. 2009). Additionally, pallid sturgeon (*Scaphirhynchus albus*; federally endangered) will not occur in the Project area, nor will it be impacted by Project development. The Project will not adversely affect downstream waters in the North Platte, South Platte, or Laramie River basins where pallid sturgeon occurs. The remaining federally threatened species that were identified in the IPaC query—Mexican spotted owl (*Strix occidentalis lucida*), piping plover (*Charadrius melodus*), greenback cutthroat trout (*Oncorhynchus clarkii stomias*), and western prairie fringed orchid (*Platanthera praeclara*)—have a very low likelihood of occurring and are summarized in Table 1.

TABLE I. FEDERAL TES WITH POTENTIAL TO OCCUR IN THE TERRAIN NORTH BASIN PROJECT, DOUGLAS COUNTY, COLORADO.

Common Name (Scientific Name)	Status ¹	Range or Habitat Requirements	Potential for Occurrence in Project Area
BIRDS			
Least tern (<i>Sternula antillarum</i>)	FE	Prefers sparsely vegetated mudflats, gravel bars, and sand spits along coasts and rivers. Species requires large waterbodies for foraging (Thompson et al. 1997).	Very Low
Mexican spotted owl (<i>Strix occidentalis lucida</i>)	FT	Requires specific habitat conditions of mixed-conifer and steep canyons (Gutiérrez et al. 1995). Designated critical habitat is located >12 mi. from Project.	Very Low
Piping plover (<i>Charadrius melodus</i>)	FT	Species requires open, sparsely-vegetated areas with low to zero slope and large surface water features (Elliott-Smith and Haig 2004).	Very Low
Whooping crane (<i>Grus americana</i>)	FE	Project area is outside of species' range and does not contain croplands or palustrine wetlands that are typical of migrant stopover habitat (Urbanek and Lewis 2015).	Very Low
FISH			
Greenback cutthroat trout (<i>Oncorhynchus clarkii stomias</i>)	FT	Historically occupied steep, cold, high mountain streams and rivers in the South Platte and Arkansas River watersheds (Young 2009). A single, genetically pure population remains in Bear Creek, El Paso County (Martin et al. 2015). Perennial flows are not present in the Project area.	Very Low
Pallid sturgeon (<i>Scaphirhynchus albus</i>)	FE	Species requires large, silty rivers with a natural hydrograph (Krentz 2004).	Very Low
MAMMALS			
Preble's meadow jumping mouse (<i>Zapus hudsonius preblei</i>)	FT	Species requires dense shrubs and wetland grasses near water with adjacent upland grasses (Bakeman 1997). Designated Critical Habitat is more than 9 miles from the Project hydrologically along Cherry Creek (USFWS 2020b). McMurdo Gulch converges with Cherry Creek approximately three miles downstream (north) of the Project area.	Low-Moderate
PLANTS			
Ute ladies'-tresses orchid (<i>Spiranthes diluvialis</i>)	FT	Suitable hydrology and open herbaceous vegetation are present along small portions of McMurdo Gulch. Overall habitat is low to moderate quality for species (AEC 2015).	Low-Moderate
Western prairie fringed orchid (<i>Platanthera praeclara</i>)	FT	Tallgrass prairies and meadows where this species typically occurs are not present in the Project area (USFWS 2019)	Very Low

¹ Status: FE=Federally Endangered; FT=Federally Threatened (USFWS 2020a)

SITE RECONNAISSANCE

CORE conducted multiple site visits in 2014, 2015, and 2019 to determine the potential for the occurrence of TES and their associated habitats. More recently, CORE reviewed the Atwell study and revisited the site on November 19 and 20 and December 13, 2019 to conduct an updated habitat assessment for TES. During the site visit, CORE confirmed the results of the Atwell study and results of prior USFWS consultation and concluded that habitat quality in the Project area had not improved in the intervening five years. Earlier impoundments and residential developments downstream near the confluence with Cherry Creek left a gap of unsuitable habitat upstream from Cherry Creek, precluding PMJM access to the Project area. This, coupled with the negative trapping study results from the North Basin Project area, indicate a lack of suitability for Preble's in McMurdo Gulch. The highest quality potential PMJM habitat is present in Planning Area I, and the quality generally degrades in an upstream direction along the McMurdo Gulch channel (Attachments III and IV).

Planning Area I is composed of 98.43 acres of upland habitat immediately adjacent to the floodplain on the western side of the main channel of McMurdo Gulch. The upland habitat is comprised of a mix of Gambel oak, mixed montane shrubland, and mixed-foothills grasslands. Planning Area I abuts a high quality portion of PMJM habitat within the McMurdo Gulch channel. This portion of the channel is characterized by an open, broad perennial stream channel. Periodic flooding is evident by the dense streamside riparian habitat located on gently sloping banks adjacent to the stream (Attachment IV). Willows and immature cottonwoods comprise the dense shrubby mid-story riparian habitat along the banks of the channel, providing potential cover and forage. Planning Area I does not include the stream channel but does include uplands abutting the stream channel (Attachment I). As such, impacts to the uplands in this area would avoid impacts to potential riparian habitat along McMurdo Gulch.

CONCLUSIONS

Upon completion of a desktop review and site reconnaissance of the Project, CORE has determined that some potential biological constraints are present within the Project area. Site reconnaissance indicated that small areas of potential PMJM habitat exist within the Project area, particularly at the north end. The current Project design would avoid impacts to the highest quality potential PMJM habitat. Prior negative trapping surveys from within the North Basin Project area are an indication that, although potential habitat is present, Preble's may not occupy the Project area. Furthermore, manmade impoundments downstream of the Project area may preclude Preble's from accessing this habitat.

Potentially suitable habitat for the federally threatened ULTO is present in the Project area. The USFWS *Interim Survey Requirements for Ute Ladies'-tresses Orchid* (USFWS 1992) require ULTO surveys of relatively undisturbed jurisdictional wetlands within the 100-year floodplain on sites with elevations below 6,500 feet above sea level. Such a survey was conducted in August 2015, and a follow-up survey to confirm absence of ULTO is scheduled for July/August 2020.

If you should have any questions or require additional information, please feel free to contact CORE directly at 303.910.4568, or at jahnke@corecivil.com.

Sincerely,

CORE Consultants, Inc.



Ethan Jahnke
Senior Project Manager

ATTACHMENTS

- I. SITE LOCATION MAP
- II. PRIOR USFWS SECTION 7 CONSULTATION
- III. PREBLE'S MEADOW JUMPING MOUSE HABITAT MAP
- IV. PHOTOGRAPHIC LOG

REFERENCES

- AEC (Auckland Environmental Consulting). 2015. Terrain Residential Development: Rare plant survey report. Prepared for CORE Consultants, Littleton, Colorado. Prepared by Auckland Environmental Consulting. November 3, 2015.
- Bakeman, M.E. 1997. Report on habitat findings of the Preble's meadow jumping mouse. Presented to the U.S. Fish and Wildlife Service and the Colorado Division of Wildlife. 91 pp.
- Chapman, S.S., G.E. Griffith, J.M. Omernik, A.B. Price, J. Freeouf, and D.L. Schrupp. 2006. Ecoregions of Colorado (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,950,000).
- CPW (Colorado Parks and Wildlife). 2016. Preble's meadow jumping mouse fact sheet. https://cpw.state.co.us/Documents/LandWater/WetlandsProgram/PrioritySpecies/Factsheet-and-Habitat-Scorecard_PreblesMeadowJumpingMouse.pdf. Accessed July 2019.
- Elliott-Smith, E. and S.M. Haig. 2004. Piping plover (*Charadrius melodus*), version 2.0. The Birds of North America (A. F. Poole, Ed.). Cornell Lab of Ornithology, Ithaca, New York, USA. <https://doi.org/10.2173/bna.2>. Accessed February 2020.
- Fertig, W., R. Black, and P. Wolken. 2005. Rangewide status review of Ute's ladies'-tresses (*Spiranthes diluvialis*). https://www.fws.gov/mountain-prairie/species/plants/uteladiestress/spdi_status%20review_fertig2005.pdf. Accessed March 2020.
- Frey, J.K. 2011. Inventory of the meadow jumping mouse in Arizona. Final report. Arizona Game and Fish Department Heritage Fund, July 5, 2011. 114 pp.
- Grunau, L., R. Schorr, D. Green, B. Rosenlund, C. Pague, and J. Armstrong. 1999. Conservation and management plan for Preble's meadow jumping mouse on the U.S. Air Force Academy. Prepared by the Colorado Natural Heritage Program, Colorado State University, Fort Collins, Colorado. 48 pp.
- Gutiérrez, R. J., A. B. Franklin, and W. S. Lahaye. 1995. Spotted owl (*Strix occidentalis*), version 2.0. The Birds of North America Online (A.F. Poole and F.B. Gill, Eds.). Cornell Lab of Ornithology, Ithaca, New York, USA. <https://doi.org/10.2173/bna.179>. Accessed March 2020.
- Harrington, F.A., A. Deans, M.E. Bakeman, and B.J. Bevirt. 1996. Recent studies of Preble's meadow jumping mouse (*Zapus hudsonius preblei*) at Rocky Flats Site, Colorado. Journal of Colorado-Wyoming Academy of Science 28:11.
- Krentz, S. 2004. Scaphirhynchus albus. (Missouri River Fish & Wildlife Management Assistance). The IUCN Red List of Threatened Species. e.T19940A9111329. <http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T19940A9111329.en>. Accessed March 2020.
- Martin, A., J. Metcalf, C. Kennedy, and K. Rigers. 2015. Comparison between modern and historical distribution and diversity of cutthroat trout in Colorado. Abstract from American Fisheries Society 145th Annual Meeting.
- NRCS (Natural Resources Conservation Service). 2009. Ute ladies'-tresses (*Spiranthes diluvialis*) plant guide. https://plants.usda.gov/plantguide/pdf/pg_spdi6.pdf. Accessed March 2020.
- NRCS. 2020. Soil Data Access (SDA) Hydric Soils List. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1316620.html. Accessed March 2020.

- Ryon, T.R. 2001. Summer nests of Preble's meadow jumping mouse. *The Southwestern Naturalist* 46(3):376-378.
- Schorr, R.A. 2001. Meadow jumping mice (*Zapus hudsonius preblei*) on the U.S. Air Force Academy, El Paso County, Colorado. Colorado Natural Heritage Program, Fort Collins, Colorado.
- Schulz, T., and W.L. Leininger. 1991. Nongame wildlife communities in grazed and ungrazed montane riparian sites. *Great Basin Naturalist* 51:286-292.
- Shenk, T.M., and M.M. Silvert. 1999. Movement patterns of Preble's meadow jumping mouse (*Zapus hudsonius preblei*) as they vary across time and space. Unpublished technical report, Colorado Parks and Wildlife.
- Sullivan, B.L., C.L. Wood, M.J. Iliff, R.E. Bonney, D. Fink, and S. Kelling. 2009. eBird: a citizen-based bird observation network in the biological sciences. *Biological Conservation* 142:2282-2292. www.ebird.org. Accessed March 2020.
- Thompson, B.C., J.A. Jackson, J. Burger, L.A. Hill, E.M. Kirsch, and J.L. Atwood. 1997. Least tern (*Sternula antillarum*), version 2.0. The Birds of North America (A. F. Poole and F. B. Gill, Eds.). Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/bna.290>. Accessed February 2020.
- Trainor, A.M., T.M. Shenk, and K.R. Wilson. 2007. Microhabitat characteristics of Preble's meadow jumping mouse high-use areas. *Journal of Wildlife Management*, 71(2):469-477.
- Urbanek, R.P., and J.C. Lewis. 2015. Whooping crane (*Grus americana*), version 2.0. The Birds of North America Online (A.F. Poole, Ed.). Cornell Lab of Ornithology, Ithaca, New York, USA. <https://doi.org/10.2173/bna.153>. Accessed March 2020.
- USFWS (U.S. Fish and Wildlife Service). 1992. Interim survey requirements for Ute ladies'-tresses orchid (*Spiranthes diluvialis*). November 23, 1992.
- USFWS. 2004. Preble's meadow jumping mouse (*Zapus hudsonius preblei*) Survey Guidelines. <https://www.fws.gov/mountain-prairie/es/species/mammals/preble/CONSULTANTS/pmjm2004guidelines.pdf>.
- USFWS. 2014. Species profile for Ute ladies'-tresses (*Spiranthes diluvialis*). <https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=Q2WA>.
- USFWS. 2018. Recovery plan/Preble's meadow jumping mouse (*Zapus hudsonius preblei*). U.S. Department of the Interior, Mountain-Prairie Region, Lakewood, Colorado. <https://www.fws.gov/mountain-prairie/es/species/mammals/preble/RECOVERY%20PLAN/Sept2018FinalRecoveryPlan.pdf>. Accessed February 2020.
- USFWS. 2019. Prairie fringed orchids fact sheet. Midwest Region Endangered Species, Bloomington, MN. <https://www.fws.gov/midwest/endangered/plants/prairief.html>. Accessed March 2020.
- USFWS. 2020a. IPaC – Information for Planning and Conservation. <https://ecos.fws.gov/ipac>. Accessed March 2020.
- USFWS. 2020b. Environmental Conservation Online System (ECOS) – Critical habitat portal. <https://ecos.fws.gov/ecp/report/table/critical-habitat.html>. Accessed January 2020.
- USGS (U.S. Geological Survey). 2016. U.S. Geological Survey 7.5-Minute Topographic Map. Castle Rock North – Colorado.
- White, G.C., and T.M. Shenk. 2001. Population estimation with radio-marked animals. *In* Radio Tracking and Animal Populations. pp. 329-350.

Young, M.K. 2009. Greenback cutthroat trout (*Oncorhynchus clarkii stomias*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region.
<http://www.fs.fed.us/r2/projects/scp/assessments/greenbackcutthroattrout.pdf>. Accessed March 2020.

ATTACHMENT I
SITE LOCATION MAP

ATTACHMENT II
PRIOR USFWS SECTION 7 CONSULTATION



United States Department of the Interior



FISH AND WILDLIFE SERVICE
COLORADO FIELD OFFICE/LAKEWOOD
P.O. BOX 25486, DENVER FEDERAL CENTER
DENVER, COLORADO 80225-0486

IN REPLY REFER TO:

ES/CO: CDOT

TAILS: 06E24000-2015-I-0269

JAN 22 2015

Chris Haas
CORE Consultants
1950 West Littleton Boulevard, Suite 109
Littleton, Colorado 80120

Dear Mr. Haas:

Based on the authority conferred to the U.S. Fish and Wildlife Service (Service) by the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.*), the Service reviewed your December 30, 2014, report regarding the **Autumn Sage and SH84 Intersection project near Castle Rock, Douglas County, Colorado**, and its potential effects on the threatened Ute ladies'-tresses orchid (*Spiranthes diluvialis*), and the threatened Colorado butterfly plant (*Gaura neomexicana* ssp. *coloradensis*). No critical habitats have been designated in the area; therefore, none will be affected. Also, on May 29, 2014, we concurred that the project is not likely to adversely affect the Preble's meadow jumping mouse (*Zapus hudsonius preblei*) (06E24000-2014-TA-0651).

The project area is approximately 100 feet wide, 2,400 feet long, and located along the northern edge of the SH86 right-of-way. The proposed project involves extending Autumn Sage Street south to intersect SH86, which will be widened to the north to accommodate a turn lane for westbound traffic. Widening the roadway will require extending the culvert that conveys McMurdo Gulch under SH86 by 30 feet. The site is surrounded by existing residential developments to the southeast and northwest and undeveloped, grazed lands to the north.

Most of the project area is vegetated with non-native annual and biennial forbs such as Canada thistle, bull thistle, leafy spurge, kochia, and hoary cress. Native grasses occur on small portions of the area, as do small pockets of upland shrubs. McMurdo Gulch is steeply incised and frequently scoured during rain events and does not support seasonally inundated or other wetland habitats typical of those occupied by either the Ute ladies'-tresses orchid or the Colorado butterfly plant. Because neither species is likely to occupy the site due to the lack of suitable habitat, effects of the project to the species are expected to be discountable.

Given your habitat and project descriptions, the Service finds the report acceptable and concurs with the determination that the impacts resulting from the proposed project are not likely to

adversely affect the Ute ladies'-tresses orchid or the Colorado butterfly plant. Please note that should project plans change or if additional information regarding listed or proposed species becomes available, this determination may be reconsidered under the ESA.

We appreciate your submitting this report to our office for review and comment. If the Service can be of further assistance, please contact Alison Deans Michael of my staff at (303) 236-4758.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Seth L. Willey', with a long horizontal stroke extending to the right.

Seth L. Willey
Acting Colorado Field Supervisor

cc: CDOT, HQ (Jeff Peterson)
CDOT, Region 1 (Francesca Tordonato)
Michael

Ref: Alison\H:\My Documents\CDOT 2007+\Region 1\Terrain_Autumn_Sage_SH86\Terrain_Autumn_Sage_SH86_ULTO_CBP_concur.docx



Michael, Alison <alison_michael@fws.gov>

Preble's surveys not required for a project in Castle Rock in 500-year floodplain

1 message

Dan Maynard <maynard@corecivil.com>

Wed, Dec 20, 2017 at 3:45 PM

To: "Michael, Alison" <alison_michael@fws.gov>

Cc: "KMarx@crgov.com" <KMarx@crgov.com>

Hi Alison,

I'm emailing about a residential development project in Castle Rock along McMurdo Gulch, and want to confirm with you that Preble's Meadow Jumping Mouse surveys would not be required for the project. The project is south of Highway 86 at the headwaters of McMurdo Gulch, and a portion is in a Zone X 500-year floodplain. As part of the site development plan approval process with the Town of Castle Rock, we are being asked to provide some sort of acknowledgement from the Service that Preble's are not a concern for project development, and that we have done our due diligence re: PMJM. The Town has referred us to USFWS guidance for Preble's surveys which state that surveys are required, in counties where the species occurs, within 300 feet of a 100-year floodplain. I've spent quite a bit of time on the site, and can confirm that the habitat is just not suitable for Preble's. Water is only present for brief periods during heavy rains, and the vegetation lacks any of the riparian composition preferred by the species. I attached a picture of the site showing the Gambel oak and upland grasses along McMurdo Gulch on the site. Since habitat is unsuitable, and we are not within a designated 100-year floodplain, the requirement for focused Preble's surveys should not apply. A map of the project area is also attached for you reference.

I've copied Kathy Marx, who is the planner on this project with the Town of Castle Rock. Kathy would like some sort of confirmation that the project would not require PMJM surveys since it is not within a 100-year floodplain, and lacks the basic, requisite habitat structure and composition. Would you be able to respond to us both via email to confirm that Preble's surveys would not be required for this project?

Thank you, Alison

Dan Maynard

Senior Ecologist

O 303.730.5979

M 971.237.3906

2018-TA-0378

U.S. FISH AND WILDLIFE SERVICE	
☒	NO CONCERNS
☐	CONCUR NOT LIKELY TO ADVERSELY AFFECT
☐	NO COMMENT
	
Dru DeBerry	DATE 1/9/18
Colorado and Nebraska Field Supervisor	

• no shrubs on other components of habitat in area.

• negative surveys in nearby areas.



1950 W Littleton Blvd Suite 109
 Littleton CO 80120
 303.703.4444
CoreCivil.com

2 attachments

 IMG_2254.pdf
 1911K



Lakamp, Donna <donna_lakamp@fws.gov>

Fwd: Terrain - PMJM Determination

1 message

Linner, Susan <susan_linner@fws.gov>
To: Donna Lakamp <donna_lakamp@fws.gov>

Thu, May 22, 2014 at 8:01 AM

Log as a TA.

----- Forwarded message -----

From: **Phil Dalrymple** <pdalrymple@coreconsultantsco.com>
Date: Thu, May 22, 2014 at 6:31 AM
Subject: Terrain - PMJM Determination
To: "susan_linner@fws.gov" <susan_linner@fws.gov>

3014TAD651 EM-P. Dalrymple

U.S. FISH AND WILDLIFE SERVICE	
☐ NO CONCERNS	
☒ CONCUR NOT LIKELY TO ADVERSELY AFFECT	
☐ NO COMMENT	
<i>Susan C. Linner</i>	MAY 29 2014
SUSAN C. LINNER	DATE
COLORADO FIELD SUPERVISOR	

Susan,

Attached is a site layout of the property from our phone conversation on Tuesday. The site is generally located at the northeast corner of State Highway 86 and Founders Parkway in the Town of Castle Rock Colorado. The name of the drainageway within the site is McMurdo Gulch. I received some information from our environmental consultant, and it appears that a Prebles Mouse study was done back in 2000 for this area, but it did not extend far enough south. I have attached that map as well. Please take a look and let me know if you have any questions. Thanks for your help!

Phil Dalrymple, PE

pdalrymple@coreconsultantsco.com

O- 303.703.4444 x116 M- 720.339.7074

1950 W. Littleton Blvd. Ste. 109
Littleton, CO 80120

More on CORE:

www.coreconsultantsco.com



Lakamp, Donna <donna_lakamp@fws.gov>

Fwd: FEMA CLOMR Review Request

1 message

Linner, Susan <susan_linner@fws.gov>

To: Donna Lakamp <donna_lakamp@fws.gov>

Fri, Nov 14, 2014 at 10:21 AM

Log and print.

----- Forwarded message -----

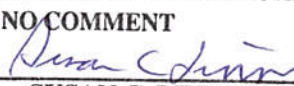
From: **Tina Brazil** <brazil@corecivil.com>

Date: Fri, Nov 14, 2014 at 10:17 AM

Subject: FEMA CLOMR Review Request

To: "susan_linner@fws.gov" <susan_linner@fws.gov>

Cc: Chris Haas <haas@corecivil.com>, Scott Pease <pease@corecivil.com>

U.S. FISH AND WILDLIFE SERVICE	
☒ NO CONCERNS	
☒ CONCUR NOT LIKELY TO ADVERSELY AFFECT	
☐ NO COMMENT	
	NOV 25 2014
SUSAN C. LINNER	DATE
COLORADO FIELD SUPERVISOR	

Dear Susan,

We respectfully request your review of the attached FEMA CLOMR report which will support a pending FEMA application for the development of Terrain Residential Development Property located in Castle Rock, Douglas County. Please don't hesitate to contact us should you have further questions.

Kind Regards,

Tina Brazil**Environmental Consultant**

brazil@corecivil.com

O- 303.703.4444 x123 M- 215.280.2370

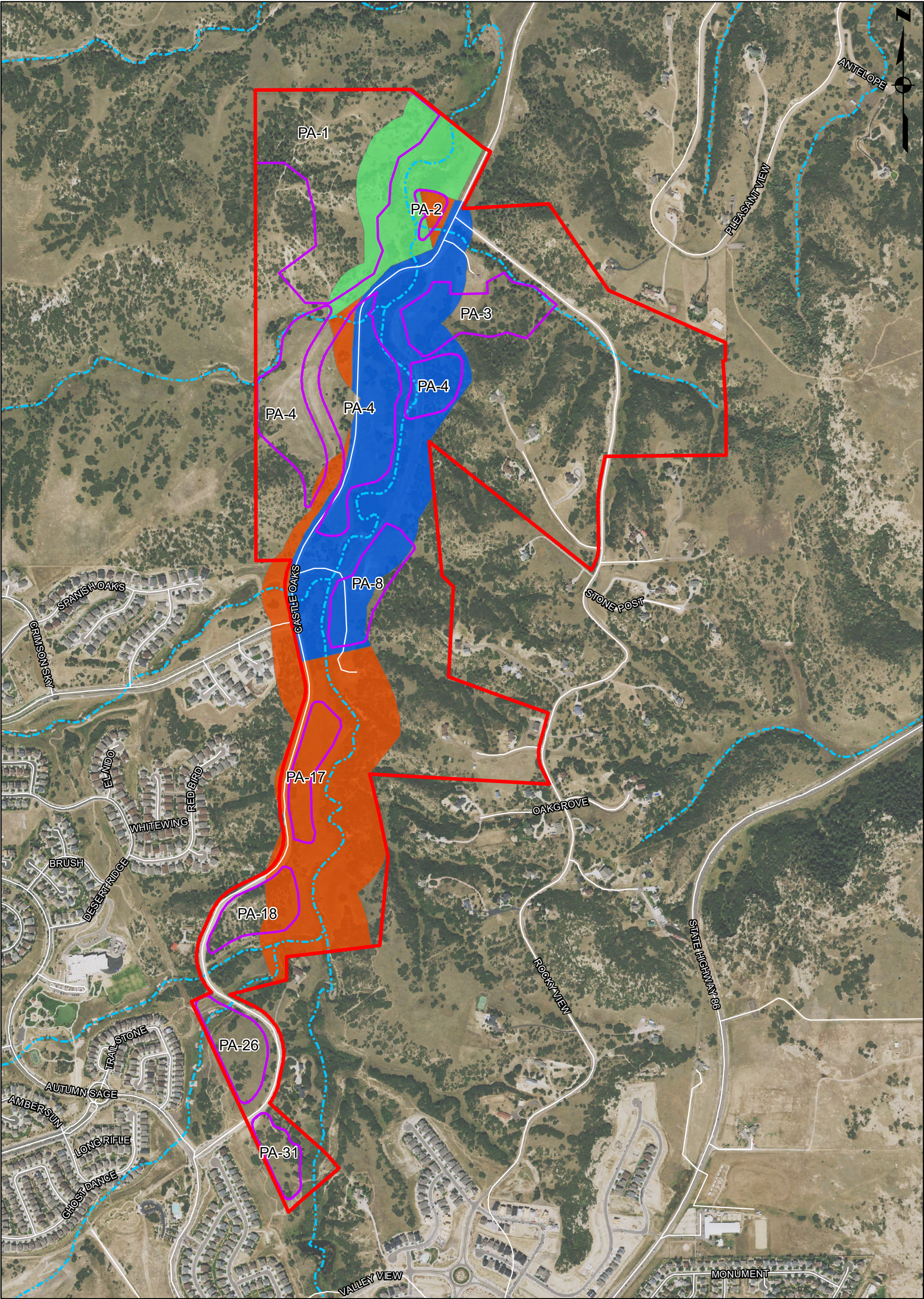
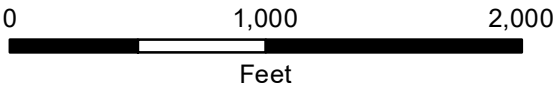
1950 W. Littleton Blvd. Ste. 109
Littleton, CO 80120

More on CORE:

www.corecivil.com

ATTACHMENT III

PREBLE'S MEADOW JUMPING MOUSE HABITAT MAP



Study Area

Planning Area

NHD Watercourse (USGS 2012)

Potential Habitat Quality

High

Moderate

Low



Terrain - North Basin

PMJM Habitat Map

Douglas County, Colorado

ATTACHMENT IV
PHOTOGRAPHIC LOG



Photo 1. Near Planning Area 18 looking north, showing one of the extensive cattail marshes that fill the middle and upper stretches of McMurdo Gulch. These marshes are low quality Preble's habitat. Photo taken in May 2015.



Photo 2. Middle portion of McMurdo Gulch 6 looking northwest. Photo taken in November 2019.



Photo 3. Planning Area 8 near the middle portion of McMurdo Gulch facing west. Photo taken in May 2015.



Photo 4. Middle stretch of McMurdo Gulch looking northeast. Photo taken in November 2019.



Photo 5. Planning Area I facing northeast near northern boundary of Project. Photo taken in May 2015.