Realignment of a Portion of the Utah Lake Drainage Basin Water Delivery System Draft Environmental Assessment

Prepared for

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Contents

Acronyms and Abbreviations ..... **vii**

1.0 General Overview **1-1**
1.1 Introduction 1-1
1.2 Purpose and Need 1-1
1.3 History and Background 1-2
1.4 Location of the Project 1-2
1.5 Authorizing Actions, Permits, and Licenses 1-2
1.5.1 Permanent Easements 1-4
1.5.2 Temporary Easements 1-4
1.6 Participating Agencies 1-4
1.7 Decisions to be Made 1-4
1.8 Interrelated Projects 1-5
1.8.1 Provo Reservoir Canal Enclosure Project 1-5
1.8.2 Central Utah Water Conservancy District Water Development Project 1-5
1.8.3 Interstate 15 Reconstruction 1-5
1.8.4 Provo City Pipeline 1-6
1.8.5 Provo–Orem Bus Rapid Transit 1-6

2.0 Description of Alternatives **2-1**
2.1 Introduction 2-1
2.2 Development of Alternatives 2-1
2.3 No Action Alternative 2-2
2.3.1 Flow-control Facilities 2-2
2.3.2 Modifications to the No Action Alternative Due to the PRCE Project 2-2
2.3.3 Geological Hazards 2-3
2.3.4 Traffic Considerations 2-3
2.3.5 Utility Congestion 2-5
2.3.6 Schools and Residential Impacts 2-5
2.4 Project Features Common to All Alternatives 2-6
2.5 Project Features Common to Action Alternatives 2-6
2.5.1 Flow Control Structure 2-6
2.5.2 Alpine/Jordan Aqueduct Connection Structure 2-7
2.5.3 Provo River Delivery Point 2-7
2.5.4 Increased Pipe Diameter 2-7
2.5.5 Pipeline Segment from Flow Control Structure to Alpine/Jordan Aqueduct 2-7
2.5.6 Flow Control Structure to PRC Connection 2-7
2.5.7 Alignment Options 2-7
2.6 Alternative 1—University Avenue Alignment 2-8
2.6.1 Geological Hazards 2-9

2.6.2 Traffic Considerations 2-9
2.6.3 Utility Congestion 2-11
2.6.4 Schools and Residential Impacts 2-11
2.7 Alternative 2—Timpview Drive Alignment 2-11
2.7.1 Geological Hazards 2-12
2.7.2 Traffic Considerations 2-12
2.7.3 Utility Congestion 2-13
2.7.4 Schools and Residential 2-13
2.8 Alternative 3—1450 East Alignment 2-14
2.8.1 Geological Hazards 2-14
2.8.2 Traffic Considerations 2-15
2.8.3 Utility Congestion 2-15
2.8.4 Schools and Residential Impacts 2-15
2.9 Construction Schedule 2-16
2.10 Best Management Practices 2-16
2.10.1 Landscape Preservation and Impact Avoidance 2-16
2.10.2 Erosion and Sediment Control 2-17
2.10.3 Site Restoration and Revegetation 2-17
2.10.4 Air Quality Protection 2-18
2.10.5 Prevention of Water Pollution 2-18
2.10.6 Hazardous Material Storage, Handling, and Disposal 2-18
2.10.7 Compliance with NHPA Section 106 2-19
2.10.8 Traffic Control 2-20
2.10.9 Public Involvement and Public Notice 2-23
2.11 Comparison of Alternatives and Effects 2-23
2.11.1 Alternative Comparison 2-23
2.11.2 Comparison of Effects 2-24

3.0 Affected Environment and Environmental Consequences 3-1
3.1 Introduction 3-1
3.2 Transportation/Traffic 3-1
3.2.1 Introduction 3-1
3.2.2 Issues Addressed in the Impact Analysis 3-2
3.2.3 Affected Environment 3-2
3.2.4 Impact Analysis 3-2
3.3 Utilities 3-3
3.3.1 Introduction 3-3
3.3.2 Issues Addressed in the Impact Analysis 3-3
3.3.3 Affected Environment 3-4
3.3.4 Impact Analysis 3-4
3.4 Public Health and Safety 3-5
3.4.1 Introduction 3-5
3.4.2 Issues Addressed in the Impact Analysis 3-5
3.4.3 Affected Environment 3-5
3.4.4 Impact Analysis 3-5
3.5 Noise 3-5
3.5.1 Introduction 3-5

3.5.2 Issues Addressed in the Impact Analysis 3-6
3.5.3 Affected Environment 3-6
3.5.4 Impact Analysis 3-6
3.6 Visual..... 3-6
3.6.1 Introduction 3-6
3.6.2 Issues Addressed in the Impact Analysis 3-6
3.6.3 Affected Environment 3-7
3.6.4 Impact Analysis 3-8
3.7 Socioeconomics 3-9
3.7.1 Introduction 3-9
3.7.2 Issues Addressed in the Impact Analysis 3-9
3.7.3 Affected Environment 3-9
3.7.4 Impact Analysis 3-10
3.8 Soils and Geological Hazards 3-11
3.8.1 Introduction 3-11
3.8.2 Issues Addressed in the Impact Analysis 3-11
3.8.3 Affected Environment 3-11
3.8.4 Impact Analysis 3-12
3.9 Surface Water Resources and Quality 3-13
3.9.1 Introduction 3-13
3.9.2 Issues Addressed in the Impact Analysis 3-13
3.9.3 Affected Environment 3-13
3.9.4 Impact Analysis 3-13
3.10 Biological Resources..... 3-14
3.10.1 Introduction 3-14
3.10.2 Issues Addressed in the Impact Analysis 3-14
3.10.3 Affected Environment 3-14
3.10.4 Impact Analysis 3-14
3.11 Threatened and Endangered Species..... 3-15
3.11.1 Introduction 3-15
3.11.2 Issues Addressed in the Impact Analysis 3-15
3.11.3 Affected Environment 3-15
3.11.4 Impact Analysis 3-16
3.12 Air Quality..... 3-17
3.12.1 Introduction 3-17
3.12.2 Issues Addressed in the Impact Analysis 3-17
3.12.3 Affected Environment 3-17
3.12.4 Impact Analysis 3-18
3.13 Historic, Cultural, Archaeological, and Paleontological Resources..... 3-19
3.13.1 Introduction 3-19
3.13.2 Issues Addressed in the Impact Analysis 3-20
3.13.3 Affected Environment 3-20
3.13.4 Impact Analysis 3-20
3.14 Environmental Justice..... 3-21
3.14.1 Introduction 3-21
3.14.2 Issues Addressed in the Impact Analysis 3-21
3.14.3 Affected Environment 3-21

3.14.4 Impact Analysis ... 3-22
3.15 Hazardous Waste ... 3-22
3.15.1 Introduction ... 3-22
3.15.2 Issues Addressed in the Impact Analysis ... 3-22
3.15.3 Affected Environment ... 3-22
3.15.4 Impact Analysis ... 3-23
3.16 Cumulative Impacts ... 3-26
3.16.1 Transportation and Utilities ... 3-26
3.16.2 Public Health and Safety ... 3-26
3.16.3 Soils ... 3-26
3.16.4 Historic, Cultural, Archaeological, and Paleontological Resources ... 3-27
3.16.5 Hazardous Waste ... 3-27
3.17 Mitigation ... 3-27
3.17.1 Transportation ... 3-27
3.17.2 Utilities ... 3-27
3.17.3 Socioeconomics ... 3-28
3.17.4 Soils ... 3-28
3.17.5 Surface Water Resources ... 3-28
3.17.6 Air Quality ... 3-28
3.17.7 Historic, Cultural, Archaeological, and Paleontological Resources ... 3-29
3.17.8 Hazardous Waste ... 3-29

4.0 Coordination and Consultation ... 4-1

5.0 References ... 5-1

6.0 List of Preparers ... 6-1

Tables

2-1 Proposed Traffic Control ... 2-21
2-2 Comparison of Alternatives ... 2-23
2-3 Effects among Alternatives ... 2-25
3-1 Installation Conditions ... 3-3
3-2 Threatened, Endangered, or Candidate Species with Historic Utah County Range ... 3-15
3-3 Moderate to High Potential Contaminated Site Impact within Each Alternative Alignment ... 3-23
3-4 Hazardous Waste Sites and Contaminated Properties with Potential Impacts to Proposed Pipe Alignments ... 3-24
4-1 Comments Received during Public Comment Period ... 4-1
4-2 Coordination Letters ... 4-2

Figures

2-1 Alternative Alignments 2-27
2-2 Concept Design of Stand Pipe Required for ULS/PRC Connection 2-29
2-3 Geological Hazards 2-31
2-4 Conceptual Site Plan of Northern Terminus Area 2-33
2-5 Typical Construction Cross Section—Seven Peaks Blvd/700 North/1200 East/ Locust Lane/Cherry Lane/900 East/2200 North/2320 North 2-35
2-6 Typical Construction Cross Section—Seven Peaks Blvd/ 700 North/1200 East/Birch Lane/900 East/1450 East/ North Temple Dr/2200 North/Canyon Rd 2-37
2-7 Typical Construction Cross Section—Seven Peaks Blvd/Birch Lane/900 East/Timpview Drive/4525 North 2-39
2-8 Typical Construction Cross Section—University Ave 2-41
3-1 Proposed Completed Appearance of the Alpine/Jordan Aqueduct Connection 3-7
3-2 Proposed Completed Appearance of the Flow Control Structure 3-8

Appendix

A Geologic Hazards Memorandums

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Acronyms and Abbreviations

$\mu g/m^3$	micrograms per cubic meter
ACHP	Advisory Council on Historic Preservation
amsl	above mean sea level
APE	Area of Potential Effects
AST	aboveground storage tank
BMP	best management practice
BRT	Bus Rapid Transit
BYU	Brigham Young University
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CESQG	conditionally exempt small-quantity generator
CFR	*Code of Federal Regulations*
CO	carbon monoxide
CRSPA	Colorado River Storage Project Act of 1956
CUP	Central Utah Project
CUPCA	Central Utah Project Completion Act of 1992
CUWCD	Central Utah Water Conservancy District
CWP	Central Utah Water Conservancy District Water Development Project
DERR	Utah Division of Environmental Response and Remediation
EA	environmental assessment
EDR	Environmental Data Resources Inc.
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ERNS	emergency response notification system
ESA	Endangered Species Act of 1973, as Amended
FONSI	Finding of No Significant Impact
ft^3/s	cubic feet per second
FWS	Fish and Wildlife Service
I	Interstate
Interior	U.S. Department of the Interior
LUST	leaking underground storage tank
MLTS	Material Licensing Tracking System
MSDS	material safety data sheet
MUTCD	*Manual on Uniform Traffic Control Devices*

NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act of 1969
NOI	Notice of Intent
NO_x	nitrogen oxides
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
O_3	ozone
OSHA	Occupational Safety and Health Administration
PM	particulate matter
PM_{10}	PM less than 10 micrometers in aerodynamic diameter
$PM_{2.5}$	PM less than 2.5 micrometers in aerodynamic diameter
PRC	Provo Reservoir Canal
PRCEP	Provo Reservoir Canal Enclosure Project
RCRA	Resources Conservation and Recovery Act of 1976
RLS	reconnaissance-level survey
ROD	Record of Decision
ROW	right-of–way
SFPRC	Spanish Fork–Provo Reservoir Canal
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
SOP	standard operating procedure
SPCC	Spill Prevention, Control, and Countermeasure
SQG	small-quantity generator
SVS	Strategic Value Solutions
T&E	threatened and endangered
THPO	Tribal Historic Preservation Office
U.S.	United States
UDAQ	Utah Division of Air Quality
UDOT	Utah Department of Transportation
ULS	Utah Lake Drainage Basin Water Delivery System
UPDES	Utah Pollutant Discharge Elimination System
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
UST	underground storage tank
UVWTP	Utah Valley Water Treatment Plant
VE	value engineering

1.0 General Overview

1.1 Introduction

The Central Utah Water Conservancy District (CUWCD), the United States (U.S.) Department of the Interior (Interior), and the Utah Reclamation Mitigation and Conservation Commission (Mitigation Commission), as Joint Lead Agencies, are proposing a Realignment of a Portion of the Utah Lake Drainage Basin Water Delivery System (ULS) pipeline through Provo and Orem, Utah (Realignment). The Realignment is being considered to avoid active and historical landslides and reduce the risk associated with geologic faults.

The Joint Lead Agencies initiated preparation of this environmental assessment (EA) with a Notice of Intent (NOI), which was published in the *Federal Register* on February 25, 2010. This EA will analyze and describe the environmental impacts of the Realignment alternatives.

This EA is being prepared pursuant to Section 102(2)(C) of the National Environmental Policy Act of 1969 (NEPA), as amended; Public Law 102-575, Central Utah Project Completion Act of 1992 (CUPCA), as amended; the Council on Environmental Quality's (CEQ's) implementing regulations under NEPA (40 *Code of Federal Regulations* [CFR] 1500 through 1508) and the revised Interior NEPA Implementing Procedures (43 CFR Part 46).

This EA tiers from and updates a portion of the Utah Lake System Water Delivery System Environmental Impact Statement (ULS EIS) published in 2004, pursuant to 40 CFR 1502.20 and 1508.28. The ULS EIS may be accessed electronically at http://www.cuwcd.com/cupca/projects/uls/environmentalimpact.htm. Copies are also available for inspection at: Central Utah Water Conservancy District, 355 West University Parkway, Orem, Utah 84058; Utah Reclamation Mitigation and Conservation Commission, 102 West 500 South, Suite 315, Salt Lake City, Utah 84101; Department of the Interior, Natural Resource Library, Serials Branch, 18th C Streets, NW., Washington DC 20240; and Department of the Interior, Central Utah Project Completion Act Office, 302 East 1860 South, Provo, Utah 84606.

1.2 Purpose and Need

The purposes and need for this portion of the ULS pipeline through Provo and Orem have not changed from those stated in the ULS EIS.

The proposed Realignment would avoid active and historical landslides, reduce the risk associated with geologic faults, and shorten the overall pipeline length.

1.3 History and Background

The Central Utah Project (CUP) was authorized for construction as a participating project under the Colorado River Storage Project Act of 1956 (CRSPA). The CUP, as originally authorized, consisted of the following six individual units: (1) the Vernal Unit, (2) the Jensen Unit, (3) the Upalco Unit, (4) the Uintah Unit, (5) the Ute Indian Unit, and (6) the Bonneville Unit.

The Bonneville Unit, the largest unit of the CUP, is located in central and northeastern Utah. The unit includes facilities to develop and more fully use waters tributary to the Duchesne River in the Uinta Basin of Utah, to facilitate a transbasin diversion from the Colorado River Basin to the Bonneville Basin, and to develop and distribute project water in the Bonneville Basin. The CUPCA (Titles II through VI of P.L. 102-575), as amended, authorized funding for the completion of the Bonneville Unit and established the Utah Reclamation Mitigation and Conservation Commission. The ULS was authorized in Section 202(a)(1) of the CUPCA, as amended, to provide water for municipal and industrial purposes, irrigation, fish and wildlife, and recreation. The ULS EIS was completed in September 2004. Portions of the ULS system have been constructed or are under construction. When complete, the ULS system will deliver Bonneville Unit water to Salt Lake and Utah Counties.

1.4 Location of the Project

The proposed action is located principally in Provo, Utah. As shown in Figure 2-1, each alternative alignment originates near 450 North and Seven Peaks Boulevard in Provo and continues northward to the mouth of Provo Canyon.

Construction of the Realignment would involve approximately 77.5 acres of land (45,000 feet in length by generally 75 feet in width right-of–way [ROW]) in the cities of Provo and Orem. Most, if not all, of the ROW has been previously disturbed.

1.5 Authorizing Actions, Permits, and Licenses

Fish and Wildlife Coordination Act. The Joint Lead Agencies coordinated with the Fish and Wildlife Service (FWS) on fish and wildlife resources and habitat that could be affected by the Proposed Action and other alternatives. Recommendations have been incorporated into the Proposed Action.

Endangered Species Act of 1973, as Amended (ESA). The Joint Lead Agencies obtained a list of threatened and endangered (T&E) species from the FWS that are located in the impact area of influence.

National Historic Preservation Act. Prior to construction, CUWCD would consult with the Advisory Council on Historic Preservation (ACHP) and the State Historic Preservation Office (SHPO) on cultural resources that could be affected by the EA alternatives.

Executive Order 11988, Floodplain Management. Protection of floodplains and their management have been incorporated into the formulation of alternatives and integrated into the resource impact analysis in Section 3.9.

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations. Federal agencies are required to adopt strategies addressing environmental justice concerns within the context of agency operations. Human health and environmental conditions in minority and low-income communities have been integrated into the resource impact analysis in Section 3.14 of the EA.

Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks. This executive order directs federal agencies to identify and assess environmental health risks and safety risks that may disproportionately affect children and ensure that policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks. This order has been taken into account during the formulation of activities.

Executive Order 13514—Federal Leadership in Environmental, Energy, and Economic Performance. Federal agencies are required to set a 2020 greenhouse gas emissions reduction target; increase energy efficiency; reduce fleet petroleum consumption; conserve water; reduce waste; support sustainable communities; and leverage federal purchasing power to promote environmentally responsible products and technologies. This order has been taken into account during the formulation of activities.

Construction Storm Water Permit. Because the area to be disturbed by construction equipment exceeds 1 acre, prior to construction an NOI for a Construction Storm Water permit will be obtained as part of the Utah General Storm Water Permit (Permit No. UTR100000, Part III D), and a construction stormwater plan will be developed and implemented to prevent runoff during construction from leaving the Subject Property and impacting other areas. Storm drains located in the vicinity of the Proposed Action will be protected from construction debris, as required by the General Storm Water Permit. A Notice of Termination will be submitted upon completion of construction.

Utah Pollutant Discharge Elimination System (UPDES). Discharge of water to streams, lakes, reservoirs, other water bodies would require a UPDES Permit, which would be obtained prior to construction.

Asbestos and Lead-based Paint Surveys. Prior to demolition activities, asbestos and lead-based paint surveys need to be performed. If asbestos or lead-based paint is discovered, the material will be removed in accordance with regulatory requirements prior to demolition. Demolition permits will be filed with Provo City. In addition, if any issues arise during the course of action concerning petroleum, oil, lubricants, storage tanks, asbestos, or lead-based paint or if there are spill prevention/response questions or concerns, Provo City Fire Department should be contacted at 911 or (801)852-6300.

Construction Permit. Prior to construction activities, construction permits would be obtained from the Occupational Safety and Health Administration (OSHA), Orem City Public Works, and Provo City Public Works.

Land Management Status and Right of Way Acquisition. Geologic hazard analyses and associated recommendations for construction are located in Appendix A.

1.5.1 Permanent Easements

Permanent easements would be obtained from public and private entities to construct and operate the pipelines, transmission line, and power facility features. Permanent easements would range from 20 to 200 feet wide. Many permanent easements would be obtained within existing road ROWs controlled by the Utah Department of Transportation (UDOT), cities, and Utah County. New permanent easements ranging from 10 to 120 feet wide would be purchased or obtained across private land and canal company land as necessary. The land surface would be restored to its preexisting condition following construction. Prior uses could continue, except for permanent structures or uses that would interfere with pipeline operation. Landowners would be compensated for loss of use or opportunity associated with permanent easements. Farmers would be compensated for temporary and permanent losses in crop and orchard production.

1.5.2 Temporary Easements

Temporary easements would be obtained from public and private entities to accommodate construction activities. New temporary easements ranging from 10 to 70 feet wide would be purchased or negotiated with public and private property owners as necessary. New temporary easements for construction staging areas would cover up to 15 acres each. Landowners would be compensated for loss of use or opportunity associated with temporary easements. Farmers would be compensated for temporary losses in crop production.

1.6 Participating Agencies

The Joint Lead Agencies are CUWCD, the Interior, and the Mitigation Commission. The Cooperating Agencies are the Bureau of Reclamation, Utah County, Provo City, and Orem City.

1.7 Decisions to be Made

Based on the identified impacts, the Joint Lead Agencies must determine whether the anticipated impacts are sufficient to necessitate the preparation of a supplement to the ULS EIS. If not, a Finding of No Significant Impact (FONSI) is warranted and will be issued. If a FONSI is not warranted, the Joint Lead Agencies must decide whether to prepare a supplemental EIS or abandon the Proposed Action.

This document will provide the Joint Lead Agencies with the necessary information to make project implementation and operation decisions that properly consider the environmental impacts of those decisions during the earliest stages of the ongoing design and construction process.

Design decisions applicable to this portion of the project and addressed in this document include the following:

- Should the Joint Lead Agencies select a different pipeline alignment from the alignment approved in the ULS EIS?

- Should the Joint Lead Agencies approve an increase from 54- and 48-inch-diameter pipe to a consistent 60-inch diameter for the pipeline through the entire length of the reach?
- Should the Joint Lead Agencies approve a consolidation of the valve station locations approved in the ULS EIS into a single location, with associated modification to the routing and connection to the Alpine/Jordan Aqueduct and discharge location to the Provo River?

1.8 Interrelated Projects

1.8.1 Provo Reservoir Canal Enclosure Project

A construction contract has been awarded to enclose the existing open Provo Reservoir Canal (PRC), located in northern Utah County. The canal is being enclosed for safety, redundancy to drinking water supplies, water savings, and improved water quality. The canal will be replaced with a 10.5-foot-diameter, welded-steel pipe capable of carrying 630 cubic feet per second (ft^3/s). Construction is in progress and is scheduled for completion in the spring of 2013. A connection from the ULS pipeline to the PRC Enclosure Project (PRCEP) pipeline will be constructed in the vicinity of 800 North and 1400 East. This connection would allow delivery of up to 120 ft^3/s of ULS water to the PRC.

1.8.2 Central Utah Water Conservancy District Water Development Project

The Central Utah Water Conservancy District Water Development Project (CWP) delivers groundwater and treated surface water from the Utah Valley Water Treatment Plant (UVWTP) to communities and agencies in northern Utah County and southern Salt Lake County. Portions the CWP have been constructed over the past 3 years, including water transmission pipelines. A segment of the 36-inch-diameter pipeline that connects the UVWTP to the Geneva Steel site has been constructed along 800 North from Geneva Road to 1000 East. The remaining segment from the UVWTP to 1000 East is yet to be constructed. The preliminary design indicates it will run west from the base of the hill south of the UVWTP to the eastern portion of the PRC ROW. Here, it will turn and run south within the PRC ROW and parallel to the PRCEP pipe to approximately 970 North. It will then turn west and cross under the PRCEP pipeline and run to 1000 East, where it will turn south and run within 1000 East to an existing vault on 1000 East at 800 North. The design for this pipeline segment is not yet complete, and ROW and encroachment documents have not yet been obtained. Construction is expected to be completed in the fall of 2012.

This is an interrelated project because of its location in relation to the Realignment alternatives.

1.8.3 Interstate 15 Reconstruction

Construction to add additional lanes and bridges to Interstate (I) 15 from Lehi to Spanish Fork has begun and is currently underway and expected to continue through the year 2012. UDOT has identified 800 North and University Avenue as one of the multiple alternative routes to avoid congestion created by I-15 reconstruction. Construction activities associated with the Realignment in the vicinity of the 800 North/University Avenue intersection makes I-15 reconstruction an interrelated project.

1.8.4 Provo City Pipeline

Provo City has planned a pipeline to be constructed in the vicinity of the Realignment along University Avenue.

1.8.5 Provo–Orem Bus Rapid Transit

The Federal Transit Administration, Utah Transit Authority, Federal Highway Administration, and UDOT in conjunction with Mountainland Association of Governments are planning a Bus Rapid Transit (BRT) project through Provo and Orem.

The proposed BRT system will be approximately 11 miles long with more than 70 percent of the system on center running bus-only lanes. The BRT system will extend from the planned Orem Intermodal Center near Utah Valley University on the north to a location near the Provo Towne Centre Mall and East Bay Business Complex (Novell Campus) on the south. The BRT would overlap with the Realignment along 900 East between 700 North and 1700 North in Provo. It is anticipated that construction would begin in fall 2010 and be completed by fall 2012.

2.0 Description of Alternatives

2.1 Introduction

This chapter describes and compares the alternatives considered for the Realignment project: the No Action Alternative and the three Action Alternatives (Alternatives 1, 2, and 3). The alignments and options are shown in Figure 2-1.

Chapter 2 includes a discussion of how the alternatives were developed, a description of each alternative and option, and a summary comparison of the effects of these alternatives. Chapter 2 is intended to present the alternatives in comparable form, define the issues, and provide a clear basis for selection among options by the decision maker and the public (40 CFR 1502.140).

2.2 Development of Alternatives

In 2004, the ULS EIS was completed and Records of Decision (RODs) were issued, which included an alignment for the 54- to 60-inch-diameter, 20-mile Spanish Fork–Provo Reservoir Canal (SFPRC) pipeline from near the mouth of Spanish Fork Canyon to the Alpine/Jordan Aqueduct in Orem, Utah.

Since the development of the ULS EIS Preferred Alternative alignment, more detailed investigations have found that the northern reach of this alignment (in Provo, Utah) may require extensive soil investigation and slope stabilization remediation to prevent triggering movement during construction. It was further determined that portions of the alignment have a relatively high risk of infrequent damage due to geotechnical hazards associated with segments through active or potentially active slide zones. CUWCD conducted a value engineering (VE) study in December 2009 on the SFPRC pipeline to review the ULS EIS alignment in light of this new information. The alternative alignments described in this EA are a result of the VE study (Strategic Value Solutions [SVS], 2010) and incorporate concepts reviewed and evaluated as part of the VE process.

A Notice of Intent (NOI) to prepare an EA was published in the Federal Register on February 25, 2010. A scoping document was prepared, and mailers were sent to approximately 2,600 residents, property owners, and businesses owning property within 250 feet of the ULS EIS and alternative alignments to provide them with scoping and public meeting information. A public meeting was held at the Provo City Library on March 23, 2010. Following the public meeting, comments were received from Provo City that warranted creation of an additional alternative (Alternative 3).

Provo City also provided comments during cooperating agency review that led to a modification of the Alternative 1 alignment. Therefore, the alignment evaluated in this document differs somewhat from what was presented in the scoping document and at the public meeting on March 23, 2010.

All comments received during the public comment period are summarized in Chapter 4.

During the VE process, it was also determined that in order to allow for future pipe cleaning, the pipeline should be a consistent diameter. The pipe would be cleaned by using a foam swab also known as a "pipeline pig." The increased diameter would also help maintain the hydraulic capacity of the system.

The VE process also determined that a modification was needed for connection to the PRCEP. This could be accomplished through a combined flow control structure to provide deliveries to the Provo River, the PRC, and the Alpine/Jordan Aqueduct.

2.3 No Action Alternative

The No Action Alternative is the ULS EIS Preferred Alternative. The No Action Alternative alignment is shown in Figure 2-1. This alternative starts at the intersection of 450 North and Seven Peaks Boulevard and would follow 1450 East, Foothill and Piute Drives, 4525 North, and University Avenue to 5600 North. At this point, the No Action Alternative would cross the Provo River and follow the Alpine Aqueduct Reach 2B alignment until reaching the PRC. The alignment would parallel the PRC inside the canal ROW and would follow the canal to the UVWTP where it would connect to the Alpine/Jordan Aqueduct. Water deliveries would be made to the Provo River, the PRC, and the Jordan Aqueduct. The overall length of this alignment is approximately 8.0 miles.

2.3.1 Flow-control Facilities

The flow-control facilities needed for the No Action Alternative would be identical to those presented in the ULS EIS with the exception of modification in the method of connection to the PRCEP at 800 North. This modification, together with the need for it, is described in more detail in Section 2.3.2.

Flow control facilities would include a flow control structure for providing deliveries to the Provo River, the PRC, and the Alpine/Jordan Aqueduct. Connection structures would be required at the PRC and the Alpine/Jordan Aqueduct.

2.3.2 Modifications to the No Action Alternative Due to the PRCE Project

The ULS EIS assumed the PRC would operate in the future as an enclosed, non-pressurized water conveyance system. The Provo River Water Users Association recently awarded a contract to enclose the canal in a pressurized pipeline. Construction is already in process and has an estimated completion date of spring 2013. Because of the change to a pressurized pipeline, the facilities conceptualized in the ULS EIS to connect to the PRC will not function properly without modifications.

Because of the pressurized enclosure of the PRC, the ULS system would be required to provide surge protection and prevent PRCEP over-pressurization. This would require a surge tank/stand pipe that would dampen surges occurring in the ULS system and also provide an overflow pipeline back to the Provo River to prevent over-pressurization of the PRC. A concept sketch of this surge tank/stand pipe is shown in Figure 2-2.

2.3.3 Geological Hazards

A variety of geologic hazards are present along the No Action alignment, including landslides, potentially active faults, steep slopes in unconsolidated deposits, potential debris flow/flood scour, and unfavorable soil conditions. Some of the alternatives to the ULS EIS Preferred Alternative alignment avoid the landslides, steep slopes, and most of the fault traces, but none of the alternatives completely avoid all risks related to geologic hazards. Some of the hazards are more easily dealt with than others by mitigation measures, construction practices, and expectations for long-term reliability of the pipeline. The various types of hazards and their general locations of occurrence are shown in Figure 2-3.

The area along Foothill Drive north of Rock Canyon is the most significant problem area for ground movements due to active landslides. Various geotechnical studies relative to the relocation of Questar's natural gas distribution pipeline along Foothill Drive and damage to existing residences have resulted in identification of an area of about 15 acres as an active landslide. The active landslide is located within a larger area of ancient landslides and lies immediately east of Foothill Drive. Although all of the currently active areas appear to lie above (east of) the street, an area down slope near the intersection of Foothill Drive with Timpview Drive has also experienced movements within the past few decades. The recent and currently active landslide movements are believed to be deep-seated and involve shear failure of the Manning Canyon Shale geologic formation that underlies this area (SVS, 2010). Placement of the pipeline through this area is considered to have increased risk to long-term operation of the pipeline, as compared with other alternative alignments.

The No Action alignment along Foothill Drive is parallel to, and is close to or crosses at a shallow angle, faults mapped by the U.S. Geological Survey (USGS) and Utah Geological Survey for a distance of approximately 10,000 feet. The far north end of the alignment along University Avenue near the mouth of Provo Canyon would be atop or in very close proximity to the trace of the Wasatch Fault. The Wasatch Fault and various splays converge in this area, through which the pipeline must pass on its way to the north terminus.

Golder Associates evaluated the No Action Alternative and Alternative 3 in the vicinity of 1450 East and found that, while technically feasible, pipeline construction on 1450 East presents the least favorable alternative for pipeline integrity due to potential geologic hazards (Golder, 2010). The memorandum containing Golder's evaluation is located in Appendix A.

A geologic hazards analysis was performed by RB&G Engineering (RB&G, 2010). This analysis evaluated all alignments and confirms the location of geologic hazards, problem soils, or shallow groundwater problems. The RB&G report is also contained in Appendix A.

2.3.4 Traffic Considerations

Traffic considerations have not significantly changed from the analysis provided in the ULS EIS. These traffic considerations were described and evaluated in Sections 1.4.7, 1.8.3, and 1.8.8.12 of the ULS EIS, which can be found at http://www.cuwcd.com/cupca/projects/uls/feis.htm.

1450 East

1450 East is a two-lane residential collector street with relatively wide shoulders and many homes that front the roadway. During construction, this street would be closed to the public. Local access would be provided to residents that live along the alignment. The total length of the street impacted during construction would be limited to allow detour routes to be established for residents that use 1450 East as a residential collector street. Residential access would not be limited unless construction was directly in front of the residence. Construction occurring in front of a residence would prohibit vehicle access for relatively short periods. The contractor would be required to provide access for emergency vehicles at all times. The contractor would provide notification and coordinate access with individual residents. A typical cross section of the working area and traffic impacts is shown in Figures 2-5 and 2-6.

Foothill Drive (South of Iroquois)

Foothill Drive south of Iroquois is considered a residential street with moderate traffic volumes. During construction, these streets would need to be closed to the public with the exception of local residents. Residential access would not be limited unless construction was directly in front of a residence. Construction occurring in front of a residence would prohibit vehicle access for relatively short periods. The contractor would be required to provide access for emergency vehicles at all times. The contractor would provide notification and coordinate access with individual residents. A typical cross section of the working area and traffic impacts is shown in Figures 2-5 and 2-6.

Piute Drive

Piute Drive is a very narrow residential street with low traffic volumes. During construction, these streets would need to be closed to the public and local traffic. The narrow width of the street would require residents to park away from their homes until construction has advanced down the street. The contractor would be required to provide access for emergency vehicles at all times. The contractor would provide notification and coordinate access with individual residents. A typical cross section of the working area and traffic impacts is shown in Figure 2-5.

Foothill Drive (North of Piute Drive)

Foothill Drive is considered a residential collector street with residential homes along the alignment. The majority of the street is a three-lane roadway that includes one lane in each direction, a center turn lane, and a bicycle path one each side. During construction, this street would be restricted to single-lane access with a traffic-directing flagger or an automated traffic signal at each end of construction. Under certain circumstances, the street would need to be closed to the public with the exception of local residents. Residential access would not be limited unless construction was directly in front of a residence. Construction occurring in front of a residence would prohibit vehicle access for relatively short periods. The contractor would be required to provide access for emergency vehicles at all times. The contractor would provide notification and coordinate access with individual residents. A typical cross section of the working area and traffic impacts is shown in Figures 2-5 and 2-6.

4525 North

4525 North is a residential collector street with residences, parks, schools, and churches along the alignment. The speed limit along this street is 25 to 30 miles per hour. 4525 North has two traffic lanes, a center turning lane, and a bike lane on each side of the street. During construction, 4525 North, between Timpview Drive and Canyon Road, would need to be closed to the public with the exception of local residents. Residential access would not be limited unless construction was directly in front of a residence. 4525 North between Canyon Road and University Avenue would be reduced to one lane with a flagger or automatic traffic signal. Construction occurring in front of a residence would prohibit vehicle access for relatively short periods. The contractor would be required to provide access for emergency vehicles at all times. The contractor would provide notification and coordinate access with individual residents. A typical cross section of the working area and traffic paths is shown in Figure 2-6.

2.3.5 Utility Congestion

Utility relocations and avoidance procedures were described and evaluated in Section 3.19 of the ULS EIS. Since the analysis remains unchanged, they are incorporated here by reference.

As part of this EA, additional utility investigations have been performed. The most significant utility impact to the No Action Alternative since the ULS EIS was issued is the installation of a Questar 24-inch-diameter high-pressure gas main along Foothill Drive. The 24-inch high-pressure gas main impacts the No Action Alternative along Foothill Drive from Piute Drive to 4525 North. The installation of this 24-inch gas main in Foothill Drive greatly restricts the width of the corridor available for the 60-inch-diameter ULS pipeline and will likely require additional utility relocations that may have not been identified as part of the ULS EIS.

Possible utility relocations that might be required for the No Action Alternative include portions of a 2-inch gas line along Foothill Drive, Iroquois Drive, and Piute Drive. Portions of a 12-inch water line along Piute Drive will likely need to be relocated as well as segments of an 8-inch water line along Foothill Drive and 4525 North. There is also a 15-inch irrigation water line that will likely need to be relocated in 4525 North during construction.

2.3.6 Schools and Residential Impacts

The No Action Alternative is primarily located in residential and residential collector streets from 1450 East to University Avenue. 1450 East and Foothill Drive are considered residential collector streets with homes that front the alignment. There are no schools located directly along the No Action Alternative alignment. However, construction would likely impact traffic associated with Timpview High School and Canyon View Elementary.

The No Action Alternative impacts residential homes that front the alignment primarily along 1450 East, Piute Drive, Iroquois Drive, and 4525 North.

2.4 Project Features Common to All Alternatives

Project features that are common to all alternatives include the following:

- Construction staging areas, which will be selected by the construction contractor; staging areas will be located within the area reviewed by this document
- Common pipeline alignment along University Avenue from 4800 North to 5600 North
- Water flow rate and quantity delivered to the PRC, the Alpine/Jordan Aqueduct, and the Provo River
- Delivery point for the PRC
- Traffic considerations described in the EIS would apply to all alternative alignments

The delivery point to the PRC would be in the same location for the No Action and Action Alternatives. Deliveries to the Alpine/Jordan Aqueduct and Provo River would be further upstream for the Action Alternatives as shown in Figure 2-1.

2.5 Project Features Common to Action Alternatives

Project features that are common to only the Action Alternatives include the following:

- Common pipeline alignment from the intersection of University Avenue and 4800 North to the Alpine/Jordan Aqueduct Connection
- Combined flow control structure at the mouth of Provo Canyon to control water deliveries to the PRC, the Alpine Aqueduct, and the Provo River
- Hydraulic structure for the Alpine/Jordan Aqueduct connection
- Pipeline in 800 North in Orem for delivering water to the PRC
- Provo River Delivery Point
- Pipeline alignment from flow control structure to Alpine/Jordan Aqueduct
- Increased diameter of pipeline to 60 inches
- Consolidation of valve station locations
- Alignment options

The following subsections describe the flow control structure, Alpine/Jordan Aqueduct connection structure, Provo River Delivery Point, increased pipe diameter, the pipeline segment from the flow control structure to Alpine/Jordan Aqueduct, and alignment options.

2.5.1 Flow Control Structure

For the Action Alternatives, a single-flow control structure would be constructed on the hill just north of 800 North in Orem. With the current construction of the PRCEP, the existing

canal will be enclosed with a pressurized pipeline, and it is essential that the pressure gradient of ULS system be hydraulically disconnected from the PRC to avoid operational conflicts associated with differential pressurization. Flows to the Alpine/Jordan Aqueduct connection structure would be controlled from the flow control structure. A conceptual site plan of the pipeline terminus area is shown in Figure 2-4.

2.5.2 Alpine/Jordan Aqueduct Connection Structure

Connection to the Alpine/Jordan Aqueduct would be made by constructing a concrete hydraulic structure at the outlet of the existing Alpine Tunnel. A weir within the structure would hydraulically separate the ULS system from the existing Alpine/Jordan Aqueduct system and provide a constant back-pressure head on the sleeve valves located at the flow control structure. Pig-launching capability would be incorporated into this structure. The approximate location of this structure is shown in Figure 2-4.

2.5.3 Provo River Delivery Point

For the Action Alternatives, the Provo River Delivery Point will be located approximately 2,600 feet upstream of the No Action Alternative. Water will be discharged at atmospheric pressure to the Provo River near the Provo Bench Diversion. Discharges to the Provo River will be measured at the above-described flow control structure located at the mouth of Provo Canyon.

2.5.4 Increased Pipe Diameter

In order to allow for pipe cleaning, the downstream reach of the pipeline is being increased from 54- and 48-inch-diameter pipe to a consistent 60-inch diameter. The pipe is cleaned by using a foam swab also known as a “pipeline pig.” The increased diameter also helps maintain the hydraulic capacity of the system.

2.5.5 Pipeline Segment from Flow Control Structure to Alpine/Jordan Aqueduct

From the flow control structure, the pipeline will proceed north across open terrain that is currently encumbered with high-voltage overhead power lines. The pipeline will cross property owned by Utah Power and Light, Orem City, and the Cascade golf course. Permanent and Temporary Easements will need to be obtained from the property owners.

2.5.6 Flow Control Structure to PRC Connection

A pipeline would be constructed between the flow control structure and the PRC to provide water deliveries. The connection to the PRC would be in the same location as the No Action Alternative.

2.5.7 Alignment Options

The following options are potential alignments that may be included in the final alignment selection. The location of each option is shown in Figure 2-1. These options have been evaluated for resource impacts along with each alternative.

Option A

Alternative Alignment Option A would begin at the intersection of 2200 North and 700 East and follow 700 East and 2270 North to Timpview Drive and then continue north along Timpview Drive to 2320 North, where it would proceed west and southwest along 2320 North and intercept 2200 North.

Utilities located in 2320 North are considered moderate and include typical utilities found in residential neighborhoods such as water, sewer, gas, telephone, and communication lines. A preliminary investigation of the utilities shows that the pipeline could be located along the north side of the street and avoid interferences with sewer, water, and gas service laterals.

Option A applies to Alternatives 1 and 3.

Option B

Alternative Alignment Option B would follow Seven Peaks Boulevard to approximately 1300 East, where the pipeline would cross private land to 820 North. From this point, it would follow 820 North, Locust Lane, and Apple Avenue to Cherry Lane. From this point, the alignment could continue along the Alternative 2 alignment or have the option to continue west down Apple Avenue to 1200 East and follow Birch Lane to 900 East and then along 900 East to the intersection of 900 East and University Parkway.

Utility congestion along the Option B alignment, which includes Locust Lane and Birch Lane, is moderate and includes typical utilities found in residential neighborhoods such as water, sewer, gas, telephone, and communication lines.

Option B applies to Alternative 2.

Option C

Alternative Alignment Option C would start at the intersection of Canyon Road and 2200 North and proceed north along Canyon Road to approximately 2045 North, where the alignment would turn west across the northern section of a soccer field to University Avenue. From University Avenue, the alignment would join the Alternatives 1 and 3 alignments.

For the Option C alignment, utilities located between Canyon Road and University Avenue include an 8-inch sewer line that the pipeline would parallel. Utility congestion in Canyon Road is moderate and includes underground sewer, storm drains, water lines, gas lines, and communication lines

Option C applies to Alternatives 1 and 3.

2.6 Alternative 1—University Avenue Alignment

Alternative 1 (Figure 2-1) would begin in Provo at the intersection of 450 North and Seven Peaks Boulevard and follow Seven Peaks Boulevard to 700 North and then proceed west on 700 North to 900 East. The alignment would proceed north on 900 East to 2200 North and then continue west along 2200 North to University Avenue. The alignment would then proceed north along University Avenue to approximately 700 North in Orem, where the

pipeline would cross the Provo River and connect to the flow control structure located just north of 800 North. From the flow control structure, the pipeline would continue north and terminate at the Alpine/Jordan Aqueduct. Alternative 1 also includes a pipeline along 800 North that would connect the flow control structure to the PRC on 800 North and a pipeline to the previously described Provo River delivery point. The overall length of this alignment is approximately 6.8 miles.

2.6.1 Geological Hazards

Alternative 1 avoids landslides that are known to exist along or in proximity to the north portion of the No Action Alternative. The area along Foothill Drive north of Rock Canyon is a problem area for ground movements due to active landslides. Various geotechnical studies relative to the relocation of Questar's natural gas distribution pipeline and damage to existing residences have resulted in identification of an active landslide. The active landslide is located within a larger area of ancient landslides and lies immediately east of Foothill Drive. Although all of the currently active areas appear to lie above (east of) the street, an area downslope, near the intersection of Foothill Drive and Timpview Drive, has also experienced movements within the past few decades. However, this area is not expected to affect Alternative 1 construction. The recent/currently active landslide movements are believed to be deep-seated and involve shear failure of the Manning Canyon Shale geologic formation that underlies this area (SVS, 2010).

Alternative 1 avoids placing the pipeline parallel to and atop or in proximity to traces of the Wasatch Fault and associated splays for most of its length. The far north end of the alignment along University Avenue near the mouth of Provo Canyon would be atop or in extreme proximity to the trace of the Wasatch Fault. (This section of the alignment is common among all alternatives.) The Wasatch Fault and various splays converge in this area, through which the pipeline must pass on its way to the north terminus.

The geologic conditions in the valley bottom along University Avenue, which are expected to characterize most of this alignment, may include liquefiable soils. These are soils that could lose strength when subject to construction vibrations or earthquake shaking. Geotechnical investigations would target identification of these conditions so that final design and construction planning would include appropriate mitigation measures.

2.6.2 Traffic Considerations

Seven Peaks Boulevard, 700 North, and 2200 North

Seven Peaks Boulevard, 700 North, and 2200 North are residential collector streets with residential homes, parks, and churches along the alignment. Seven Peaks Boulevard and 2200 North are three-lane roadways that include one lane in each direction and a center turn lane. 700 North is a two-lane residential street that includes a bike lane and shoulders on each side of the street. During construction, Seven Peaks Boulevard would be restricted to single-lane access with a traffic-directing flagger or an automated traffic signal at each end of construction. Under certain circumstances, Seven Peaks Boulevard would need to be closed to the public with the exception of local residents. 700 North and 2200 North would be closed to the public, and access would be provided to local residences only. Residential access would not be limited unless construction was directly in front of a residence.

Construction occurring in front of a residence would prohibit vehicle access for relatively short periods. The contractor would be required to provide access for emergency vehicles at all times. The contractor would provide notification and coordinate access with individual residents. A typical cross section of the working area and traffic impacts is shown in Figures 2-5 and 2-6.

900 East

900 East is a five-lane roadway that includes two lanes in each direction with a center turn lane and is considered a commercial city street. The roadway has a very narrow shoulder and sidewalk along certain reaches. Because of the traffic volumes in 900 East, it is proposed that two lanes be open during normal traffic hours (one lane in each direction) with the option to go to a single lane or night closure for special crossings such as major intersections or utility-congested areas. The contractor would be required to provide access for emergency vehicles at all times. Traffic control would be closely coordinated with the city during construction, and construction would be limited to summer months when traffic volumes are reduced. Because of the amount of traffic, narrow working room, and utility congestion, construction is expected to advance at a relatively slower pace. A typical cross section of the working area and traffic impacts is shown in Figure 2-7.

The BRT is proposed for 900 East from 700 North to University Parkway (1700 North). If Alternative 1 is selected for the location of the Realignment, the BRT construction schedule would need to be coordinated with the Realignment construction.

2320 North, 700 East, and 2270 North (Option A)

2320 North, 700 East, and 2270 North are residential streets with low traffic volumes. During construction, these streets would need to be closed to the public with the exception of local residents. Residential access would not be limited unless construction was directly in front of the residence. Construction occurring in front of a residence would prohibit vehicle access for relatively short periods. The contractor would be required to provide access for emergency vehicles at all times. The contractor would provide notification and coordinate access with individual residents. A typical cross section of the working area and traffic impacts is shown in Figures 2-5 and 2-6. This cross section would apply to residential portions of Option A.

University Avenue

University Avenue has four traffic lanes, a center turning lane, and relatively wide shoulders. There is also a 20- to 30-foot-wide pedestrian and bike path parkway on the west side of the street along the northern extent. Traffic speeds along University Avenue are approximately 50 miles per hour and would need to be reduced in construction zones. During construction, it would be possible to maintain the current traffic lanes and provide two lanes of traffic each way with an option to include a left-turn lane at major intersections. A typical cross section of the working area and traffic impacts is shown in Figure 2-8. This cross section would apply to Alternative 1 along University Avenue.

2.6.3 Utility Congestion

Utility congestion along 700 North is moderate and includes typical utilities found in residential neighborhoods such as water, sewer, gas, telephone, and communication lines. A preliminary investigation of the utilities in 700 North has not identified any utilities that would need to be relocated. The sewers along 700 North are not continuous along the length of this street, and the depth of the trench for the pipeline could be potentially reduced in many locations.

Utility congestion along 900 East and 2200 North is considered moderate to heavy in locations and includes typical utilities such as water, sewer, gas, telephone, and communication lines. A preliminary investigation of the utilities in these streets identified small gas and water lines that might need to be relocated during construction. An electrical transmission line would potentially need to be relocated along 900 East. Additionally, major storm drain crossings would be required along 900 East at 820 North and 900 North.

University Avenue has minimal utility congestion and includes underground sewer, storm drains, water lines, gas lines, and communication lines. Overhead utilities along the alignment include intermittent distribution power lines, high-voltage power lines, and communication lines. Most of the existing utilities along this alignment are located outside the roadway or in the shoulder of the existing road. The existing sewer lines along this alignment are not continuous along the entire alignment and primarily service intermittent subdivisions and isolated structures along the roadway. These sewers are not considered a major utility congestion, and the majority of the pipeline could be installed with a minimum 5-foot depth of cover over the top of pipe. Based on the existing utility information available at this time, it would appear that a 60-inch pipeline could be installed in the shoulder of the roadway or just behind the curb and gutter along the majority of the street.

2.6.4 Schools and Residential Impacts

Alternative 1 passes Wasatch Elementary School along 900 East and is located in the vicinity of Brigham Young University (BYU). Access to Wasatch Elementary is on Birch Lane, which is located east of 900 East. Option A passes Rock Canyon Elementary School and Centennial Middle School. The timing of construction near Wasatch Elementary and BYU would be coordinated with the schools and city for events that might be occurring at the schools.

Alternative 1 impacts residential homes that front the alignment primarily along 700 North and 2200 North. The majority of the alignment is located in major collector and arterial streets (900 East and University Avenue).

2.7 Alternative 2—Timpview Drive Alignment

Alternative 2 would initially follow the same route as Alternative 1 to 700 North but would continue north on 1200 East and Cherry Lane. It would follow 900 East to Timpview Drive and before rejoining the No Action Alternative alignment at 4525 North. Alternative 2 also includes a pipeline along 800 North in Orem that would connect the flow control structure to the PRC on 800 North and a pipeline to the previously described Provo River delivery point. The overall length of this alignment is approximately 6.7 miles. This alignment is shown in Figure 2-1.

2.7.1 Geological Hazards

Alternative 2 avoids landslides that are known to exist along or in proximity to the north portion of the No Action Alternative. The area along Foothill Drive north of Rock Canyon is a problem area for ground movements due to active landslides. Various geotechnical studies relative to the relocation of Questar's natural gas distribution pipeline and damage to existing residences have resulted in identification of an active landslide. The active landslide is located within a larger area of ancient landslides and lies immediately east of Foothill Drive. Although all of the currently active areas appear to lie above (east of) the street, an area downslope, near the intersection of Foothill Drive and Timpview Drive, has also experienced movements within the past few decades. However, this area is not expected to affect construction on Timpview Drive. The recent/currently active landslide movements are believed to be deep-seated and involve shear failure of the Manning Canyon Shale geologic formation that underlies this area (SVS, 2010).

Alternative 2 avoids placing the pipeline parallel to and atop or in proximity to traces of the Wasatch Fault and associated splays for most of its length. The far north end of the alignment along University Avenue near the mouth of Provo Canyon would be atop or in extreme proximity to the trace of the Wasatch Fault. (This section of the alignment is common among all alternatives.) The Wasatch Fault and various splays converge in this area, through which the pipeline must pass on its way to the north terminus.

The geologic conditions in the valley bottom along University Avenue, which are expected to characterize most of this alignment, may include liquefiable soils. These are soils that could lose strength when subject to construction vibrations or earthquake shaking. Geotechnical investigations would target identification of these conditions so that final design and construction planning would include appropriate mitigation measures.

2.7.2 Traffic Considerations

1200 East, Locust Lane, Apple Avenue, Cherry Lane, and 2320 North

1200 East, Locust Lane, Apple Avenue, Cherry Lane, and 2320 North are residential streets with low traffic volumes. During construction, these streets would need to be closed to the public with the exception of local residents. Residential access would not be limited unless construction was directly in front of a residence. Construction occurring in front of a residence would prohibit vehicle access for relatively short periods. The contractor would be required to provide access for emergency vehicles at all times. The contractor would provide notification and coordinate access with individual residents. A typical cross section of the working area and traffic impacts is shown in Figure 2-5.

Birch Lane, Timpview Drive, and 4525 North

Birch Lane, Timpview Drive, and 4525 North are residential collector streets with residences, parks, schools, and churches along the alignment. Speed limits along these streets are 25 to 30 miles per hour. Timpview Drive has two traffic lanes, a bike lane, and parking space on each side of the street. 4525 North has two traffic lanes, a center turning lane, and a bike lane on each side of the street. During construction, Birch Lane, Timpview Drive, and 4525 North, between Timpview Drive and Canyon Road, would need to be closed to the public with the exception of local residents. Residential access would not be

limited unless construction was directly in front of a residence. 4525 North between Canyon Road and University Avenue would be reduced to one lane with a flagger or automatic traffic signal. Construction occurring in front of a residence would prohibit vehicle access for relatively short periods. The contractor would be required to provide access for emergency vehicles at all times. The contractor would provide notification and coordinate access with individual residents. A typical cross section of the working area and traffic paths is shown in Figure 2-6.

University Avenue

University Avenue has four traffic lanes, a center turning lane, and relatively wide shoulders. There is also a 20- to 30-foot-wide pedestrian and bike path parkway on the west side of the street along the northern extent. Traffic speeds along University Avenue are approximately 50 miles per hour and would be reduced in construction zones. During construction, it would be possible to maintain the current traffic lanes and provide two lanes of traffic in each direction with an option to include a left-turn lane at major intersections. A typical cross section of the working area and traffic impacts is shown in Figure 2-8.

2.7.3 Utility Congestion

Utility congestion along 1200 East and Cherry Lane is moderate and includes typical utilities found in residential neighborhoods such as water, sewer, gas, telephone, and communication lines. A preliminary investigation of the utilities in these two streets identified a short section of 2-inch gas line that would likely need to be relocated as well as short reaches of 4- and 6-inch water lines.

Timpview Drive and 4525 North are located in residential neighborhoods with moderate to significant utility congestion. The utility congestion along these streets includes underground sewer, storm drain, water lines, gas lines, and communication lines. Overhead utilities along the alignment include power and communication lines. Because of the 8- to 10-inch sewer lines that parallel this alignment, it is expected that the pipeline would have to be buried at a depth below the top of the sewers. Water lines along Timpview Drive primarily include 12- and 16-inch water mains with 6- and 8-inch water lines branching off the water mains at residential street crossings. Gas utilities include 2- and 4-inch service lines. During construction, it is expected that sections of the 2-inch gas line and sections of the storm drain will need to be relocated in Timpview Drive, and portions of the 15-inch irrigation water line may need to be relocated in 4525 North.

University Avenue has minimal utility congestion and includes underground sewer, storm drain, water lines, gas lines, and communication lines. Overhead utilities along the alignment include power lines and communication lines. Along approximately 85 percent of this alignment, there are 10- and 6-inch parallel sewers on both sides of the street that would likely allow the 60-inch pipeline to be installed with a minimum of 5 feet of cover over the top of pipe.

2.7.4 Schools and Residential

The alignment along Timpview Drive would pass Rock Canyon Elementary School, Timpview High School, and Edgemont Elementary School. The timing of construction

would be coordinated with the schools and city for events that might be occurring at the schools.

Alternative 2 impacts residential homes that front the alignment primarily along 1200 East, Apple Avenue, Cherry Lane, Timpview Drive, and sections of 4525 North. Option B is primarily located in residential streets.

2.8 Alternative 3—1450 East Alignment

Alternative 3 would follow Seven Peaks Boulevard and traverse across open land in a future roadway corridor to 1450 East. From this point, it would follow 1450 East to Rock Canyon and then head west along North Temple Drive to the intersection of North Temple Drive and 900 East. At this point, it would then follow the Alternative 1 alignment. Alternative 3 also includes a pipeline along 800 North that would connect the flow control structure to the PRC on 800 North. The overall length of this alignment is approximately 7.6 miles. This alignment is shown in Figure 2-1.

Alignment Options A and C are potential alignments that may be included in the final alignment selection for Alternative 3. Each option is shown in Figure 2-1.

2.8.1 Geological Hazards

Alternative 3 crosses a mapped landslide as shown by USGS mapping (Baker, 1964). The alignment crosses an estimated 1,200-foot length of this landslide feature. Damage to several homes has occurred within this area, as well as settlement to the pavement and curb along the west side of the street. Although it has been suggested that this damage may not be due to geologic hazards, the location of the damages within a mapped landslide feature suggests that this feature should be assumed to be an active landslide feature for the purpose of evaluating this alternative.

Alternative 3 crosses private, undeveloped land between Seven Peaks Boulevard and 1450 East that is planned as a future roadway. Placement of the pipeline would require coordinating the location of the pipeline relative to the future roadway and cutting and laying back the slope along its east side. This slope is relatively steep and consists of alluvial fan and debris flow deposits. The introduction of a future roadway in this section introduces and increases the potential for stability problems along the existing sloped hillside. Specific geotechnical investigation and design measures may be required to ensure a stable final slope configuration in this area.

The main trace of the Wasatch Fault appears to cross the 1450 East alignment four or five times. The faults in this area have not been located with great detail or accuracy. Trenching studies would likely be needed to identify fault locations (Golder, 2010).

Golder Associates evaluated the No Action Alternative and Alternative 3 in the vicinity of 1450 East and found that while technically feasible, pipeline construction on 1450 East presents the least favorable alternative for pipeline integrity due to potential geologic hazards (Golder, 2010). RB&G Engineering performed a geologic hazards analysis in May 2010. The hazard analysis supports the Golder findings. The memorandum containing Golder's evaluation and the RB&G analysis are located in Appendix A.

If a surface-rupture fault movement event were to occur within the life of the pipeline, it would be expected to rupture the pipe where it crosses a plane of rupture. Where the pipeline runs parallel to an active fault, either atop, crossing at shallow angles, or in proximity, damage could occur at any or all locations along the entire length. In the event of a major earthquake, ground rupture could also occur at locations not on currently known faults. It is considered good practice to minimize exposure to known fault locations.

2.8.2 Traffic Considerations

Traffic considerations for Seven Peaks Boulevard, 1450 East, 2200 North, 2320 North, and University Avenue are discussed under the No Action Alternative and Alternative 1. These descriptions would also apply to the Alternative 3 alignment. North Temple Drive is the only remaining street in this alignment that has not been discussed.

North Temple Drive

North Temple Drive would be considered a residential collector street lined with residences and parks. The eastern section of North Temple Drive is a two-lane roadway with traffic in each direction. From 1200 East to 900 East, North Temple Drive is a three-lane roadway with one lane in each direction, a center turn lane, and relatively wide shoulders on each side of the street. During construction, traffic between 1450 East and 1200 East would be closed to the public with the exception of local residents. Between 1200 East and 900 East, two lanes of traffic would be maintained. Residential access would not be limited unless construction was directly in front of a residence. Construction occurring in front of a residence would prohibit vehicle access for relatively short periods. The contractor would be required to provide access for emergency vehicles at all times. The contractor would provide notification and coordinate access with individual residents. A typical cross section of the working area and traffic paths is shown in Figures 2-5 and 2-7.

2.8.3 Utility Congestion

Utility relocations and avoidance procedures for Alternative 3 along Seven Peaks Boulevard and 1450 East are described in Section 1.4.4.6 of the ULS EIS.

Utility congestion along 1450 East and North Temple Drive includes typical utilities found in residential neighborhoods such as water, sewer, gas, telephone, and communication lines. There are portions along 1450 East that contain parallel 8- and 16-inch water lines that restrict the width of the corridor available for the 60-inch-diameter ULS pipeline. Utility congestion in North Temple Drive is moderate, and relocation of some minor utilities during construction could be expected.

Utility congestion along 2200 North, 2320 North, Canyon Road, and University Avenue was discussed under Alternative 1 and would be the same in these reaches for Alternative 3.

2.8.4 Schools and Residential Impacts

The Option A alignment passes Rock Canyon Elementary School and Centennial Middle School. Should Option A be selected, the timing of construction in this reach would be coordinated with the schools and with other events that might be occurring at the schools. Residential homes are located along 1450 East, North Temple, and 2200 North.

2.9 Construction Schedule

It is anticipated that construction of the realigned pipeline would occur over 2 ½ years. The tentative timeframe for construction is spring 2011 through fall 2013.

2.10 Best Management Practices

Adherence to standard and project-specific best management practices (BMPs) for the following activities would reduce short-term impacts during the construction of the selected alignment and other related construction activities:

- Landscape preservation and impact avoidance
- Erosion and sediment control
- Biological and cultural resource site clearances
- Site restoration and revegetation
- Air quality protection
- Prevention of water pollution
- Hazardous material storage, handling, and disposal
- Cultural clearance
- Traffic control
- Public involvement and public notification

Each of these procedures would be incorporated into all construction specifications and contract documents, as appropriate, and all contractors would be required to follow them.

2.10.1 Landscape Preservation and Impact Avoidance

Construction specifications would require contractors to preserve the natural landscape and prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the work vicinity. All trees, native shrubbery, and other vegetation would be preserved and protected from construction operations and equipment except where clearing operations are required for permanent structures, approved construction roads, or excavation operations. All maintenance yards, field offices, and staging areas would be arranged to preserve trees and vegetation to the maximum practicable extent.

Clearing operations would be limited to those needed for construction and borrow material sites. In critical habitat areas, such as riparian communities, clearing would be restricted to only a few feet beyond areas required for construction. Areas around structures would be backfilled and compacted and all disturbed areas reclaimed to the native vegetation type.

To reduce environmental damage, critical environmental areas (stream corridors, riparian areas, and steep slopes) would not be used for equipment or material storage or stockpiling; construction staging or maintenance; field offices; hazardous material or fuel storage, handling, or transfer; or temporary access roads. Damage to critical area vegetation would be strictly limited to only areas required for construction activities and for which no practical alternative exists. Construction buffers would be identified during the design phase around sensitive resources to prevent damage to the resource. Buffer locations would

be included in the final design package. Orange or other high-visibility fencing would be used to clearly define the limits of the buffers around critical areas.

Existing access roads would be used for all construction activities where possible. If new roads must be constructed, the width would be kept to the absolute minimum needed. Access roads would be situated to limit disturbance to vegetation and to avoid all trees where possible, but especially trees greater than 10 inches in diameter. Riparian areas would be avoided where possible.

2.10.2 Erosion and Sediment Control

Several procedures would be used as necessary to prevent and minimize erosion and siltation during construction and during the period needed to reestablish permanent vegetative cover on disturbed sites. These include planting native grasses, forbs, trees, or shrubs beneficial to wildlife or placement of riprap, sand bags, jute, sod, erosion mats, bale dikes, mulch, or excelsior blankets.

Clearing schedules would be arranged to minimize the practical exposure of soils. Final erosion control and site restoration measures would be initiated as soon as an area is no longer needed for construction, stockpiling, or access.

Cuts and fills on relocated and new roads would be appropriately sloped to prevent landslides and to facilitate revegetation. The identified areas would be stabilized or protected to prevent mass soil movement into reservoir pools or streams to the extent practicable. No constructed slopes would exceed existing slopes.

Borrow areas would be contoured to prevent water from collecting, unless the borrow excavation is below groundwater level. Before borrow areas are abandoned, their sides would be brought to stable slopes with intersections shaped to carry the natural contour of adjacent undisturbed terrain into the borrow area.

No soil, rock stockpile, or excess soil materials would be placed near sensitive resource habitats, including water channels, wetlands, and riparian areas, where they may erode into these habitats, or where runoff from spoils could run into sensitive habitats. Waste piles would be revegetated after they are shaped to provide a natural appearance.

2.10.3 Site Restoration and Revegetation

Erosion control measures would be initiated as soon as an area is no longer needed for construction, stockpiling, or access. Upon completion of construction, any land disturbed, but not permanently occupied by new facilities, would be graded to provide proper drainage and blend with the natural contours of the land and restored to its preconstruction condition. Where such lands were vegetated, they would be covered with topsoil stripped from construction areas and revegetated, as appropriate, with plants native to the area and beneficial to wildlife. Post-construction monitoring would allow spot-treatment for noxious/invasive weeds to ensure successful revegetation.

Upon project completion, all staging areas, construction materials, and debris would be removed from the site. Road surfaces, including all new access roads, would be scarified, as needed, to establish conditions suitable for proper drainage and erosion prevention.

At all times, construction areas, including storage yards, would be kept free from accumulations of waste materials and trash. During the final phase of work, contractors would be required to remove all unused materials and trash, dump it in an approved sanitary landfill, and leave work areas neat to conform to the natural landscape.

2.10.4 Air Quality Protection

Contractors would be required to establish measures to protect air quality during construction. Proper controls will be implemented to minimize air quality impairments during construction. Dust would be suppressed using appropriate technology during construction activities. All dirt-surfaced roads would be regularly watered during dry periods during active construction periods to prevent fugitive dust emissions from the roads. All loads leaving the site that consist of material that could leave the bed of the truck during movement would be covered.

2.10.5 Prevention of Water Pollution

Contractors would be required to comply with all federal and state laws and regulations regarding control and abatement of water pollution. All waste materials and sewage from construction activities or project-constructed features would be disposed of as specified by federal and state health and pollution control regulations.

Contractors would be required to monitor water quality of discharges and receiving water (both background and below discharges) during any construction activities that could impact surface water quality.

Construction specifications would require construction activities to be performed using methods that would prevent entrance or accidental spillage of solid matter, contaminants, debris, and other objectionable pollutants and wastes into flowing or dry watercourses and underground water sources. Potential pollutants and wastes include refuse, garbage, cement, concrete, sewage effluent, industrial waste, oil, and other petroleum products, aggregate processing tailings, mineral salts, and thermal pollution.

Excavated materials would not be stockpiled or deposited near or on streambanks, wetlands, or other watercourse perimeters where they could be washed away by high water or storm runoff or encroach upon the sensitive area.

Construction specifications would require riprap materials to be free of contaminants and not contribute measurably to the turbidity of the river.

2.10.6 Hazardous Material Storage, Handling, and Disposal

Contractors would be required to comply with Utah Hazardous Waste Management Regulations established under the authority of the federal Resources Conservation and Recovery Act of 1976 (RCRA) and the Utah Hazardous Waste Act of 1979.

The potential for adverse impacts from oil and fuel spills would be reduced through careful handling and designation of specific equipment repair and fuel storage areas. Oil, petroleum waste products, chemicals, and hazardous or potentially hazardous wastes would not be drained onto the soil but confined in sealed containers or sealed sumps for

removal to approved disposal sites. They would be transported in accordance with all applicable state and federal safety standards.

The contractor would be required to prepare a Spill Prevention, Control, and Countermeasure (SPCC) Plan if the project is storing, transferring, using, or consuming oil and oil products and has an aggregate aboveground storage capacity of greater than (1) 1,320 gallons; (2) a completely buried storage capacity of 42,000 gallons or less (except if the completely buried storage tanks are in compliance with either federal regulations contained in 40 CFR 280 or a state-approved program under 40 CFR 281); or (3) completely buried storage capacity of greater than 42,000 gallons if there is a reasonable expectation of a discharge of an oil or petroleum product into or upon navigable waters of the U.S. or adjoining shorelines. Only aboveground containers with a capacity of 55 gallons or greater are counted in determining if the aggregate storage quantity of 1,320 gallons is exceeded. The proposed project does not involve the use of any underground storage tanks.

Waste materials known or found to be hazardous would be disposed of in approved treatment or disposal facilities in accordance with federal, state, and local regulations, standards, codes, and laws.

All hazardous materials used would be required to have a material safety data sheet (MSDS) filed onsite. A hazardous material safety and communication plan would be required from each contractor with special emphasis on preventing hazardous materials from entering wetlands and watercourses or contaminating the soil or groundwater. Concrete trucks would not be washed at construction sites. All spilled concrete would be removed from construction areas and disposed of properly.

2.10.7 Compliance with NHPA Section 106

Utah SHPO consultations are complete. A cultural resources report has been submitted to the SHPO and a concurrence letter was received. Dates of these consultations and correspondence are located in Chapter 4.

In accordance with 36 CFR 800.13(a) and (b)(1), the Joint Lead Agencies are providing for the protection, evaluation, and treatment of any historic property discovered prior to or during construction. Should any archaeological or historic site or object be discovered within the Realignment project area, which has not been documented and evaluated as part of the current project implementation or subsequent professional cultural resources evaluations, the Joint Lead Agencies will immediately be verbally notified of the nature and exact locations of the findings. If the discovery resulted from construction or other ground-disturbing activities, these activities will immediately cease until the Joint Lead Agencies, in consultation with the SHPO, have made an evaluation of the significance of said site or object and have determined a course of treatment. The contractor, engineer, or other person responsible for the discovery will not damage the discovered objects and will provide written confirmation of the discovery to the Joint Lead Agencies within 2 calendar days.

The Joint Lead Agencies will inform the contractor or engineer when the restriction is terminated, with written confirmation following within 2 calendar days.

Should a discovery occur, the Joint Lead Agencies will consult with the SHPO in accordance with 36 CFR 800.14(b)(3) toward developing and implementing an appropriate treatment plan prior to allowing further ground disturbance.

2.10.8 Traffic Control

To minimize impacts during construction, the contractor would be required to follow the specifications in the *Manual on Uniform Traffic Control Devices* (MUTCD), provide advance notice for road closures and delay, and maintain access to residences and businesses. The impacts to traffic would be temporary in nature and not have any long-term delays. Access to property would be maintained during construction to the extent possible. Table 2-1 contains a summary of the proposed traffic control for streets in each alternative and option.

TABLE 2-1
Proposed Traffic Control

Street Name	Alternative or Option	Type Roadway	Proposed Traffic Control Approach			Simple Detours Available
			Peak Traffic	Off Peak Traffic	Night Traffic	
Seven Peaks Boulevard	NAA,1, 2, 3	Three-lane, One Each Way with Center Turn Lane, Wide Shoulders	One Lane with Flagger	One Lane with Flagger	No Night Construction	Yes
700 North	1	Two-lane, One Each Way with Bike Path Each Way, Wide Shoulders	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Yes
900 East	1	Five-lane, Two Each Way with Center Turn Lane, Very Narrow Shoulders	Two Lanes, One Each Way with Option to Have Left Turn at Major Intersections	Two Lanes, One Each Way with Option to Have One Lane with Flagger under Special Circumstances	No Night Construction Except for Special Crossings	No
2200 North (East of 2320 North)	1, 3	Three-lane, One Each Way with Center Turn Lane, Wide Shoulders	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Yes
2200 North (West of 2320 North)	1, 3	Three-lane, One Each Way with Center Turn Lane, Wide Shoulders	One Lane with Flagger	One Lane with Flagger	No Night Construction	Yes
University Ave	NAA, 1, 2, 3	Five-lane, Two Each Way with Center Turn Lane, Very Wide Shoulders	Four Lanes, Two Each Way with Left Turn Lane at Major Intersections	Four Lanes, Two Each Way with Left Turn Lane at Major Intersections	No Night Construction	No
1200 East	2	Residential Street	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Yes
Apple Avenue	2	Residential Street	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Yes
Cherry Lane	2	Residential Street	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Yes
Timpview Drive	2	Two-lane, One Each Way, Bike Path Each Way, Wide Shoulders	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Yes
4525 North (Timpview to Canyon)	NAA, 2	Three-lane, One Each Way with Center Turn Lane, Wide Shoulders and Bike Path	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Yes
4525 North (Canyon to University)	NAA, 2	Three-lane, One Each Way with Center Turn Lane, Wide Shoulders and Bike Path	Two Lanes, One Each Way	Two Lanes, One Each Way	No Night Construction	Yes
1450 East	NAA, 3	Two-lane Residential Collector Street	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Limited
North Temple Drive (1450 East to 1200 East)	3	Two- and Three-lanes, with One Lane Each Way and Center Turn Lane	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Limited
North Temple Drive (1200 East to 900 East)	3	Two- and Three-lanes, with One Lane Each Way and Center Turn Lane	Two Lanes, One Each Way	Two Lanes, One Each Way	No Night Construction	Yes
Foothill Drive (South of Iroquois)	NAA	Residential Street	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Limited
Piute Drive	NAA	Residential Street	Street Closed with Limited Residential Access	Street Closed with Limited Residential Access	No Night Construction	No
Foothill Drive (North of Piute)	NAA	Three-lane, One Each Way with Center Turn Lane, Wide Shoulders and Bike Path	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Limited
700 East	A	Residential Street	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Yes
2270 North	A	Residential Street	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Yes
2320 North	A	Residential Street	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Yes
Locust Lane	B	Residential Street	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Yes
Birch Lane	B	Two-lane Residential Collector Street	Street Closed with Only Residential Access	Street Closed with Only Residential Access	No Night Construction	Yes
Canyon Road	C	Three-lane, One Each Way with Center Turn Lane, Wide Shoulders	Two Lanes, One Each Way	Two Lanes, One Each Way	No Night Construction	Yes

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2.10.9 Public Involvement and Public Notice

The Joint Lead Agencies will comply with all public notice requirements to ensure that the public has an opportunity to participate in the NEPA process. Public notice requirements consist of public meetings and publishing notices in local newspapers and the Federal Register. The public involvement and participation program involves employees, onsite contractors, and individual citizens residing in the project area and occurs throughout the preparation of this document. Construction-related public involvement will be addressed in the construction contract. Chapter 4 of this document contains additional detail associated with the public involvement activities associated with the preparation of this document.

2.11 Comparison of Alternatives and Effects

2.11.1 Alternative Comparison

A comparison of segments and options contained in the No Action and Action Alternatives is shown in Table 2-2.

TABLE 2-2
Comparison of Alternatives

	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Segments				
1450 East	Yes	No	No	Yes
1200 East	No	No	Yes	No
Cherry Lane	No	No	Yes	No
900 East	No	Yes	Yes	No
Foothill Boulevard	Yes	No	No	No
Timpview Drive	No	No	Yes	No
2200 North	No	Yes	No	Yes
University Ave (south of 4800 North)	No	Yes	No	Yes
University Ave (north of 4800 North to 5600 North)	Yes	Yes	Yes	Yes
PRCEP Alignment	Yes	No	No	No
Alpine/Jordan Segment from Flow Control Structure	No	Yes	Yes	Yes
Alignment Options				
Option A (2320 North)	No	Yes	No	Yes
Option B (Birch Lane and Locust Lane)	No	No	Yes	No
Option C (Canyon Road to University Avenue)	No	Yes	No	Yes

2.11.2 Comparison of Effects

Table 2-3 presents a summary of the environmental impacts of each alternative based on the detailed analysis provided in Chapter 3 of this EA. The summary is a condensed set of findings. A description of impacts to relevant resource categories is provided in Chapter 3.

The severity of impacts is defined as none, minimal, and significant. Effects from construction of the pipeline are indicated by "Construction." Effects from use of the pipeline are indicated by "Operation." Effects are described in detail, together with mitigation measures, in Chapter 3. All impacts listed in Table 2-3 are residual after implementation of BMPs (Section 2.10) and mitigation measures described in Chapter 3.

TABLE 2-3
Effects among Alternatives

Resource Area	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Transportation/Traffic	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect
Utilities	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect
Public Health and Safety	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect
Noise	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect
Visual	Construction: **Minimal Effect** Operation: **Minimal Effect**	Construction: **Minimal Effect** Operation: **Minimal Effect**	Construction: **Minimal Effect** Operation: **Minimal Effect**	Construction: **Minimal Effect** Operation: **Minimal Effect**
Socioeconomics				
School and Residential	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect
Employment	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect
Soils and Geologic Hazards	Construction: **Significant Effect** Operation: No Effect	Construction: No Effect Operation: No Effect	Construction: No Effect Operation: No Effect	Construction: **Significant Effect** Operation: No Effect
Surface Water	Construction: No Effect Operation: **Beneficial Effect**	Construction: No Effect Operation: **Beneficial Effect**	Construction: No Effect Operation: **Beneficial Effect**	Construction: No Effect Operation: **Beneficial Effect**
Biological	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect
Threatened and Endangered Species	Construction: No Effect Operation: No Effect	Construction: No Effect Operation: No Effect	Construction: No Effect Operation: No Effect	Construction: No Effect Operation: No Effect
Air Quality	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect

TABLE 2-3
Effects among Alternatives

Resource Area	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Historic, Cultural, Archaeological, and Paleontological	Construction: No Effect Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect	Construction: **Negative Effect** Operation: No Effect	Construction: **Minimal Effect** Operation: No Effect
Environmental Justice	Construction: No Effect Operation: No Effect	Construction: No Effect Operation: No Effect	Construction: No Effect Operation: No Effect	Construction: No Effect Operation: No Effect
Hazardous Waste	Construction: No Effect Operation: No Effect	Construction: No Effect Operation: No Effect	Construction: No Effect Operation: No Effect	Construction: No Effect Operation: No Effect

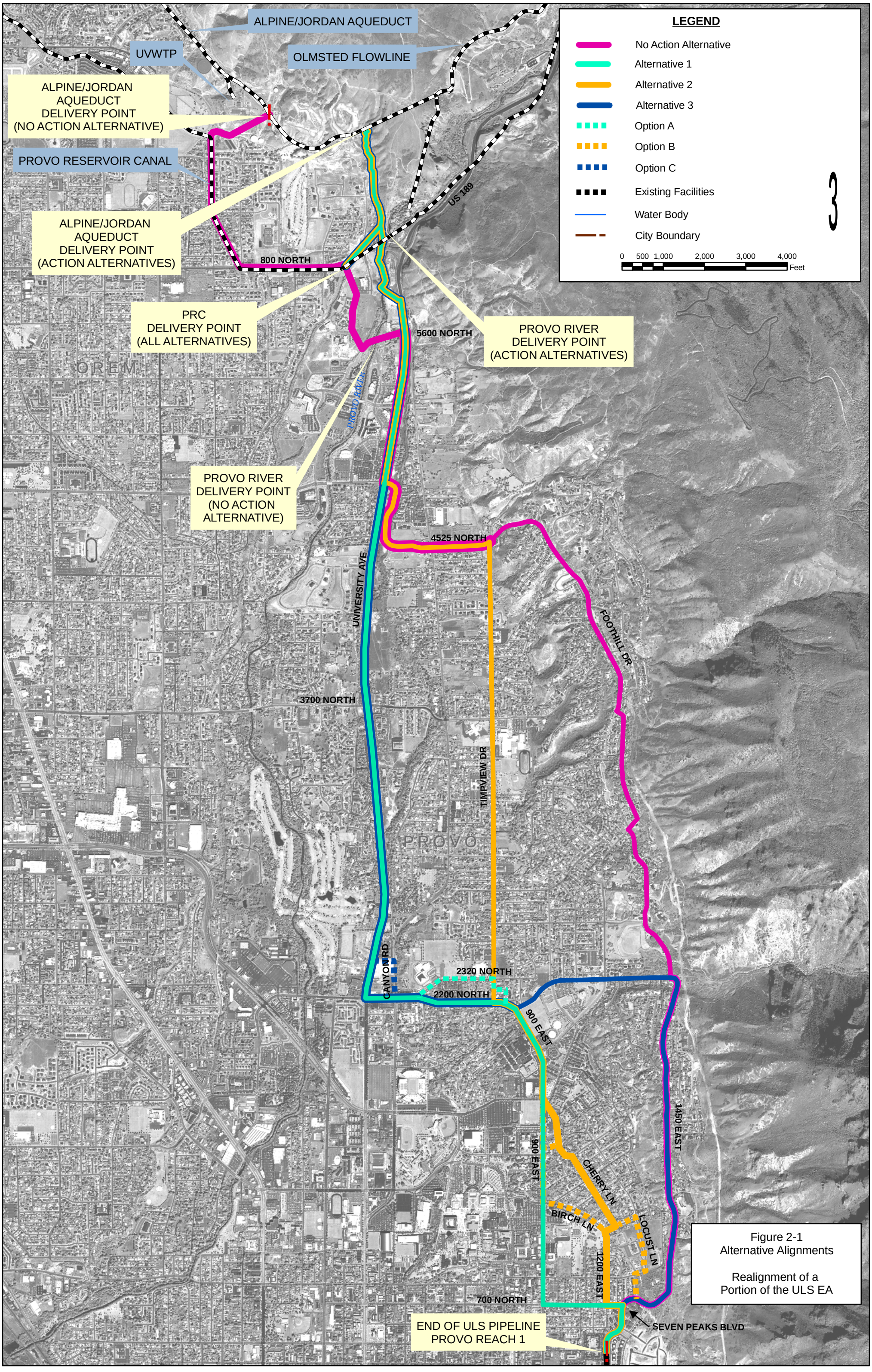
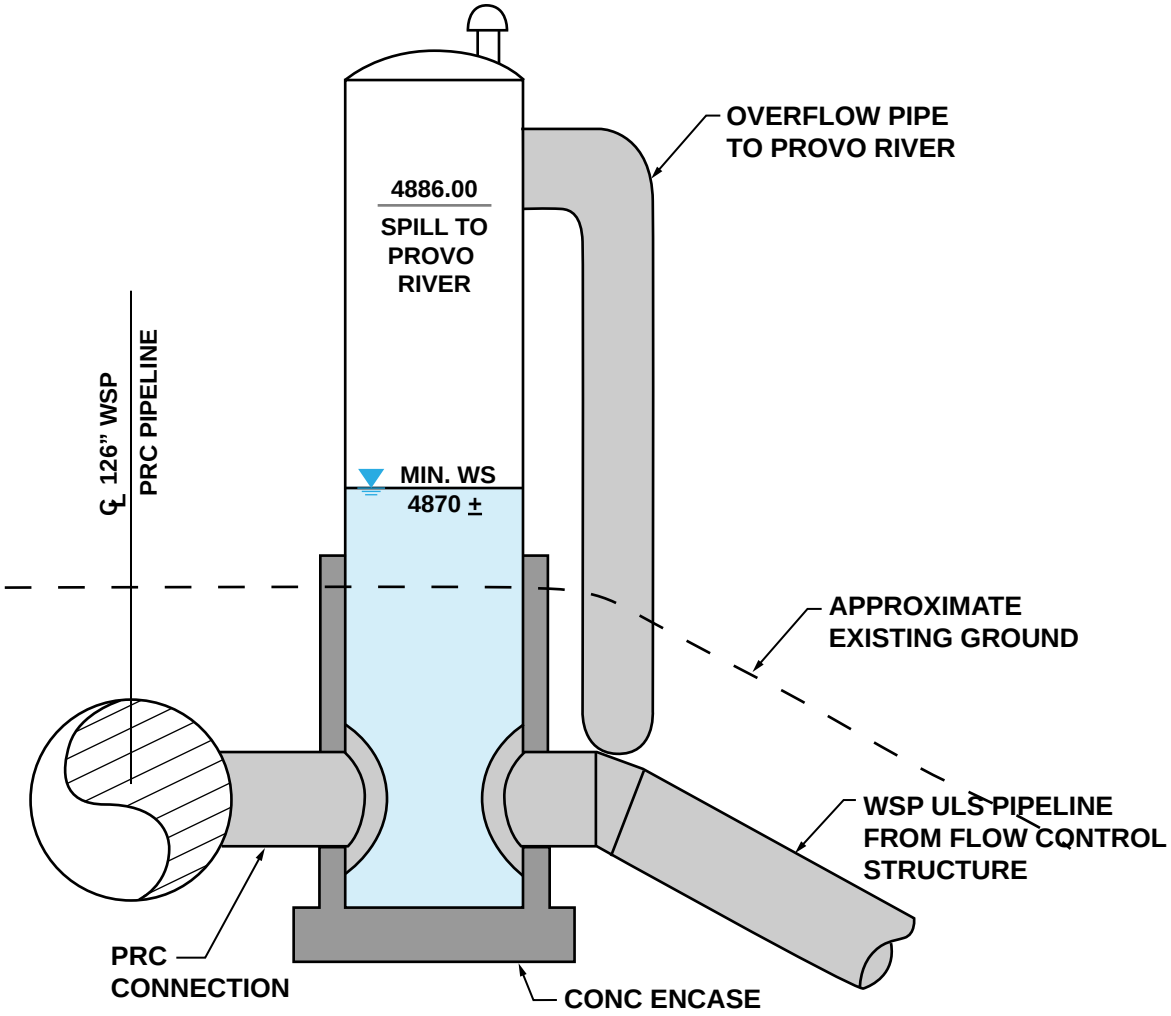


Figure 2-1
Alternative Alignments

Realignment of a
Portion of the ULS EA



NOT TO SCALE

Figure 2-2
Concept Design of Stand Pipe
Required for ULS/PRC Connection
Provo Reach Realignment EA

ES051010122957SLC ConceptDesign_StandPipe_v2.ai JUL-10 ckm

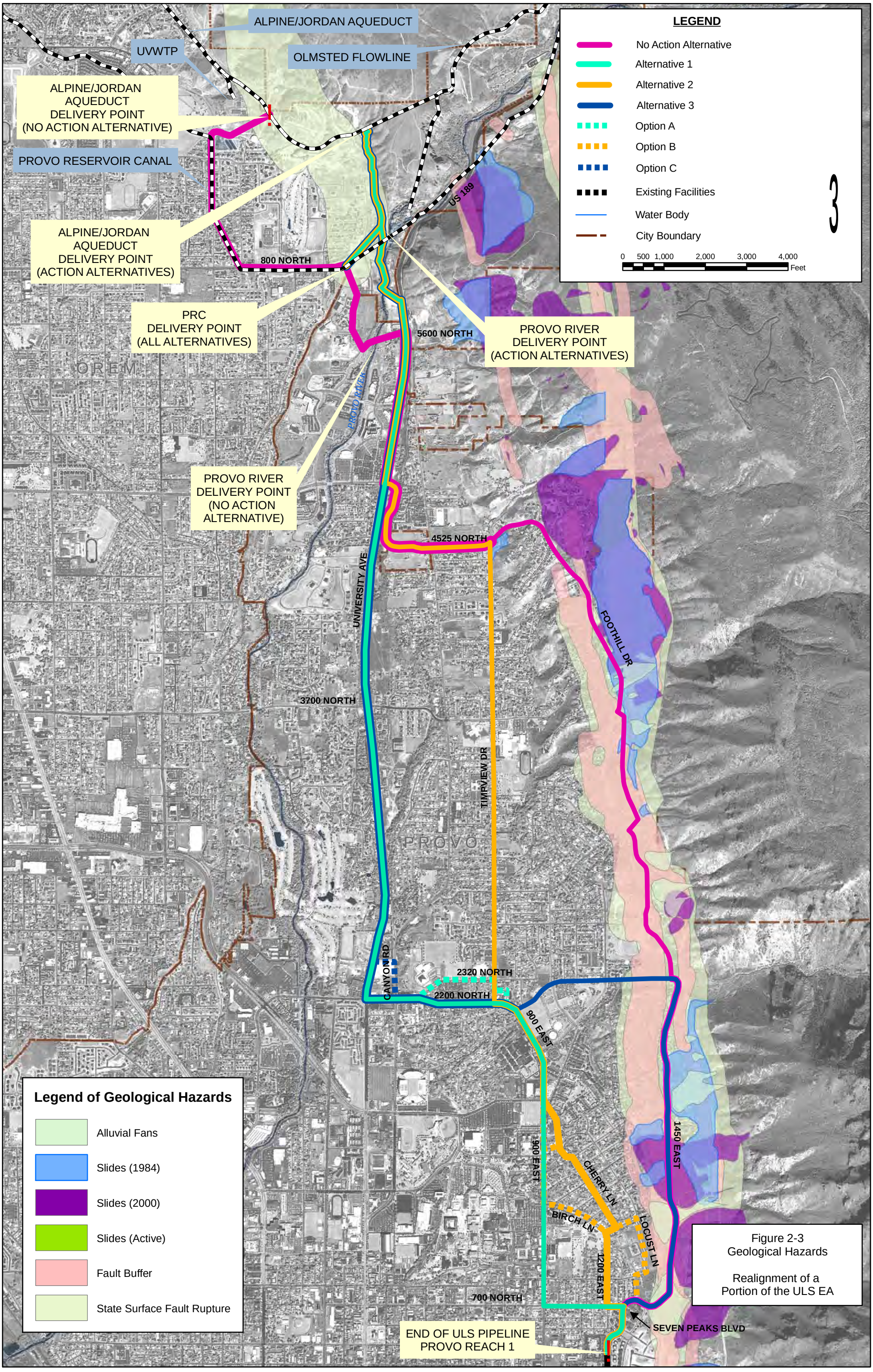


Figure 2-3
Geological Hazards

Realignment of a
Portion of the ULS EA

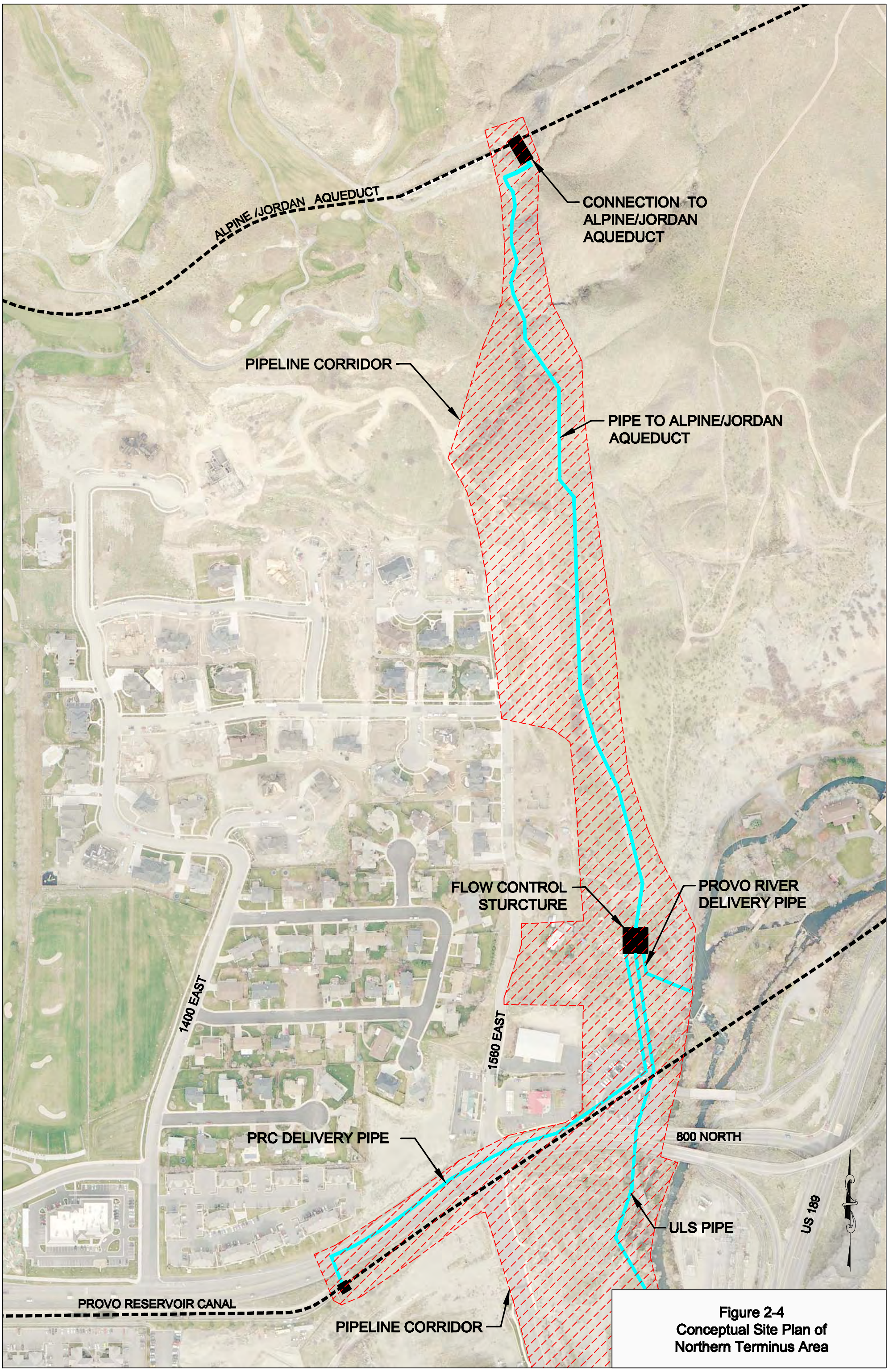
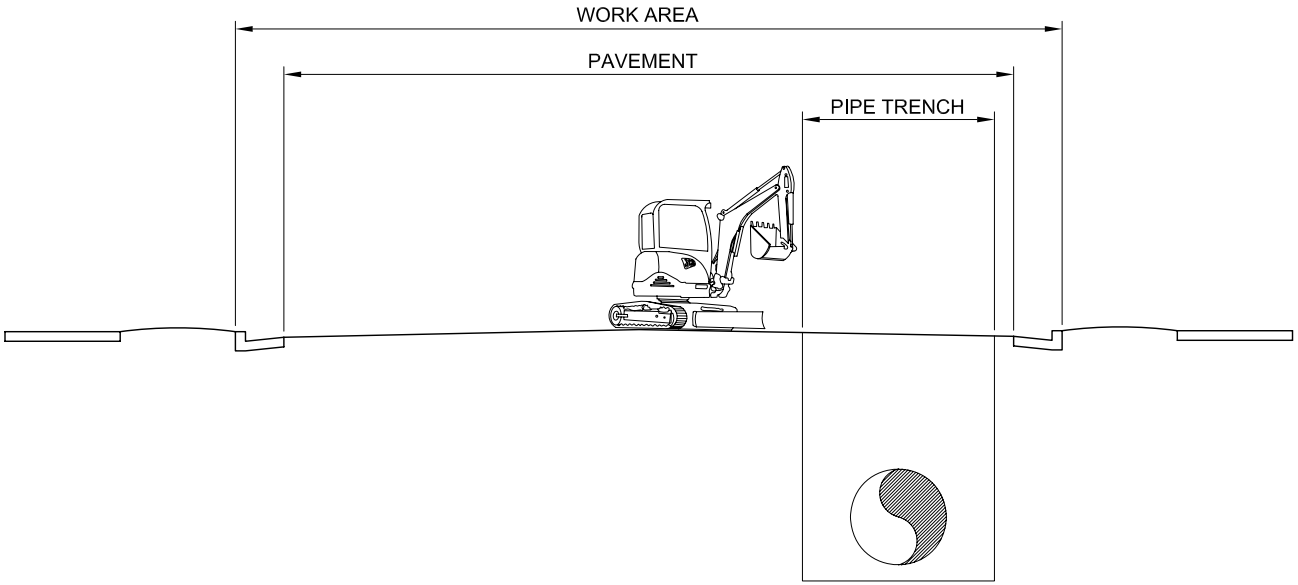
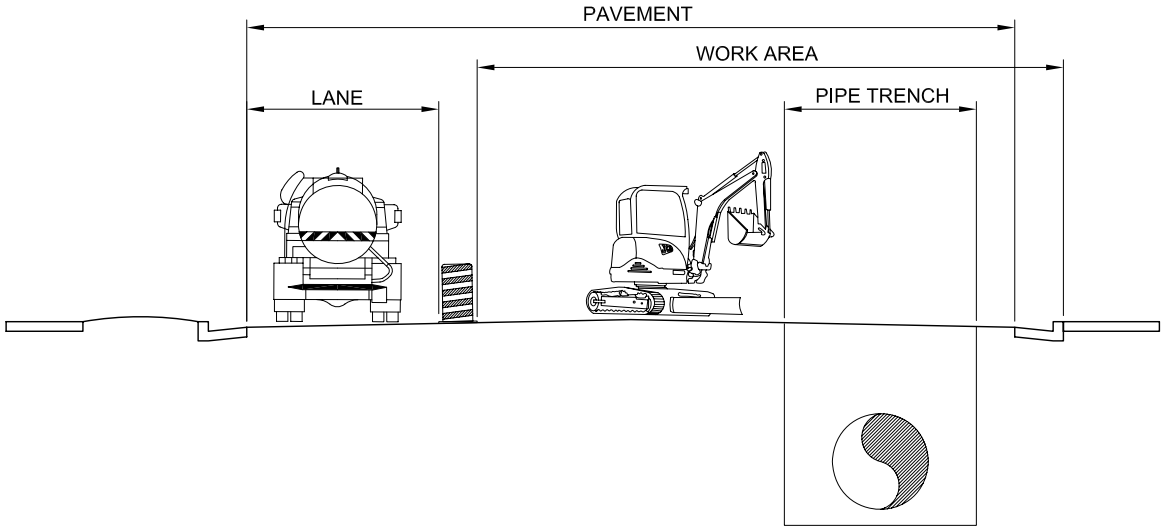


Figure 2-4
Conceptual Site Plan of
Northern Terminus Area



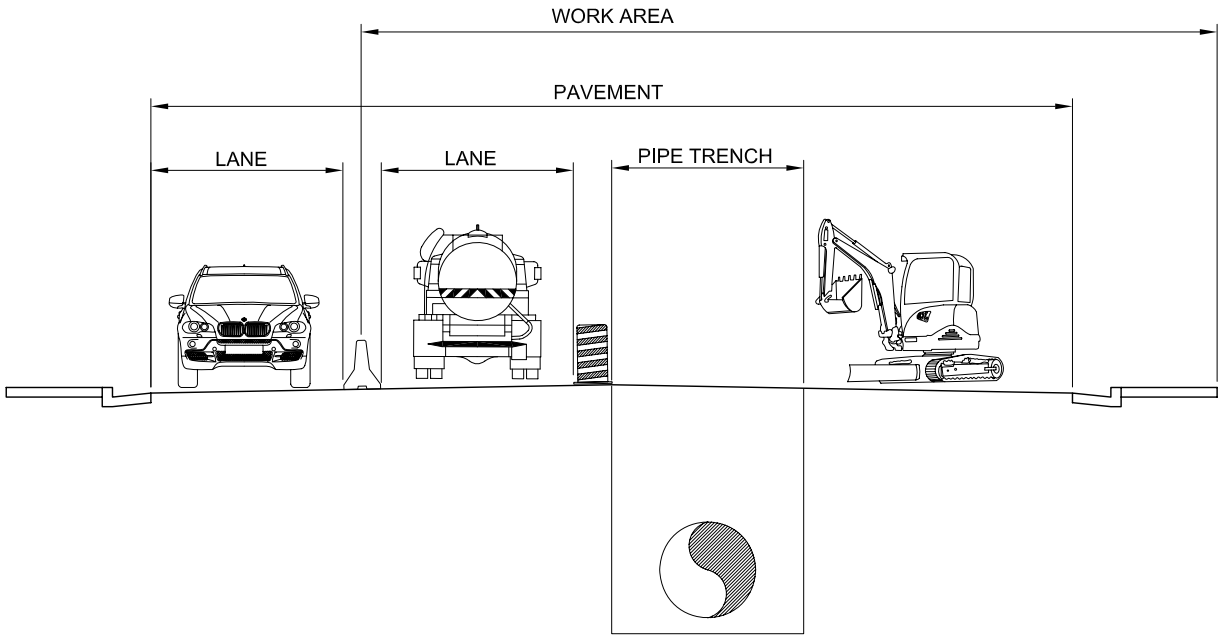
SCALE: 1" = 10'

Figure 2-5
Typical Construction Cross Section -
Seven Peaks Blvd/700 North/1200 East/Locust Lane/Cherry Lane/900 East/2200 North/2320 North
Realignment of a Portion of the ULS EA



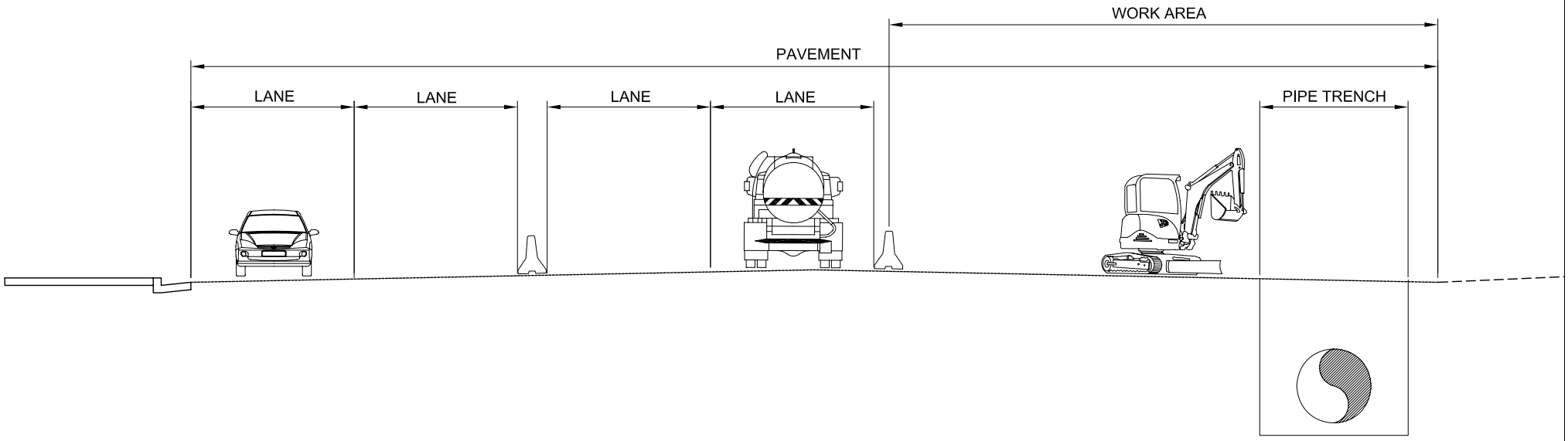
SCALE: 1" = 10'

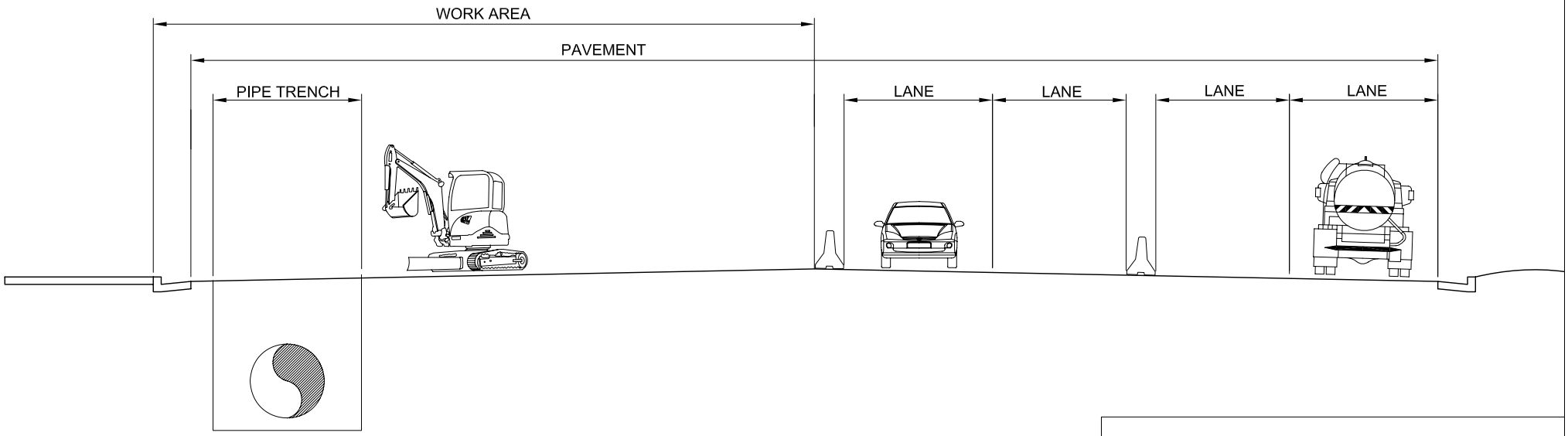
Figure 2-6
Typical Construction Cross Section -
Seven Peaks Blvd/700 North/1200 East/Birch Lane/900 East/1450 East/North Temple Dr/2200 North/Canyon Rd
Realignment of a Portion of the ULS EA



SCALE: 1" = 10'

Figure 2-7
Typical Construction Cross Section -
Seven Peaks Blvd/Birch Lane/900
East/Timpview Drive/4525 North
Realignment of a Portion of the ULS EA





SCALE: 1" = 10'

Figure 2-8
Typical Construction Cross Section -
University Ave
Realignment of a Portion of the ULS EA

3.0 Affected Environment and Environmental Consequences

3.1 Introduction

This chapter describes the affected environment and environmental consequences that would result from the construction, operation, and maintenance of proposed project features. The affected environment discussions describe existing conditions for resources within the project area of influence, which is shown in Figure 2-1. Environmental consequences for the quality of the human environment resulting from any change from the No Action condition are described in this chapter.

The impact analyses focus on direct, indirect, and cumulative impacts on project area resources. All issues identified during scoping that are relevant to this EA were considered in the impact analyses. The final section of this chapter describes the irreversible and irretrievable commitment of resources that would occur if one of the Action Alternatives is implemented.

Except for resources having specific legal requirements, resources that would not be affected or would be only negligibly affected by the alternatives are not discussed further in this document. These resources include the following:

- Wetlands
- Invasive species
- Vegetation
- Prime and unique farmlands
- Agriculturally protected areas
- Floodplains
- Wild and scenic rivers
- Groundwater
- Energy
- Land use
- Climate change
- Indian Trust assets

3.2 Transportation/Traffic

3.2.1 Introduction

This analysis addresses potential changes to the transportation networks from construction, operation, and maintenance of the Realignment through Provo and Orem. Percentages of each alternative's total length are used to evaluate construction impacts. These percentages are presented in Table 3-1, which is located in Section 3.2.4.

3.2.2 Issues Addressed in the Impact Analysis

As part of the ULS EIS scoping process, issues related to the potential impacts to transportation were raised. Those transportation/traffic issues that were considered and eliminated from further analysis in that document have not been included or addressed in this analysis.

3.2.3 Affected Environment

The affected environment for the transportation network includes roads that would be used in construction, operation, and maintenance of the pipeline. The proposed haul routes used for construction access through Provo and Orem would change as construction progresses along the alignment from street to street.

3.2.4 Impact Analysis

No Action Alternative

Impacts associated with the No Action Alternative were evaluated in Section 3.19 of the ULS EIS. Traffic pattern detours result in minimal impact in relation to the No Action Alternative.

Alternatives 1, 2, and 3 and Options A, B, and C

Construction phasing and traffic control will be developed to avoid lengthy vehicular travel delays. Two lanes of traffic will be maintained in each direction on University Avenue. However, some rerouting of normal traffic patterns is anticipated on a temporary basis during construction, which would be considered a minor inconvenience. Street damage at construction access is anticipated. Provo City will be consulted for repair guidance following construction.

While not considered a significant impact based on the criteria, Alternatives 1, 2, and 3 do shift expected construction impacts to a more urban area and have a greater potential to impact traffic and travel patterns.

Table 3-1 indicates pipe lengths, type of street, and overall percentage of each street type for each alternative.

TABLE 3-1
Installation Conditions

Alternative	Length (feet [and percentage of alternative alignment])				
	Residential Streets	Collector Streets	Arterial Streets	Open Terrain	Total Length
Alternative 1	5,035 (14%)	1,265 (3%)	25,005 (68%)	5,609 (15%)	36,914
Alternative 2	19,182 (54%)	4,048 (11%)	7,981 (22%)	4,559 (13%)	35,770
Alternative 3	13,750 (34%)	1,837 (5%)	18,185 (45%)	7,034 (17%)	40,806
No Action Alternative	24,847 (59%)	4,620 (11%)	5,269 (12%)	7,708 (18%)	42,444

Approximately two-thirds of the Alternative 1 alignment is located within arterial streets. Construction along arterials creates an impact through delays and detours. Since a greater portion of the Alternative 1 alignment is located within arterial streets than the other action alternatives, construction of this alternative would result in the greatest impact to arterial users.

Over half of the Alternative 2 alignment is located in residential streets, which is a much larger portion than the Alternative 1 and 3 alignments. Traffic routes would be less easily detoured without impacting additional residents, and road closures would create hardships for nearby residential neighborhoods. Therefore, Alternative 2 construction would result in the greatest impact to residents.

Nearly half of the Alternative 3 alignment is located within arterial streets, and approximately one-third is located in residential streets. Construction impacts associated with this alternative are less than Alternative 1 for arterial streets and less than Alternative 2 for residential streets. This alignment contains slightly more open terrain than the other action alternatives.

These impacts would be relevant only to the alignment segment under construction, which would change throughout the construction duration. Therefore, construction impact would be localized to the construction area, short-term and minimal for all action alternatives. There would be no operation impact for any of the alternatives.

3.3 Utilities

3.3.1 Introduction

This analysis addresses potential impacts to utilities from construction, operation, and maintenance of the Realignment. The analysis considers all four alternatives.

3.3.2 Issues Addressed in the Impact Analysis

This analysis addresses potential changes to utilities from construction, operation, and maintenance of the Realignment through Provo and Orem. The analysis uses utility service disruptions to evaluate potential impacts.

3.3.3 Affected Environment

The affected environment for the utility network includes water, sewer, gas, communication, electricity, and other utility services that would potentially be impacted during construction, operation, and maintenance of the pipeline.

3.3.4 Impact Analysis

Any disruption in utility service would be minimized, and mitigation measures are proposed to limit the possibility of accidentally impacting utility services. Coordination with utility providers would result in minimal construction impact and no operation impact for all Action Alternatives.

Alternative 1

Alternative 1 has the least amount of pipeline alignment that is located in residential neighborhoods. Disruptions to residential utility services such as water, sewer, and gas will be less compared with the other alternatives.

The utility congestion along 700 North, 900 East, and 2200 North (including Options A and C) is moderate and includes underground sewer, water, gas, and communication lines. In locations where the sewer lines parallel the alignment, such as 2200 North, it is expected that the 60-inch pipeline would have to be buried at a depth that is below the top of the sewers to avoid utility conflicts with sewer service laterals. A short section of buried electrical and telephone lines may need to be relocated if Option A is selected and the pipeline is not located north of Centennial Middle School.

The impact to utility service disruptions for residents is less with this alternative than with the No Action and other Action Alternatives.

Alternative 2

Alternative 2 is primarily located in residential neighborhoods, and temporary interruptions to residential utility services such as water, sewer, and gas can be expected during construction.

Alternative 3

Alternative 3 is located in residential neighborhoods along 1450 East, North Temple, and 2200 North, and temporary interruptions to residential utility services such as water, sewer, and gas can be expected during construction.

These impacts would be relevant only to the alignment segment under construction, which would change throughout the construction duration. Therefore, construction impact would be short-term and minimal for all alternatives. There would be no impact from any alternative during operation.

No Action Alternative

The No Action alternative is primarily located in residential neighborhoods, and temporary interruptions to residential utility services such as water, sewer, and gas can be expected during construction. The No Action Alternative moderately impacts existing utilities.

3.4 Public Health and Safety

3.4.1 Introduction

This section addresses public health and safety during construction and operation of the pipeline alternatives.

3.4.2 Issues Addressed in the Impact Analysis

Health and safety issues include short-term effects during construction and long-term effects during operation. Short-term effects are evaluated with respect to construction workers and the public, while long-term effects are evaluated for only the public.

Public health and safety also incorporates air quality, traffic, and noise. These resources are presented in Sections 3.12, 3.2, and 3.5, respectively. They are not evaluated in this section.

3.4.3 Affected Environment

The area of influence is located in Orem and Provo City limits. The area of influence includes pipeline construction ROW, construction staging areas and access roads, existing surfaced roads used for construction, and where normal traffic flow would be disrupted.

3.4.4 Impact Analysis

Alternatives 1, 2, and 3 and Options A, B, and C

Construction areas would be secured as necessary to prevent unauthorized access to work sites or excavations. Workers would be at risk of accidents during construction despite following all required safety procedures. However, the risk and severity of accidents would be minimized by contractors fully implementing standard operating procedures (SOPs) and BMPs for health and safety. Minimal impacts are anticipated for construction of the Action Alternatives.

No impacts are anticipated during operation of the completed pipeline, regardless of alternative.

No Action Alternative

Health and safety impacts for construction of the No Action Alternative are presented in Table 2-1 of the ULS EIS. Impacts presented in the table apply to the entire SFPRC pipeline, and this EA addresses only a portion of that pipeline. No operation impacts are anticipated for the completed pipeline.

3.5 Noise

3.5.1 Introduction

This section addresses potential changes in noise levels from construction and operation of the pipeline alternatives.

3.5.2 Issues Addressed in the Impact Analysis

Noise issues addressed in this section include short-term effects during construction and long-term effects during operation.

3.5.3 Affected Environment

The area of influence is entirely within the Provo and Orem City limits and consists primarily of residences, businesses, and schools. The project will be generally constructed in the ROW/shoulder of existing surfaced roads. During peak hours, traffic is very heavy along all alternative routes, with the largest traffic volumes occurring along either University Avenue or 900 East. The area of influence is considered a heavily urbanized area.

3.5.4 Impact Analysis

Alternatives 1, 2, and 3 and Options A, B, and C

All noise during construction, such as trench excavation, backfilling, grading, use of jackhammers, cleaning, and restoring would be localized and short-term. Operation of the pipeline would not result in significant changes to noise levels in the area of influence, resulting in no long-term noise impacts associated with the Action Alternatives.

Traffic noise may compound construction noise in heavy traffic areas, but noise levels from traffic in construction areas cannot be adequately quantified at this time. Existing traffic noise in the impact area of influence varies greatly. In high-volume traffic areas, construction traffic is not expected to noticeably increase sound levels. On some residential streets with lower traffic volume, construction traffic may temporarily (short-term) increase noise levels, but these are not expected to be significant. No long-term noise impacts are anticipated.

No Action Alternative

Construction-related noise impacts for the No Action Alternative are presented in the ULS EIS, Section 3.16 (specifically, see Section 3.16.8.3, Pipeline Construction), which can be found online at http://www.cuwcd.com/cupca/projects/uls/feis.htm. No long-term noise impacts are anticipated for operation.

3.6 Visual

3.6.1 Introduction

This section addresses visual resources during construction, operation, and maintenance of the pipeline alternatives.

3.6.2 Issues Addressed in the Impact Analysis

This analysis addresses changes to existing landscape characteristics that would result from construction, operation, or maintenance of any alternative.

3.6.3 Affected Environment

The visual resources impact area of influence includes any area that would be directly affected by construction, operation, or maintenance of any of the features associated with the alternatives.

Figures 3-1 and 3-2 indicate the proposed completed appearance of the connection to the Alpine/Jordan Aqueduct and the flow control structure, respectively.

FIGURE 3-1
Proposed Completed Appearance of the Alpine/Jordan Aqueduct Connection

ULS_EA_AA-1_FlowControlStructure.ai JUN-10 dcm

FIGURE 3-2
Proposed Completed Appearance of the Flow Control Structure

3.6.4 Impact Analysis

The impact evaluation on visual resources was based on best professional judgment using existing conditions as the point of comparison.

Alternatives 1, 2, and 3 and Options A, B, and C

Construction activities and equipment used for excavating, pipe placement, and material hauling would be visible along the proposed alignments. Upon construction completion, disturbed areas would be reclaimed and restored to preconstruction conditions, with the possible exception of a maintenance corridor remaining along portions of the ROW.

Construction of permanent pipeline valves and access points along each alternative alignment would cause minor long-term visual impacts because of the introduction of new permanent features in the characteristic landscape. The completed pipeline would be underground, and access points would be manhole covers at ground level.

No Action Alternative

Visual impacts associated with the No Action Alternative were presented in Section 3.14.8.3.7 of the ULS EIS and were determined to be below the significance criteria.

3.7 Socioeconomics

3.7.1 Introduction

This analysis addresses potential impacts to socioeconomic resources from construction, operation, and maintenance of the Realignment. The analysis considers the four proposed alternatives, including the No Action Alternative.

3.7.2 Issues Addressed in the Impact Analysis

The ULS EIS evaluated the following topics in relation to the No Action Alternative:

- Employment (regional and local)
- Income (regional and local)
- Public and business services and fiscal conditions
- Agriculture
- Recreational fishing

All four alternatives occur within the same vicinity and would have similar impacts for each of these topics. Therefore, a new analysis has not been performed. Employment information has been updated and is presented in this section. A discussion of the remaining topics is located in Section 3.12 of the ULS EIS.

Impacts to schools and residences are addressed in the following analysis.

3.7.3 Affected Environment

The potentially affected communities are located along the Wasatch Front. The impact area of influence includes the communities of Provo and Orem.

Schools and Residences

The alternatives pass various schools and through residential areas. Because Timpview Drive serves as a major residential collector street and has homes with driveway accesses that front the street, Alternative 2 would have increased impacts to the schools and residences compared with the University Avenue section in Alternative 1 and Alternative 3. The No Action Alternative has the greatest impact to residential streets compared with all of the Action Alternatives.

Alternative 1 impacts residential homes that front the alignment primarily along 1200 East, 700 North, and 2200 North. The majority of the alignment is located in arterial streets (900 East and University Avenue). Alternative 1 has the least impact to residential streets as compared with Alternatives 2 and 3. Selecting Option A or C for Alternative 1 would not significantly change the impact to residential streets for Alternative 1.

Alternative 2 impacts residential homes that front the alignment along 1200 East, Apple Avenue, Cherry Lane, Timpview Drive, and sections of 4525 North. Alternative 2 has a greater impact to residential streets as compared with Alternatives 1 and 3. Option B is primarily located in residential streets, and selecting the Option B alignment for Alternative 2 would not significantly change the impact to the residential streets.

Alternative 3 impacts residential homes that front the alignment along 1450 East, North Temple, and 2200 North. Selecting Option A or C for Alternative 3 would not significantly change the impact to residential streets for Alternative 3.

Employment (Regional and Local)

Salt Lake and Utah Counties hosted approximately 1,041,000 jobs in 2009, or about 60 percent of all statewide employment. The leading employment sectors for the counties are similar to that of the state. The construction job force is a leading employment sector within both counties, representing about 66,000 jobs (State of Utah Governor's Office of Planning and Budget, 2008).

The state's unemployment rate has paralleled the direction of the U.S. unemployment rate but at a slightly lower percentage level. The unemployment rate has increased in recent years, with the current 2010 rate estimated to be 7.2 percent. Near-term unemployment rate forecasts suggest that the rate will decrease through 2011 (State of Utah Governor's Office of Planning and Budget, 2010).

The current leading economic sectors are expected to remain strong within the long-range future, though some changes would likely occur. The service sector, in general, is forecast to increase as a percentage of the total labor force, continuing a trend established since 1970, and the manufacturing sector is expected to decline slightly. The retail trade sector is likely to hold at about the same relative percentage of total employment in the future as that of current levels, while construction would continue to decrease (State of Utah Governor's Office of Planning and Budget, 2008).

3.7.4 Impact Analysis

All Alternatives and Options

The timing of construction would be coordinated with schools and the city for events that may occur during the proposed construction schedule.

Construction in residential areas would minimally impact access to individual homes. Provo City does not allow overnight street parking in the Tree Streets. The Joint Lead Agencies would work with individual residents to ensure minimal impacts during construction. The narrowness of residential streets would potentially result in the need to remove trees along the work area to allow construction access. This would result in a negative impact on the aesthetic character of the residential neighborhoods. The depth of the construction trench may also have a potential impact on the root structure of trees close to the street. Alternative 2 contains the greatest amount of residential streets in its alignment. Therefore, the potential for negative impact is greatest for this alternative.

Coordination would ensure that only minimal construction impacts occur. No operation impacts are anticipated.

Construction jobs would be filled by the existing construction force labor pool. Local senior engineering, professional management, and construction inspection staff would be employed by the project.

Construction would occur regardless of the selected alternative. Therefore, no net employment changes are anticipated. Construction of any of the alternatives would have no impact on employment.

Project operations would be limited to monitoring and maintenance by the Joint Lead Agencies. The same staff employed to perform these tasks for the remainder of the SFPRC pipeline would service this reach of the pipeline. Therefore, no employment impact would occur from operation.

3.8 Soils and Geological Hazards

3.8.1 Introduction

This analysis addresses potential impacts to soil resources from construction, operation, and maintenance of the Realignment. The analysis considers the four proposed alternatives, including the No Action Alternative.

3.8.2 Issues Addressed in the Impact Analysis

The soil impact analysis examines the potential effects of project-related activities on soil erosion potential as well as the potential impacts to soil productivity in the project area. Geological hazards are also identified.

3.8.3 Affected Environment

A custom soil resource report for the project area was generated by the U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS, 2010) to assess soil types within the project boundaries. According to the soil resource report, over 40 soil units are present within the general project area of the four alignments. However, 13 of these soil units compose over 80 percent of the total project area. The three most dominant soil units present in the vicinity of the alternatives include the Pleasant Grove, Welby, and Taylorsville units.

The Pleasant Grove soils occur on alluvial fans at elevations between 4,600 to 5,700 feet above mean sea level (amsl). The soils generally occur on 3 to 10 percent slopes but can occur on steeper slopes up to 60 percent, which are prevalent along the steep slopes east of the proposed project. Pleasant Grove soils are characterized as well-drained soils with moderately high water movement, no tendency to flood or pond, and low to no salinity. The upper soil layers (first 60 inches of soil) are generally composed of gravelly or cobbly loam or sandy loam. Pleasant Grove soils are typically derived from colluviums or slope alluvium derived from limestone, quartzite, and shale (NRCS, 2010).

The Welby unit soils are generally situated on lake terraces, such as terraces associated with historic Lake Bonneville, or escarpments at elevations ranging from 4,500 to 5,200 feet amsl. Slopes usually range from 1 to 10 percent, and the soils are characterized as well-drained with moderately high to high water movement, no tendency to flood or pond, and nonsaline. The upper soil layers comprise silt loams. The parent material consists of lacustrine deposits derived from limestone, sandstone, and shale material (NRCS, 2010).

The Taylorsville silty clay loam is situated on lake terraces in areas with 1 to 3 percent slopes at elevations ranging from 4,500 feet to 4,900 feet amsl. Taylorsville unit soils are characterized as well-drained with no threat of flooding or ponding. Water movement is considered moderately low to moderately high, and the soils are slightly saline. The parent material consists of lacustrine deposits derived from limestone and shale (NRCS, 2010).

The NRCS report indicates that these three soil units also possess moderate to high erosion potential, with the highest potential located along the steeper slopes of the No Action Alternative and Alternative 3 and the Alpine/Jordan Aqueduct pipeline segment construction area.

Other soils within the project area include the Keigley silty clay loam, Hillfield-Sterling complex, Hillfield-Layton complex, Kidman very fine sandy loam, Provo-Sunset complex, and Steed gravelly sandy loam units. Over 3 percent of the soils in the general project area are classified as "cobbly alluvial land," and over 12 percent are considered urban land (NRCS, 2010). Urban lands have a high percentage of their surface area covered by impervious surfaces such as asphalt and concrete from roads and parking areas, as well as building structures or homes. Urban land is located along University Avenue between 4800 North and North Edgewood Drive, as well as the southernmost portion of the project area within Provo.

3.8.4 Impact Analysis

All Alternatives and Options

The most prevalent soils within the project area are moderately to highly erodible (NRCS, 2010). However, the erosion potential for soils disturbed within the alternative alignments is anticipated to be low since a large portion of the proposed pipeline will be constructed within the ROW of existing county and state roads/highways, and many portions of the project area are relatively flat. Along the No Action Alternative alignment and within northern portions of the project area where slopes are steeper, the erosion potential is much greater, and mitigation measures as described in Section 2.10.3 would minimize soil erosion potential.

Soil productivity will not be impacted within any of the proposed alignments. As mentioned previously, most of the soils that would be disturbed within the alignments are situated within or immediately adjacent to existing county and state road ROWs. As such, the productivity of these soils has previously been impacted by road construction and associated activities.

In northern portions of the proposed project area, the pipeline will leave existing road ROWs and traverse relatively undeveloped areas. This includes the pipeline segment leading to the Alpine/Jordan Aqueduct. The soils in this area are located on steep slopes where productivity is already limited (NRCS, 2010). Section 2.10.3 describes site restoration and revegetation procedures.

Should fault movement occur, there is a risk that the pipeline could be ruptured. Consequences associated with a pipeline rupture include loss of use of the pipeline while repairs are made as well as erosion and flooding that could occur in surrounding areas due to uncontrolled release of flows. If faults must be crossed, it is preferred that they be crossed

at steep angles, such that the pipe length exposed to fault rupture is minimized. Final design studies can adjust the location and layout of critical structures to avoid fault hazards to the extent practical.

Geologic mapping by the USGS and Utah Geological Survey show the presence multiple landslides along 1450 East (see Figure 2-3). These landslides are in the vicinity of the Alternative 3 and No Action Alternative alignments. Site-specific studies are needed to better assess potential impacts of these slides for purposes of pipeline design. However, these areas should be considered potential hazards to the pipeline until investigations prove otherwise.

Construction of Alternative 3 or the No Action Alternative may require slope stabilization, such as soil nail walls, to create a bench for pipeline construction. Strain gauges and special backfill would be used to monitor potential soil movement. While minimal impact is created by slope stabilization, additional soil disturbance would occur, thus creating a negative impact for the No Action Alternative and Alternative 3. Minimal construction impacts are anticipated for Alternatives 1 and 2.

No operation or maintenance impacts are anticipated for any of the alternatives.

3.9 Surface Water Resources and Quality

3.9.1 Introduction

This section addresses the effects to surface water resources and surface water quality from the implementation of the pipeline alternatives. The surface water evaluation presented in the ULS EIS specifically addressed the No Action Alternative; however, the evaluation applies to the action alternatives addressed in this document. A summary of the evaluation contained in the EIS is provided in Section 3.9.4 of this EA.

3.9.2 Issues Addressed in the Impact Analysis

Issues addressed in this section include potential short- and long-term effects on water quality in the Provo River during construction, operation, and maintenance of the pipeline alternatives.

3.9.3 Affected Environment

Surface water resources in the impact area of influence include the Provo River as it emerges from Provo Canyon and flows through Provo City.

3.9.4 Impact Analysis

All Alternatives and Options

Water resources and water quality conditions in the Provo River would be generally improved because the water delivery point introduces the flow upstream of the location contained in the ULS EIS. Contaminant loading, which was found to have no impact in the ULS EIS, would not be changed by any of the action alternatives.

No potential water quality impacts associated with construction are anticipated. Application of the SOPs and BMPs described in this EA (see Chapter 2, Section 2.10) would eliminate water quality impacts from construction activities.

3.10 Biological Resources

3.10.1 Introduction

This section addresses potential impacts on wildlife and aquatic species and their habitats from the construction and operation of the pipeline alternatives. Wildlife resources and habitat described in Section 3.8 of the ULS EIS are applicable to all alternatives evaluated by this EA.

3.10.2 Issues Addressed in the Impact Analysis

Issues addressed in this analysis are short- and long-term impacts of pipeline construction and operation to the Provo River and wildlife and their habitats.

3.10.3 Affected Environment

The impact area of influence occurs in a highly urbanized section of Provo City. As a result, wildlife values are limited in these areas due to high levels of human presence, activity, and noise. The entire pipeline construction will occur in or adjacent to the existing ROW of major transportation corridors within Provo City. The Provo River is the only aquatic habitat in the vicinity of the proposed pipeline construction area. The proposed alternatives for pipeline construction do not impact the Provo River beyond that which was analyzed for the No Action Alternative in the ULS EIS other than the upstream location difference between No Action and Action Alternatives delivery point.

3.10.4 Impact Analysis

Alternatives 1, 2, and 3 and Options A, B, and C

Wildlife populations and species diversity would not be affected by the alternatives because wildlife habitat is minimal to nonexistent in the proposed pipeline corridor and the presence of significant wildlife populations is unlikely. Revegetation of disturbed areas would restore those minimal habitat values.

Pipeline construction would cause minimal short-term impacts to small wildlife species. Noise-sensitive wildlife species would disperse into abundant adjacent habitat during construction. The pipeline construction would have little or no long-term impacts on wildlife habitat values, and wildlife home ranges would not be affected because the pipeline would be constructed within existing highway ROWs or shoulders.

Operation of the pipeline would have no impact on wildlife habitat or populations as it would not create or eliminate any wildlife habitat.

The impacts associated with delivery of water to the Provo River were evaluated under the No Action Alternative in the ULS EIS. The proposed alternatives for pipeline construction and operation in this EA would not alter the flow in the Provo River from that which was

analyzed in the ULS EIS other than upstream location difference between No Action and Action Alternatives delivery point. The length of river affected by the instream flow delivery would be increased by 2,600 feet, a positive impact for the aquatic resources in the Provo River from the construction and operation of the pipeline in any alternative.

No Action Alternative

Impacts associated with the No Action Alternative are addressed in Section 3.8.8.3 of the ULS EIS, which can be found online at http://www.cuwcd.com/cupca/projects/uls/feis.htm.

3.11 Threatened and Endangered Species

3.11.1 Introduction

This analysis addresses potential effects on T&E species and their habitat from construction, operation, and maintenance of the pipeline alternatives.

3.11.2 Issues Addressed in the Impact Analysis

The issue addressed in this section is whether the proposed project would affect federally listed or candidate T&E species.

3.11.3 Affected Environment

Table 3-2 contains a list of threatened, endangered, or candidate species that are known to occur within the proposed project or could potentially be impacted by the proposed project. This list was provided by the FWS via e-mail on June 16, 2010.

TABLE 3-2
Threatened, Endangered, or Candidate Species with Historic Utah County Range

Listing Name	Species	Listing Status
June sucker	*Chasmistes liorus*	E
Ute ladies'-tresses	*Spiranthes diluvialis*	T
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	C

NOTES:
E = Endangered
T = Threatened
C = Candidate

June sucker was listed as endangered on April 30, 1986. The lower 4.9 miles of the main channel of the Provo River, from Tanner Race Diversion downstream to Utah Lake, were designated as critical habitat. The species is endemic to Utah Lake and its tributaries. The primary factors that have contributed to the reduction in June sucker numbers include changes that have occurred both in Utah Lake and in historical spawning tributaries. In the tributaries, these effects include water management (primarily irrigation use) that has reduced streamflows during critical spawning times, reductions in available spawning habitat caused by impassable barriers associated with irrigation diversions, introduction of

nonnative species, loss of spawning habitat, poor water quality, reduced aquatic vegetation, and channelization or channel simplification. In Utah Lake, contributing factors include changes in chemical and physical habitat and introduction of nonnative species. The adults go up the tributaries to spawn in the spring, and the larvae hatch and float downstream into Utah Lake by the end of July. The Provo River, the largest tributary of Utah Lake, has been the major spawning tributary for June sucker. However, June sucker also migrate up and spawn in Hobble Creek and the Spanish Fork River. June sucker were almost extinct, but ongoing efforts by the June Sucker Recovery Implementation Program and its signatory agencies have been successful in reversing the decline of this species. The target date for recovery listed in the June sucker Recovery Plan is 2040.

Ute Ladies'-tresses were listed as threatened on January 17, 1992. They are a perennial orchid found along riparian edges, gravel bars, old oxbows, and moist to wet meadows along perennial freshwater streams and springs at elevations ranging from approximately 4,300 to 7,000 feet. It is an early to mid-successional species that is well adapted to low floodplain terraces along alluvial streams where scouring and sediment deposition are natural processes. It has been found in irrigated and subirrigated pastures that are mowed or moderately grazed. In general, the orchid occurs in relatively open grass and forb-dominated habitats and seems intolerant of dense shade. The plants bloom from late July through August (sometimes September), setting seed in the early fall. A colony is defined as any location where flowering plants have been found in a similarly delineated habitat on that geomorphic surface. Therefore, a colony may comprise one or more individuals on a sandbar (large or small) or on a large floodplain delineated by topographical changes in slope or elevation (FWS, 1992; Stone, 1993). No Ute ladies'-tresses have been located within the impact area of influence.

Yellow-billed Cuckoo was listed as a candidate species in the western U.S. in 2001 (FWS, 2003). As a candidate species, this species has no protection under the ESA. However, addressing it now could reduce scheduling impacts to the project in the event it is listed during the project's construction period. This species historically flourished in western cottonwood and willow riparian forests and thickets. In Utah, they favor areas with dense undergrowth of willow combined with mature cottonwoods and an abundant subcanopy or shrub layers at elevations between 2,500 and 6,000 feet and generally within 300 feet of slow or standing water. This secretive bird is a neotropical species that breeds in North America and winters primarily south of the U.S. border. They typically arrive in the Utah in late May or early June. Southward migration usually begins in late August or early September. This species has been observed along the Provo River (UDNR, 2003), although it has not been observed within a 2-mile radius of the project area (UDNR, 2010).

3.11.4 Impact Analysis

All Alternatives and Options

There would be "**No Effect**" to any listed or candidate species with construction, operation, or maintenance of any of the pipeline alternatives.

Construction, operation, and maintenance of any of the pipeline alternatives or options would occur near habitat for June sucker, western yellow-billed cuckoo, and Ute ladies'-

tresses, but the effects are no different than were analyzed for the ULS EIS. Relocation of the delivery point has no effect on flows in the lower river.

3.12 Air Quality

3.12.1 Introduction

This analysis addresses potential impacts on air quality from construction and operation of the pipeline alternatives.

3.12.2 Issues Addressed in the Impact Analysis

This section addresses the temporary effects on air quality from construction activities associated with the pipeline alternatives as well as potential long-term effects on air quality from pipeline operations.

3.12.3 Affected Environment

In accordance with the Clean Air Act (CAA), National Ambient Air Quality Standards (NAAQS) have been established by the U.S. Environmental Protection Agency (EPA) to protect the public from exposure to air pollutants that may be harmful to their health and may be harmful to the environment. NAAQS have been established for six air pollutants that are most commonly found throughout the U.S., referred to as criteria pollutants, which include ozone (O_3), particulate matter (PM), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and lead. The federal NAAQS for these criteria pollutants have been adopted by the State of Utah.

Attainment is achieved when the existing background concentrations for criteria air pollutants are less than the maximum allowable ambient concentrations defined in the NAAQS. If a particular air shed or area cannot comply with one or more NAAQS, the EPA designates the area as a non-attainment area for those pollutants. According to the Utah Division of Air Quality (UDAQ, 2010), the proposed pipeline alternatives, which are located in the Utah Valley air shed, are located in an area of Utah County that has been designated as non-attainment for PM less than 10 micrometers in aerodynamic diameter (PM_{10}) and PM less than 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$). The proposed project area is also located in a portion of Utah County that has been designated a maintenance area for CO (UDAQ, 2010). Maintenance areas are geographic areas that had a history of non-attainment for a NAAQS (CO in this instance) but are now consistently meeting the NAAQS. Maintenance areas have been redesignated by the EPA or UDAQ from "non-attainment" to "attainment with a maintenance plan." The maintenance plan is a 10-year plan developed by the UDAQ that outlines the measures needed to comply with air quality standards and other requirements of the CAA.

The UDAQ Rule R307-300 sets requirements for specific locations within non-attainment and maintenance areas. Rule R307-309 describes the rules for Davis, Salt Lake, Utah, and Counties; Ogden City; and any non-attainment area for PM_{10}: fugitive emissions and fugitive dust. Rule R307-309-8 is applicable to construction and demolition activities and states, "*Any person engaging in clearing or leveling of land with an area of 1/4 acre or more, earthmoving, excavating, construction, demolition, or moving trucks or construction equipment over*

cleared land or access haul roads shall prevent, to the maximum extent possible, material from being deposited onto any paved road other than a designated deposit site. Any such person who deposits materials that may create fugitive dust on a public or private paved road shall clean the road promptly." Finally, the fugitive emissions and fugitive dust rule, R307-309, requires a fugitive dust control plan (R307-309-6) from all sources whose activities or equipment have the potential to produce fugitive dust, airborne dust in Davis, Salt Lake, and Utah Counties and Ogden City.

3.12.4 Impact Analysis

Alternatives 1, 2, and 3 and Options A, B, and C

Temporary impacts are anticipated for construction of all action alternatives; however, use of BMPs for dust control would minimize or mitigate the impacts. There are no anticipated air quality emissions from operation of the proposed pipeline alternatives.

Temporary impacts on air quality from construction activities result from two primary sources for each alternative, including (1) exhaust from heavy construction equipment and trucks and (2) fugitive dust produced during construction. Since the general project area is in non-attainment for PM_{10} and $PM_{2.5}$ and is designated as a maintenance area for CO, the following analysis focuses on the potential emissions of these pollutants from project construction activities. Exhaust emissions from construction equipment and vehicles will generate emissions of other criteria pollutants as well, including NO_x, SO_2, and O_3; however, these emissions are expected to be well below applicable NAAQS and are not further evaluated as a part of the following analysis.

PM_{10} and $PM_{2.5}$. Fugitive dust emissions during construction and from construction vehicles working in areas with exposed surfaces would result in temporary emissions of PM with a significant portion of the emissions being of larger particulate size. In addition, emissions of PM_{10} and $PM_{2.5}$ will result from exhaust from construction equipment and trucks.

According to the ULS EIS analysis for the SFPRC pipeline alternative, estimated daily PM_{10} emissions from equipment exhaust and dust emissions for construction of a typical pipeline is anywhere from 14.5 to 32.2 pounds per day, depending on the phase of construction. The clearing and grubbing phase of construction would have the lowest PM_{10} emission rate, while the trench excavation phase is estimated to have the highest PM_{10} emission rate.

As a part of the ULS EIS, the EPA SCREEN3 model was used to calculate potential PM_{10} emissions from pipeline construction in an urban setting. All pipeline alternatives are located in an urban setting within Provo City. The SCREEN3 model estimated that the total peak 24-hour concentration of PM_{10} during pipeline construction activities resulting from both equipment exhaust and fugitive dust would be 325 micrograms per cubic meter ($\mu g/m^3$), which exceeds the 24-hour NAAQS for PM_{10} of 150 $\mu g/m^3$.

The ULS EIS did not analyze or model potential $PM_{2.5}$ emissions from pipeline construction because $PM_{2.5}$ data were not widely available. However, multipliers that can be used to infer $PM_{2.5}$ concentrations from PM_{10} emissions in fugitive dust have been established (Pace, 2005). According to recent studies, the $PM_{2.5}/PM_{10}$ multiplier for fugitive dust from construction sites averages 0.10 (EPA, 2010). Ratios for $PM_{2.5}/PM_{10}$ for emissions from vehicle exhaust have not been well developed. Based on the calculated 24-hour maximum

concentration of PM_{10} from the SCREEN3 model for pipeline construction and the established multipliers for $PM_{2.5}/PM_{10}$, it can be inferred that $PM_{2.5}$ emissions from pipeline construction could exceed the NAAQS for $PM_{2.5}$ of 35 $\mu g/m^3$ during pipeline construction.

The estimated exceedance of the NAAQS 24-hour standard for PM_{10} is considered a significant impact. Use of dust control BMPs would mitigate these impacts to less than significant. Construction duration is anticipated to be 30 months, so any impact would be temporary. Furthermore, the SCREEN3 modeling results assume a worst-case scenario, so actual PM emissions are likely to be less than estimated by the model. Since PM concentrations are anticipated to rapidly decrease with distance from the construction area, the impacts are considered to be highly localized.

There are no differences between alternatives in estimated PM emissions since potential pipeline alignments are located with the urban area of Provo City (mostly within existing ROWs) and are all similar in overall length.

CO. Emissions of CO will be generated from construction equipment and vehicle exhaust during construction activities. As mentioned previously, the general project area is located within an area of Utah County that has been designated as a maintenance area for CO. The SCREEN3 model used during the ULS EIS estimated that maximum potential concentrations of CO from pipeline construction could total 10.4 $\mu g/m^3$ in a 1-hour period and 6.7 $\mu g/m^3$ in a 24-hour period. The NAAQS for CO is 40 $\mu g/m^3$ in a 1-hour period and 10 $\mu g/m^3$ in any 24-hour period. Based on these model estimates, it does not appear that CO concentrations resulting from pipeline construction activities would exceed NAAQS, so no significant impact to air quality from project CO emissions is anticipated.

There is no difference between alternatives in estimated CO emissions since all possible pipeline alignments are located with the urban area of Provo City (mostly within existing ROWs) and are all similar in overall length.

No Action Alternative

Impacts associated with the No Action Alternative were evaluated in the ULS EIS, Section 3.20. Temporary, significant impacts were anticipated for the entire SFPRC pipeline. This EA evaluates only a portion of that pipeline, and impacts would be reduced accordingly. Temporary impacts are anticipated for the No Action Alternative; however, use of BMPs for dust control would mitigate the impacts. Because the segment of pipeline in Alternative 1 is shorter than that in the No Action Alignment, air emissions for the proposed project would be less than the No Action Alternative.

3.13 Historic, Cultural, Archaeological, and Paleontological Resources

3.13.1 Introduction

This analysis addresses potential impacts on cultural resources from construction and operation of the pipeline alternatives.

Native American tribes in the area have been contacted to inform them about the proposed project and to solicit their input regarding the Area of Potential Effects (APE) and the preservation of cultural resource, if any, in the corridor in connection with the archaeological survey. Tribal consultation would be reinitiated if construction reveals previously unknown tribal resources.

3.13.2 Issues Addressed in the Impact Analysis

A cultural survey and paleontological file search were completed for the project area that was not surveyed during preparation of the ULS EIS. The area surveyed for this EA is located at the northern extent of all alignments.

A paleontological file search revealed no localities within the project area for any of the alignments. The effect to historic architectural resources was evaluated for Alternatives 1, 2, and 3 and Options A, B, and C.

A reconnaissance-level survey (RLS) was conducted by a historic preservation specialist (Horrocks, 2010). The RLS identified architectural resources potentially impacted by each alternative.

3.13.3 Affected Environment

The APE surveyed for cultural resources included both sides of streets along all four alternative alignments. All architectural resources within the APE older than 45 years of age (constructed in or prior to 1962) were evaluated for their eligibility for the National Register of Historic Places (NRHP). The RLS identified 143 total properties that were potentially eligible for the NRHP.

3.13.4 Impact Analysis

The term "effect," in terms of historic resources, is defined as an "alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register" (36 CFR 800.16[i]). Effects are categorized as No Historic Properties Affected, No Adverse Effect, and Adverse Effect. Findings of effect are made by the lead federal agency, in consultation with the Utah SHPO (or Tribal Historic Preservation Office [THPO], if tribes attach religious and cultural significance to historic properties that may be affected by the proposed action).

This pipeline is intended to be placed within existing roadway ROW to the extent possible to minimize environmental impacts. The pipeline may even be installed beneath existing utility lines to avoid costly utility relocations. Due to the narrowness of some of the streets, it may not be possible to confine the construction work to the existing roadway. Therefore, this analysis has assumed a potential impact from temporary construction-related activities to all adjacent historic properties of a maximum of 5 feet behind the existing sidewalk.

Alternatives 1, 2, and 3 and Options A, B, and C

Alternatives 1, 2, and 3 would potentially impact the historic properties under the assumptions specified previously. Alternative 2 contains more properties eligible for the NRHP than any other alternative. However, it is important to note that if construction activities can be confined to the existing roadway, impacts may be avoided.

There may be some exceptions where construction activity in the roadway would potentially damage the root system to certain trees listed as contributing features to historic properties. Root systems would be avoided where possible, thus resulting in no construction impact for any of the action alternatives.

One cultural resource is located within the project area. This is a water tank that was constructed in the 1920s.

Additional cultural resources are located within 1 mile of the alternative alignments. These resources are mainly sites associated with water conveyance—the Murdock Diversion (42UT947) and the Provo Bench Diversions #1 and #2 (42UT1334). These resources have been determined to be eligible for inclusion in the NRHP due to their association with the development of agricultural in Utah. However, these resources are outside of the proposed project area and will not be affected by the project.

There would be no operation impact associated with any alternative or option.

No Action Alternative

Architectural resources potentially affected by the No Action Alternative were discussed in the USL EIS. The evaluation can be found in Chapter 3.13 of that document.

Determination of Eligibility and Finding of Effect

Once a Preferred Alternative has been selected, CUWCD will prepare a Determination of Eligibility and Finding of Effect regarding those properties that would be included in the APE for the Preferred Alternative and submit it to SHPO for their concurrence with the findings of effect.

3.14 Environmental Justice

3.14.1 Introduction

This section addresses the environmental justice effects from construction, operation, and maintenance of the No Action Alternative and Action Alternatives.

3.14.2 Issues Addressed in the Impact Analysis

This section addresses the effect the proposed project would have on disadvantaged populations, such as minorities and low-income individuals.

3.14.3 Affected Environment

On February 11, 1994, the President issued Executive Order 12898 on Environmental Justice in Minority Populations and Low Income Populations. This Executive Order requires agencies to identify and address disproportionately high and adverse human-health or environmental effects of their actions on minorities and low-income populations and communities, as well as the equity of the distribution of the benefits and risks of their decisions.

A total of 545,307 people lived in Utah County in 2009. According to the U.S. Census Bureau, the majority of those individuals are white (94.9 percent) (Census Bureau, 2010). Hispanic/Latino individuals made up the second largest group (9.6 percent). Some individuals were identified in multiple races. In total, non-Hispanic or non-Latino minorities are 3.4 percent of the population.

3.14.4 Impact Analysis

All Alternatives and Options

There would be no disproportionate disruption of minority groups by construction of the proposed project because the alignments are not located near large minority group populations. No disproportionate negative impacts on minorities or low-income communities are expected.

3.15 Hazardous Waste

3.15.1 Introduction

This analysis addresses potential impacts to the three action alternative alignments from existing hazardous waste sites/releases and potential impacts to the environment from use of hazardous materials and generation of hazardous wastes during the construction, operation, and maintenance of the Realignment.

3.15.2 Issues Addressed in the Impact Analysis

The hazardous materials/waste impact analysis examines the potential for existing hazardous waste sites/spills located along the proposed alignments to affect environmental media during construction of the project. The analysis also examines potential impacts to environmental resources such as soil, groundwater, and surface water from the use of hazardous materials and generation of hazardous waste during construction, operation, and maintenance of the proposed pipeline.

3.15.3 Affected Environment

Existing Contaminated Sites/Incidents

A hazardous waste site/contaminated site assessment was conducted for the project area. The assessment was performed by Environmental Data Resources Inc. (EDR) and included reviews of various federal, state, local, and tribal databases. The database search was conducted in accordance with 40 CFR Part 312, Standards and Practices for All Appropriate Inquiries. These standards require that the database search be conducted for properties within a 0.25- to 1-mile radius surrounding a subject property. Because the proposed project is a linear project that crosses hundreds of property boundaries, an area study was completed by EDR in which a centerline is chosen, in this case Alternative 2, and a 1-mile radius surrounding this centerline is searched for potential incidents.

The database search revealed the presence of over 100 sites within the proposed project area (EDR, 2009). To narrow down the list of sites that may have direct impacts to proposed

alignments, only those sites that are located immediately adjacent (within 500 feet) to a proposed alignment are analyzed. Table 3-3 provides a summary of these sites and their potential impact on each proposed alignment.

TABLE 3-3
Moderate to High Potential Contaminated Site Impact within Each Alternative Alignment

Alternative	Total Moderate to High Potentially Contaminated Sites Impacting the Alternatives	Sites or Events Included in Total Contaminated Sites	
		Leaking Underground Storage Tanks (LUST) Sites	Recorded Spills
Alternative 1	6 (2 within University Ave ROW and 4 along 900 East/ 2200 North)	3	3
Alternative 2	2	2	None
Alternative 3	3	None	3
Option A	None	None	None
Option B	2	2	None
Option C	None	None	None
No Action Alternative	3	2	1

3.15.4 Impact Analysis

All Alternatives and Options

Existing Contaminated Sites/Incidents. The proposed pipeline alignments would potentially encounter areas of environmental concern from historical incidents. Table 3-3 indicates the number of sites within each alternative alignment that have a moderate to high potential to impact each alternative. The three sites identified for Alternative 3 are the same three identified for 2200 North and University Avenue in Alternative 1.

It is possible that petroleum-impacted or contaminated soils could be encountered during pipeline construction activities in any of the proposed alignments, although Alternative 3 has the least potential for encounters.

Table 3-4 identifies all hazardous waste sites and contaminated properties with potential impacts to pipeline alignments.

TABLE 3-4
Hazardous Waste Sites and Contaminated Properties with Potential Impacts to Proposed Pipe Alignments

Facility/Property Name	Location	Alignment Affected	Distance and Direction from Alignment	Relative Groundwater Gradient (Flow Direction) to Study Area	Database	Estimated Relative Potential to Impact Alignment
Rock Canyon Fire Station	1437 E 2320 N	No Action Alternative	<100 feet	Downgradient	UST	Low – No documented release
Brooke Roney Residence	2755 Foothill Dr.	No Action Alternative	<100 feet	Crossgradient	UST	Low – No documented release
Blake Roney Residence	3187 Foothill Dr.	No Action Alternative	<100 feet	Downgradient	UST	Low – No documented release
Wrangler Laboratory	3853 N Sherwood Rd.	No Action Alternative	~800 feet	Upgradient	MLTS	Low – No documented release
Oak Hill's Gas-n-Stuff	1220 N 900 E	Alternatives 1 and 2	<100 feet	Crossgradient	UST/LUST	Moderate – Documented petroleum release
BYU Service Station	850 N 900 E	Alternative 1	<100 feet	Crossgradient	UST/LUST	Moderate – Documented petroleum release
BYU Animal Science Bldg.	Deseret Towers Rd.	Alternatives 1 and 2	~ 200 feet	Downgradient	UST/LUST	Moderate – Documented petroleum release
BYU Mission Training Center	900 E	Alternatives 1 and 2	<100 feet	Crossgradient	UST	Low – No documented release
None Provided	599 E 2200 N	Alternatives 1 and 3	In ROW	Crossgradient	SPILL	Moderate – Spill of unknown chemical from truck reported
Timpview High School Driver Education Bldg.	3570 N Timpview Dr.	Alternative 2	<100 feet	Upgradient	UST	Low – No documented release
Tomco Recycling Technology, Inc.	2696 N University Ave.	Alternative 3	<100 feet	Crossgradient	RCRA-CESQG	Low – No documented release
None Provided	3200 N University Ave.	Alternatives 1 and 3	In ROW	Crossgradient	SPILL	Moderate to High – Spill of gasoline (20 gallons) along highway
None Provided	3319 N University Ave.	Alternatives 1 and 3	Unknown	Unknown	SPILL	Moderate – Spill of oil/gasoline reported in irrigation canal along road

TABLE 3-4
Hazardous Waste Sites and Contaminated Properties with Potential Impacts to Proposed Pipe Alignments

Facility/Property Name	Location	Alignment Affected	Distance and Direction from Alignment	Relative Groundwater Gradient (Flow Direction) to Study Area	Database	Estimated Relative Potential to Impact Alignment
Will's Pit Stop	36 W 3700 N	Alternatives 1 and 3	< 50 feet	Crossgradient	UST	Low – No documented release
Provo Canyon School	4501 N University Ave.	Alternatives 1 and 3	<100 feet	Crossgradient	UST/AST	Low – No documented release
Portrait Innovations	4810 N University Ave.	All alternatives	<100 feet	Crossgradient	RCRA – CESQG	Low – No documented release
Community Press	5600 N University Ave.	All alternatives	<100 feet	Downgradient	RCRA – SQG	Low – No documented release
Utah Power & Light (PacifiCorp)	1600 E 800 N	No Action Alternative	<100 feet	Crossgradient	UST/LUST	Moderate – petroleum release reported
Provo Canyon School – Orem Campus	1350 E 750 N	No Action Alternative	<100 feet	Crossgradient	UST/LUST	Moderate – petroleum release reported

NOTES:
AST = The aboveground storage tank (AST) database list facilities that are operating ASTs onsite.
ERNS = The emergency response notification system (ERNS) records and stores information on reported releases of oil and hazardous substances and is maintained by the EPA.
MLTS = The Material Licensing Tracking System (MLTS) is maintained by the Nuclear Regulatory Commission and contains a list of sites that possess or use radioactive materials and are subject to U.S. Nuclear Regulatory Commission licensing requirements.
RCRA-SQG, RCRA-CESQG = The RCRA's small-quantity generator (SQG) and conditionally exempt small-quantity generator (CESQG) databases include information on facilities that generate, transport, store, treat, and dispose of small quantities of hazardous waste.
SPILLS = This database lists incidents of spills reported to the Utah Division of Environmental Response and Remediation (DERR).
UST = The underground storage tank (UST) database contains a listing of the facility, owner, location, and number of tanks that are in operation at a facility.
LUST = The LUST database contains an inventory of reported LUST locations and indicates whether or not a site is closed, which would require no further cleanup action.

Construction, Operation, and Maintenance Activities

Construction equipment required to install the buried pipelines within the alternative alignments use diesel fuel, lubricants, and hydraulic fluids as part of routine operation. Typical of most construction projects, the temporary storage and use of these materials could result in minor incidental spills of diesel fuel or oil during fueling of equipment or handling of lubricants and hydraulic fluid. Other incidental spills could be associated with equipment failures, such as ruptured hoses.

In addition, small quantities of hazardous waste could be generated by construction operations for any of the three alternatives. Typically, these wastes would be in the form of spent lead acid batteries used for construction equipment or waste oils, oily rags, and oil-impregnated absorbent materials used to clean up minor spills from construction equipment. However, quantities of these materials are anticipated to be extremely small, as most waste generated from the construction activities would be solid (nonhazardous) wastes.

Little, if any, hazardous and solid wastes are expected to be generated during maintenance and operation of the pipeline.

3.16 Cumulative Impacts

This section describes cumulative impacts from all resource categories.

3.16.1 Transportation and Utilities

All alternatives and options result in similar residential access restrictions and impacts associated with contractor-construction traffic. However, Alternative 1 would result in greater cumulative traffic delays and detours into nearby residential neighborhoods than Alternatives 2 or 3.

3.16.2 Public Health and Safety

Short-term, construction-related impacts associated with air, traffic, and noise would result in short-term cumulative public health and safety impacts. Construction emissions (fugitive dust and equipment emissions) would increase. Phased, progressive construction would result in localized detours and traffic delays; hence, impacts to public health and safety due to traffic would not be significant. Short-term construction noise would have a greater impact in residential areas than in wider, developed corridors such as University Avenue.

No long-term operation cumulative impacts are anticipated.

3.16.3 Soils

Cumulative impacts within all alignments are considered to be negligible since the construction and operation of the pipeline would occur within existing county and state road ROWs. Soils within and adjacent to these ROWs are already highly impacted by construction and impervious surfaces in this highly populated, urbanized area.

3.16.4 Historic, Cultural, Archaeological, and Paleontological Resources

Due to the relatively stable nature of the majority of the project area, it is unlikely that there would be a cumulative impact on historic resources in the project area during the time period for the construction of this project.

3.16.5 Hazardous Waste

Other than incidental spills or leaks of diesel fuel or hydraulic fluid from construction equipment, construction and operation of the pipeline is not expected to create hazardous materials or hazardous waste impacts or add to contaminated soil conditions over those conditions that already exist within the project area.

3.17 Mitigation

Mitigation measures for applicable resources are discussed in the following section. No mitigation is proposed for resources not included in this section.

3.17.1 Transportation

The following is proposed mitigation for the expected impacts to the transportation network:

- Minimize the use of low-volume residential urban streets for construction haul routes
- Coordinate with Provo, Orem, and UDOT to develop construction phasing and traffic control plans to minimize impacts to the public
- Maintain as many open lanes of traffic as possible, with flaggers to direct traffic through construction areas
- Prepare detour plans and signing to minimize the impact to normal traffic patterns and emergency vehicles
- Prepare a public information plan to inform residents and business owners of project schedule, status, and contact information
- Coordinate with local community representatives (including schools and neighborhood organizations) to incorporate public events into the construction schedule and detour routes

The contractor would be required to implement these mitigation measures throughout the project construction

3.17.2 Utilities

Utility impacts would be mitigated by preparing a detailed inventory of utilities and coordinating with utility providers during construction to minimize the disruption in utility service.

The public information plan would provide advance notification of utility disruption.

3.17.3 Socioeconomics

Schedule coordination with schools and communication with residents would reduce impacts.

3.17.4 Soils

To minimize the potential for soil erosion, particularly in areas with steep slopes within all alignments, the following BMPs are recommended:

- Erosion-control measures—including, but not limited to, silt fencing, application of gravel or riprap, and straw bales—would be installed, where necessary, during and immediately after construction to avoid erosion and runoff.
- Topsoil and excavated soil will be stockpiled immediately adjacent to trenching activities and will be used to fill in the open trenches as soon as possible upon completion of pipe installation.
- Disturbed areas will be reseeded where vegetation previously existed.
- Avoidance of potential geological hazards (faults and landslides) must be made during pipeline design.

3.17.5 Surface Water Resources

To avoid sediment delivery or the introduction of foreign substances to the Provo River, BMPs described in Chapter 2 would be implemented during project construction. The proposed pipeline project will be operated in a manner to avoid water quality impacts. Therefore, water quality mitigation would not be necessary during construction or project operation.

3.17.6 Air Quality

To minimize emissions of PM from construction activities, BMPs for mitigating fugitive dust and diesel exhaust would be employed during construction activities. The following BMPs would be used to mitigate construction PM emissions and comply with R307-309-8:

- Minimize the extent of surface disturbance to the fullest extent possible
- Reseed or otherwise provide temporary and permanent vegetation/groundcover to disturbed areas as soon as possible after construction is completed in an area
- Build construction entrances where appropriate using aggregate material to minimize sediment trackout on paved highways
- Use dust abatement techniques (such as watering or minimizing loader bucket drop heights) for earthmoving, excavating, trenching, grading, and other construction activities
- Minimize equipment and vehicle idling times during construction activities

- Prevent to the maximum extent possible material from being deposited onto any paved road other than a designated deposit site
- Promptly remove material that may create fugitive dust on a public or private paved road

3.17.7 Historic, Cultural, Archaeological, and Paleontological Resources

Should the alternative selected as for implementation result in an adverse effect to historic resources, a memorandum of agreement to resolve the adverse effect will be prepared, agreed upon, and executed by the Interior, CUWCD, the Mitigation Commission, and the SHPO.

3.17.8 Hazardous Waste

The Division of Environmental Response and Remediation (DERR) would be contacted immediately upon the discovery of any contaminated soil or hazardous material. If petroleum hydrocarbons or other previously unidentified hazardous materials or contaminated soil are encountered during construction, appropriate characterization and handling of the soil/waste would be conducted in accordance with DERR guidance.

Maintenance of construction equipment onsite would be minimized to the fullest extent possible. If onsite maintenance of construction equipment is required, absorbent pads or sheets would be placed under likely leak or spill sources. In addition, absorbent pads or sheets would be readily available during all refueling activities in the event of minor diesel spills. Spills of fuel or hydraulic fluid would be cleaned up immediately, and contaminated soil would be removed from the site and properly disposed of in accordance with state and federal regulations.

The handling, storage, and disposal of all hazardous materials, wastes, petroleum products, and solid wastes would be conducted in conformance with federal and state regulations to prevent soil, groundwater, or surface water contamination and associated adverse effects on the environment or worker health and safety.

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4.0 Coordination and Consultation

NEPA implementing regulations provided by the CEQ and Interior direct lead agencies to involve agencies and the general public in preparing an EA. This chapter documents coordination and consultation that has occurred with agencies and the public during development of this EA.

The Interior published an NOI in the Federal Register on February 25, 2010, regarding the proposed project. The NOI announced plans to prepare an EA to evaluated potential impacts associated with the Realignment. CUWCD placed a public notice in local newspapers announcing an open house to identify and discuss any issues and concerns on the construction, operation, and maintenance of the proposed realigned pipeline.

The public open house was held on March 23, 2010, from 6:00 PM to 8:00 PM in the Provo City Library located on University Avenue in Provo, Utah. Informational displays and opportunity for public comments and discussion were available throughout the meeting. Displays included posters describing the proposed project alternatives; project purpose and need; project schedule; and the NEPA process. Visitors signed in as they entered the room and were encouraged to ask questions and identify any issues or concerns they had regarding the proposed project and to fill out and sign a comment form prior to leaving the meeting.

Thirty-one individuals signed the attendance list at the open house, and 18 comment forms or e-mails commenting on the proposed project were received following the public meeting. Comments received are summarized in Table 4-1.

TABLE 4-1
Comments Received during Public Comment Period

Nature of Comment
What are parking options if street is closed? Will sidewalks be accessible and clear?
Suggested not using the No Action Alternative because of its proximity to active faults and landslide areas.
Suggested not using the No Action Alternative because of its proximity to landslides and unstable soil.
Suggested pipeline be placed in less residential areas.
Concern about proximity to schools.
Suggests alignments further from the Forest Service boundary.
Suggested not using the No Action Alternative because of its proximity to active faults and landslide areas. Mentioned cost savings for a shorter pipeline. Suggested using University Avenue because of traffic impacts. Prefers Cherry Lane to 900 North because of business impacts.
Suggested not using the No Action Alternative because of its proximity to landslides and unstable soil.
Concern about proximity to schools and construction schedule.
Concern about alignment in relation to property line.

TABLE 4-1
Comments Received during Public Comment Period

Nature of Comment
Suggested not using the No Action Alternative because of its proximity to landslides and unstable soil.
Suggested the alignment that was added as Alternative 3.
Prefers University Avenue alignment.
Suggested not using the No Action Alternative because of its proximity to active faults and landslide areas.
Applicability of NEPA process.
Prefers Action Alternatives over the No Action alignment.
Positive impact to Provo River based on additional in-stream delivery resulting from the delivery point being moved 2600 feet upstream

Consultation with SHPO and Native American tribes occurred during preparation of these EA. Table 4-2 lists the coordination letters and the date of each letter.

TABLE 4-2
Coordination Letters

Agency	Outgoing	Response	Date
Paiute Indian Tribe of Utah	X		June 18, 2010
Ute Indian Tribe of the Uintah and Ouray Reservation	X		June 18, 2010
Shoshone-Bannock Tribes of the Fort Hall Reservation of Idaho	X		June 18, 2010
Northwestern Band of Shoshoni Nation of Utah	X		June 18, 2010
Skull Valley Bank of Goshute Indians of Utah	X		June 18, 2010
Paiute Indian Tribe of Utah		X	June 23, 2010
SHPO	X		March 19, 2010 June 8, 2010 June 21, 2010
SHPO		X	April 5, 2010 June 21, 2010 July 6, 2010

Copies of the draft EA will be sent to cooperating agencies, organizations, and individuals for review and comment.

A 30-day public comment period will provide an opportunity for additional input on alignments and associated impacts.

5.0 References

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6.0 List of Preparers

Name/Title	Degree(s)	Role
Central Utah Water Conservancy District		
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Judy Imlay		Historic Architecture
RB&G Engineering		Geological Hazards
Golder Engineers		Geological Hazards

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APPENDIX A

Geologic Hazards Memorandums

May 14, 2010 Project No. 093-81582E

Mr. Mark Breitenbach
Central Utah Water Conservancy District
355 West University Parkway
Orem, UT 84058-7303

RE: GEOLOGIC HAZARDS FOR DPR AND ALTERNATIVE ALIGNMENTS FOR 1450 EAST PIPELINESEGMENT, PROVO, UTAH

Dear Mr. Breitenbach:

As authorized, Golder Associates Inc (Golder) has reviewed geologic conditions along proposed alignments for a pipeline to be constructed east of Provo, Utah. This letter provides discussion regarding geologic hazards along both the DPR alignment along 1450 East, as well as alternative alignments within or closer to the valley bottom to the west.

The potential geologic hazard issues along the DPR and various alternative alignments were briefly outlined in the Value Engineering study for the Spanish Fork – Provo Reservoir Canal Pipeline, Provo Reach, completed in February 2010. The purpose of this letter is to provide a more detailed explanation for our opinion that the DPR alignment along 1450 East, while technically feasible, presents the least favorable alternative for pipeline integrity due to potential geologic hazards.

BACKGROUND

Nancy Dessenberger of Golder Associates Inc. was a member of the Value Engineering Team, providing expertise in geologic hazards and geotechnical engineering. Don West of Golder also provided input to regarding faults through the area of interest.

The portion of the DPR alignment discussed in the following is between approximate Stations 675+00 to 764+00, based on the proposed stationing presented in the EIS. This portion of the alignment is located along the lower slope of the mountain front. The primary geologic hazards that affect this portion of the alignment include potentially active faults, landslides, and steep slopes.

A number of resources were consulted in our review of potential geologic hazard conditions in the vicinity of the proposed DPR alignment and alignment alternatives. These resources included geologic mapping completed by the US Geological Survey and the Utah Geological Survey that cover the areas of interest. Another information source is a map created for the Value Engineering workshop using GIS-based data obtained from Provo City and Utah State hazard databases. Although the scale of the data is such that it should not be considered particularly accurate or detailed for looking at small, localized areas, it does provide a useful screening tool to identify the nature and frequency of hazards, and areas which should be given further scrutiny. The GIS data indicate that geologic hazards due to both potentially active faults and landslides have been identified for significant portions of this segment of the alignment.

POTENTIALLY ACTIVE FAULTS

The Wasatch Fault, and various splays associated with it, are located in close proximity to the alignment. These faults are considered to be “potentially active”. A 2007 study by Golder describes that the most recent fault displacement in the Rock Canyon area is estimated to have occurred about 600 years ago. The total vertical displacement of the most recent event is estimated to be about 4 to 11 feet. The

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Golder Associates: Operations in Africa, Asia, Australasia, Europe, North America and South America

estimated recurrence interval of fault rupture is about 1,400 to 3,200+ years, with an estimated slip rate of 0.05 inches per year.

Figure 1 presents a portion of the GIS data used in the Value Engineering Study. The DPR alignment is shown to lie within areas delineated as “fault buffer” or “surface fault rupture” zones. Based on more detailed, mapped fault information (US Geological Survey and Utah Geological Survey mapping), the DPR alignment lies approximately parallel atop or in close proximity to faults from about Station 687+00 to 764+00.

Between approximately Stations 700+00 and 760+00, where the alignment runs along 1450 East, the main trace of the Wasatch Fault appears to cross the alignment 4 or 5 times, at angles less than 10 degrees. The faults in this area have not been located with great detail or accuracy. Trenching studies would likely be needed to identify fault locations.

If a surface-rupture fault movement event was to occur within the life of the pipeline, it would be expected to break the pipe where it crosses a plane of rupture. Where the pipeline runs parallel to a rupturing fault, either atop, crossing at shallow angles, or in close proximity to it, significant damage could occur at any or all locations within the entire length of proximity. In the event of a major earthquake, ground rupture could also occur at new locations not on known faults. However, it is considered good practice to avoid known fault locations.

The presence of faults is not likely to be significant in terms of construction or operation of the pipeline. However, should a fault rupture event occur, there is a significant risk that the pipeline could be damaged or broken. Consequences associated with a pipeline rupture include loss of use of the pipeline while repairs are made, as well as erosion and flooding that could occur in surrounding areas due to uncontrolled release of flows. If faults must be crossed, it is preferred that they be crossed at steep angles, such that the pipe length exposed to fault rupture is minimized. Final design studies can optimize the alignment and location of critical structures to avoid fault hazards to the extent practical.

Engineering strategies are available to mitigate and/or minimize the risks and consequences of a fault rupture event. In affected parts of the world, all kinds of pipelines, including high-pressure natural gas and liquid petroleum products, are piped through potentially active fault areas. In nearly all cases, the preferred alternative is to avoid the hazards. Where hazards cannot reasonably be avoided, mitigation strategies include:

- Automated shutoff valves on the pipeline to minimize losses in the event of a loss of pressure such as might occur due to rupture;
- Specialized treatment of pipe backfill, and employment of “flexible” pipe installations; and
- Use of larger gauge pipe at fault crossings.

Alternative alignments which are in the valley bottom, away from the mountain front, avoid all faults associated with DPR Stations 675+00 to 764+00.

LANDSLIDES

Geologic mapping by US Geological Survey and Utah Geological Survey show the presence of a landslide along 1450 East, from about DPR Station 710+00 to 725+00. Additionally, the GIS data show as many as three landslide features along the alignment between Stations 675+00 and 740+00 (Figure 1). In addition to the Station 710+00 to 725+00 feature, the GIS data show the DPR crossing a landslide from approximate Station 685+00 to 700+00, and skirting the toe of a landslide from approximate Station 735+00 to 740+00. Site-specific studies are needed to better-assess potential impacts of these features for purposes of pipeline design. However, these areas should be considered as potential hazards to the pipeline until investigations prove otherwise.

Damage to several homes has been reported along 1450 East, as well as settlement to the pavement and curb along the west side of the street, although at the time of the Value Engineering study these reports were not specific as to location or details. It has been suggested that this damage may be due to poor soils/backfill quality rather than landslide movements. However, given the history of recurring settlement at one home (Nathan Jones, 2009), and the location of the damages within areas of mapped landslide features, for planning purposes this area should be assumed to include one or more active landslide features. In addition, scoping comments on the Provo realignment EA from two homeowners along 1450 East describe that they have personal experience with ground movements. One homeowner described that 70-foot deep helical piers extending to bedrock were needed to stabilize their home. A second homeowner described the area as “actively moving”, with failed retaining walls, and lots that have been denied building permits.

Construction in potentially active landslide areas can be accomplished, but it s more costly and leaves a greater long-term risk to the structures than avoidance of hazard areas. The preferred alternative is generally to avoid the hazards. Where hazards cannot reasonably be avoided, mitigation strategies include:

- Construction of specific stabilization measures, such as retaining walls, tie-backs, shear keys, mass regrading, subsurface drains or dewatering wells. Mass regrading, often the most reliable solution, is not a likely option in the residential area along 1450 East. Most of the other measures also typically require significant disturbance of adjacent areas to accommodate construction;
- Automated shutoff valves on the pipeline to minimize losses in the event of a loss of pressure such as might occur due to pipe rupture;
- Monitoring of slope movements, typically by slope inclinometers and survey monuments, and monitoring of deformations of the pipeline itself using electronic strain gages. In the event that pipe-threatening conditions are detected, typically the pipe is excavated to relieve strain and then re-buried or relocated;
- Specialized treatment of pipe backfill, employment of “flexible” pipe installations, in combination with other mitigation.

Alternative alignments which are in the valley bottom, away from the mountain front, avoid all of the mapped landslides associated with DPR Stations 675+00 to 764+00.

STEEP SLOPES

Steeply sloping ground may also present a hazard to the integrity of the proposed pipeline. Steep slopes which are not otherwise unstable may become unstable when disturbed by construction. The portion of the DPR alignment from approximate Station 688+00 to 705+00 crosses the toe of a steep slope with an angle of up to about 27 degrees (2 horizontal to 1 vertical). In addition, the GIS data indicate a potential landslide from approximate Station 685+00 to 700+00.

Construction of the pipeline would require cutting into the toe of this slope. If the feature is indeed a landslide, cutting the slope toe would create the risk of re-activating the landslide. Even if the area is not a landslide feature, large cuts would be required. These cuts would need to be laid back to an angle no steeper than 2 horizontal: 1 vertical to maintain stability if the existing slope is stable, or possibly flatter if potential landslide movements are considered a risk. Slope reinforcement such as retaining walls or tie-backs could be used, or the pipeline could be placed in a cut/fill bench/buttress along the toe of the slope. Any of these options would be visually intrusive. It is not likely feasible to move the alignment onto flatter ground west of the slope toe due to existing residences (see Photo 1).

Using one of the proposed alternative alignments to the DPR would avoid this area, and thus avoid the potential hazards associated with steep slopes.

GEOLOGIC HAZARDS OF ALTERNATIVE ALIGNMENTS

None of the alternatives to the DPR alignment is risk free, although these risks are considered to be much less likely to result in damaging consequences to the pipeline. The alternatives to the DPR are on flatter slopes or within the valley bottom west of the mountain front. Potentially liquefiable soils and shallow groundwater occur in the subsurface in many areas along the valley margins. Loose saturated cohesionless soils may be subject to loss of strength during severe earthquake shaking. This effect could cause damage or possibly even rupture of the pipeline. However, the flatter terrain of the alternative alignments makes the consequences (erosion and flooding) of pipe rupture much less severe that would occur on the steeper slopes characterizing the DPR alignment.

CONCLUSION

Construction of the pipeline along the DPR alignment is technically feasible, and could be accomplished using conventional construction methods. However, it is our opinion that the much greater potential geologic hazards associated with the DPR make it the least preferred of the feasible alternatives. Use of an alternative alignment which lies on flatter terrain to the west would avoid significant long-term risks to pipeline integrity and public safety due to potentially active faults, landslides, and steep slopes, conditions which cannot be avoided if the DPR is followed.

We appreciate the opportunity to serve as your geotechnical consultant for this project. If there are any questions, of if we may be of further service, please feel free to contact the undersigned at (303) 980-0540.

Sincerely,

GOLDER ASSOCIATES INC.

Nancy C. Dessenberger, PE, PG
Senior Engineering Geologist

James W. Niehoff, PE
Geotechnical Practice Leader

Attachment

REGISTERED PROFESSIONAL GEOLOGIST
4750180
NANCY C.
DESSENBERGER
STATE OF UTAH

Figure 1: UAGRS data for landslides and faults along DPR Stations 675+00 to 764+00.

Photo 1: Looking at toe of existing steep slope between approximate DPR stations 688+00 and 705+00, from a point west and down slope of approximate station 705+00. The DPR alignment crosses the lower portion of this slope, above the house at the far right of the photo.

GEOLOGIC HAZARDS EVALUATION

CUWCD ULS PROVO PIPELINE PROJECT

Provo, Utah

Prepared for:
CH2M HILL

May 2010

RB&G
ENGINEERING, INC.

201001-016

Geologic Hazards Evaluation

CUWCD ULS
Provo Pipeline Project

Provo, Utah

Prepared for:
CH2M HILL

May 2010

RB&G ENGINEERING, INC.

RB&G
ENGINEERING, INC.

May 11, 2010

Adam Murdock, P.E.
CH2M HILL
215 South State Street, Suite 1000
Salt Lake City, Ut 84111

Re: CUWCD ULS Provo Pipeline Project

Dear Mr. Murdock:

A Geologic Hazards Evaluation has been completed for the proposed Central Utah Water Conservancy District Utah Lake System Provo Pipeline Project in Provo, Utah. The results of the study are summarized in the Technical Memo transmitted herewith.

We appreciate the opportunity of providing this service for you. If there are any questions relating to the information contained herein, please call.

Sincerely,

RB&G ENGINEERING, INC.

PROFESSIONAL GEOLOGIST
MICHAEL N. HANSEN #5549531
STATE OF UTAH

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CUWCD UTAH LAKE SYSTEM
PROVO PIPELINE PROJECT

Alternate Alignments
Geologic Hazards Evaluation

INTRODUCTION

This report outlines the results of a reconnaissance level evaluation of potential geologic hazards associated with construction and maintenance of the ULS Provo Pipeline Project through the east central section of Provo, between about 450 North to 2300 North and 900 East to 1450 East.

The purpose for this study is to identify the geologic hazards within this area. This information will be used, along with other considerations, in determining the final alignment through this area. The original alignment was shown as trending up along the Provo east bench of the Wasatch Mountains; through the Oak Hills Subdivision primarily along 1450 E. Alternate alignments have been proposed which would avoid bringing the pipeline up and through the east bench slopes of the mountains. These alignments would take the pipeline down through various streets of the Trees Streets Subdivision. The Tree Streets area sits on the valley floor just below and west of the Provo East Bench and the Oak Hills area.

I. GEOLOGIC SETTING

For this study we have divided the alignments into two regions. The alignment which trends up along the Provo East Bench and along 1450E is referred to as the Oak Hills alignment. The other alignments trend down in the valley and trend through the area known as the Tree Streets. Through the Tree Streets area there are several different alignments which are being considered. It is our understanding that the primary alignment under consideration trends down Cherry Lane.

A portion of a geologic map of the area prepared by the USGS in 1992 is shown in Figure 1 (Machette, 1992). The map shows much of the area covered by lacustrine Lake Bonneville deposits. Lake Bonneville was an ancient Pleistocene Lake which covered much of northern Utah until about 10,000 years ago.

As shown on Figure 1, the Cherry Lane line begins on Seven Peaks Blvd. near 1200 East and 450 North and trends north across young alluvial fan deposits (afy), which likely overlay Lake Bonneville sediments. Near Birch Lane, the material is mapped as Bonneville silt and clay (lbm) to the north and along the trend of 900 East. Near the bend in the road at Temple Drive it is mapped again as young alluvial fan (afy) and then as fan alluvium from the Provo cycle of Lake Bonneville (afp). As shown of Figure 1, the other two Tree Street alignments, which diverge and reconverge with the Cherry Lane alignment, also pass through these same sedimentary deposits.

The Oak Hills alignment trends to the northeast just north of 450 East along Seven Peaks Blvd. and through the young alluvial fan (afy) deposits. At about 700 North, the street ends and the alignment trends along a proposed street alignment and up onto the Provo Bench to Oak Cliff Drive. Just north of Oak Cliffs Dr. the alignment passes through the edge of an old landslide deposits (clso). From Oak Cliffs Dr., the alignment trends north along 1450 E until it reaches Rock Canyon. Though this area the line crosses over or nearly parallels main traces of the Provo segment of the Wasatch fault. It should be noted that these mapped traces typically represent a main trace which likely has a zone of secondary faulting surrounding it. The alignment passes through Lake Bonneville sands (lbs) and gravels (lbg), old alluvial fans (afo) which predate Lake Bonneville, and old landslide (clso) deposits which may predate or be contemporaneous with Lake Bonneville.

II. GEOLOGIC HAZARDS

A. Previous Studies

Several geologic hazard studies have been completed in the Provo area. The first major study was completed in 1984 by Engineering Consultants (1984). Geologic hazard maps were prepared for the city showing locations of faults, active landslides, old landslides, potential landslides, alluvial fans, debris flows and other hazards and potential problem soils. The hazards mapped during the 1984 study are included on Plate 1.

In 1992, the USGS published a map of the Provo Segment of the Wasatch Fault Zone (Machette, 1992). This map identified the various Quaternary deposits and lake levels of ancient Lake Bonneville, which receded about 10,000 years ago. The map also identified traces and branches of the Provo segment of the Wasatch fault which last moved about 500 to 600 years ago.

In 1990, Utah County had Natural Hazards Overlay (NHO) zone maps prepared (Robison, 1990). These maps showed faults taken from preliminary copies of Machette's 1992 map along with hazards associated with landslides, rock fall, debris flow and liquefaction.

In 2000, Provo City completed a second geo hazard study, due in part to ongoing landslide problems along the northeast bench in the Sherwood Hills area. The 2000 maps included an update of the projected faults and other geologic hazards. The most recent active landslide; the 1983 slide in Oak Hills near 1500 East and 1300 North, is also included on the 2000 maps. This slide destroyed one home.

Plate 1 includes the proposed pipeline alignments and an overlay of the current Provo City Geologic Hazard map. The current map is a compilation of parts of the previous studies.

B. Trees Streets and Cherry Lane Alignments

The Tree Streets alignments are located in an area that does not have any documented geologic hazards. Surficial deposits consist of some young alluvial fan deposits derived from the mountain to the east, and Lake Bonneville silt and clay. Plate 1 shows the location of the Cherry Lane alignment relative to the mapped geologic hazards. As shown on the map, the geologic hazards are located east of the alignment. A review of old aerial photos showed development in the Trees Streets Subdivision taking place prior to 1958. Personal communications with Tom Birch and Scott Allen with Provo City did not reveal any information regarding problems with shallow groundwater tables within this area. (Personal communication, May, 2010) Scott noted that some areas further to the west near 800 N and 500 E have had shallow water and a pump station was put in the area to keep the water level down. He also mentioned that some irrigation canals (Upper Union Canal) which may have leaked in the past have been put into buried pipelines. We are not aware of any groundwater problems associated with basements in the area. A portion of the Timpanogos Canal near the toe of the bench appears to still be open.

C. Oak Hills, 1450 East Alignment

The Oak Hills Alignment starts at Seven Peaks Blvd. and about 450 North. At about 700 North, the street ends and the alignment trends along a proposed street alignment and up onto the Provo Bench to Oak Cliff Drive. Through this reach the elevation changes from 4665 ft. to 4875 ft., a rise of 210 feet. Plate 1 shows the alignment through this area, along with the topography. It should be noted that this topographic data was provided by Provo City and is mapped at 5 foot contour intervals. As shown on Plate 1, the topography towards Oak Cliff

Dr. becomes relatively steep. Profiles were taken at several locations throughout this reach and are labeled A to H on Plate 1. Figure 2 shows a plan view of this area with areas having slopes steeper than 2 horizontal to 1 vertical (2H:1V) highlighted. Profile views of the sections are shown on Figure 3. Photographs of the area are shown on Figures 4 and 5.

The profile sections show that the slope steepens between sections B through G, with the slope ranging between 2.3H:1V up to 1.8H:1V. The steeper 1.8:1 slopes are located near sections C and D. The following Table summarizes these slopes

	Grade	H		V
A	17%	5.9	:	1
B	46%	2.2	:	1
C	56%	1.8	:	1
D	43%	2.3	:	1
E	51%	2.0	:	1
F	55%	1.8	:	1
G	47%	2.1	:	1
H	15%	6.7	:	1

Reconnaissance through this area found that an excavation for a trail or roadway had been started in the past and had extended several hundred feet south of Oak Cliffs Dr. and 1450 E. The slope appears to consist of alluvial fan debris flow deposits. As shown on Figure 4 and 5, very large blocks and boulders of gray-blue limestone, some more than 15 feet across are deposited on the surface and protruding from the surficial deposits. Due to the size of some of the erratic boulders, we could not confirm whether any of these blocks were in place bedrock. In some areas, there were many large blocks sitting side by side which look almost like bedrock, but are likely debris flow materials. No bedrock exposures were observed at the surface through this section, and the depth to bedrock is not known.

Construction of a pipeline through this section of the alignment will require excavation into the steep slope areas having a mixture of materials that appear highly variable and chaotic, with very large limestone boulders. In general, the existing slopes between Sections B through G are about 2H:1V, with a few areas at 1.8H:1V. This reach is about 1,000 feet long and will likely require slope stabilization such as soil nailing to create a horizontal bench for pipeline construction.

From Oak Ciffs Dr., 1450 East extends north within an area which trends predominately along the top of the ridge, with a steep slope dropping off toward the west just west of the residents along the street. Not all of the lots along the west side of the street have been developed. A review of old aerial photos shows that some development was taking place at the north end of Oak Hills prior to 1958. Between 1966 and 1970, excavation occurred at the

southerly end of 1450 East. Aerial photos show several drainage channels or small washes trending off of the higher slopes to the east down toward the valley below.

The aerial photos show the roadway being constructed across the washes. Settlement associated with inadequate compaction of fill placed in some of the washes has occurred.

Two of these washes are located at 1223 N and 1295 N on the west side of 1450 East. Both of these lots are undeveloped with steep slopes dropping off just west of the street. The west side of the street and curb at 1223 N shows a slight dip with about one inch of movement to the west. At 1295 N, a sag area has developed in the asphalt pavement on the west side of the street, with a dip of about 5-7 inches settlement over a 30 foot section. The curb in this area shows about 2 to 3 inch of movement toward the west. On the west side of the street several trees along a steep westerly slope how signs of creep and toppling. It is not known how much of this slope is native. Figures 6 and 7 show photographs of some of the settlement noted in the area. It would appear that a significant amount of fill has been placed beneath the road to fill in the draw in this area. A small irregularity was also noted at the undeveloped lot between 1307 N and 1355 N.

Near the north end of 1450 East is an area noted on the geologic hazard map as a sag area associated with back tilting toward the east from secondary faulting towards a major fault further to the east.

The Provo City Geologic Hazard Map information has been overlain on Plate 1 with various possible alignments. For this report we have taken a closer look at the hazards beginning at the south end of the alignment and moving north along the 1450 E Oak Hills alignment.

The first mapped hazard encountered along the planned pipeline alignment at the south end is an area of potential flash flooding from Slide Canyon to the east. This area was encountered soon after leaving the paved road and ran for approximately 1000 feet. The alignment then runs for about 300 feet through an area designated as an alluvial fan and comes up against a mapped fault trace. The planned route then crosses 2 mapped fault lines and enters a potential landslide area before reaching Oak Cliff Dr. Much of this area has relatively steep slopes, particularly between profiles B and G shown in Figures 2 and 3. The alignment then passes through another 2 mapped fault lines and enters onto the roadway at 1450 E and Oak Cliff Dr., where it crosses 2 more mapped faults. Just northwest of the intersection of Oak Cliffs Dr. and 1450 E. is an active landslide scarp. Several landslide scarps have been mapped

along the hillside below 1450 E. and Old Willow Lane near the toe of the slope. The scarps are located between about 1100 N. and 1300 N.

The alignment then enters an area mapped as having the potential for collapsible soils and landslides. Landslide movement occurred east of 1500 E in 1983, which was a wet year, destroying one home. In 1983, RB&G Engineering completed an evaluation of the slide. It was noted that a small drainage channel exists above the slide area. Subsurface investigations performed in the slide area by RB&G Engineering concluded that (1) the slide occurred along the surface of the Manning Canyon Shale, (2) groundwater accumulating in the granular over-burden above the Manning Canyon Shale, likely reduced the shearing strength at the interface between the two materials, resulting in slide movement, and (3) the Manning Canyon shale appeared to dip sharply downward beneath 1500 East. While currently filled in, this same drainage channel reappears down slope of the lot at 1295 N. Personal communication with Mr. Morgan at 1307 N. reported that he has had some settlement or instability on his property right next to the drainage. He was also aware of some problems within the neighborhood, particularly some settlement at 1247 N Oak Cliff Cir which is likely over an old drainage channel.

Further north, the alignment passes through another mapped fault line and enters a potential landslide area. The line then passes through approximately 1200 feet of old landslide. At the far north end of 1450 East is approximately 1800 feet of area designated as “no known hazards”. Part of this area is located within a fault sag area near 2050 N. This sag is due to back tilting towards a main trace of the fault to the east. After this area the line turns west down 2300 N. It passes through a potential flash flood area then crosses 5 more mapped fault lines as the line now trends perpendicular over the faults.

The alignment crosses mapped faults at about 12 locations. In the past, RB&G Engineering has also conducted several surface fault rupture hazard investigations in the Oak Hills area. Our investigations have verified the presence of some of the mapped faults along with additional secondary faults surrounding the main mapped traces. Additional trenches will be required to verify the presence of other faults.

While many potential hazards have been mapped along this alignment, there has not been any landslide movement documented along 1450 E during historic time. Settlement noted along the pavement may be related to poor compaction of fill within the drainage channels, rather than movement in native materials. Manning Canyon Shale is well known for

contributing to unstable slopes in Utah. While the shallow shale contact was documented as the failure surface in the 1983 slide east of the proposed alignment, we do not know where it is located below 1450 E.
Dave Graves, Provo City Engineer, stated that the City has not had any problems with buried utilities along 1450 E due to slope movement (Personal communication May 3, 2010).

Two rockfalls have been documented in Oak Hills during the past 10 years. Both falls damaged structures further to the east near the open hillside. It is assumed that the pipeline will be buried and not subject to rock fall hazards.

No shallow groundwater has been noted along the Oak Hills alignment. Some springs had been reported near the base of the slope west of the drainages at 1223 and 1295 North. These springs were not noted on the City Geologic Hazard maps. We do not know if these springs are currently running. Near the north end of the alignment two springs are mapped several hundred feet west and down slope of 1450 East at about 2085 N 1220 E.

III. CONCLUSIONS

In summary, to the best of our knowledge no significant geologic hazards, problem soils or shallow groundwater problems have been documented in the Cherry Lane or Tree Streets area.

The Oak Hills alignment is located predominately on materials which have been mapped as old landslide or material with a potential for landslides. During the wet year of 1983, a landslide east of the alignment began moving on the Manning Canyon Shale Formation. Landslide scarps are mapped along the hillside above Old Willow Lane, below 1450 E., between about 1100 N. and 1300 N. In our opinion, there is potential for future landslide movement at locations along the alignment, which could disrupt the flow and require repair of the pipeline.

The south end of the alignment trends through relatively steep alluvial fan debris flow deposits which may require slope stabilization, such as soil nail walls, to create a bench for pipeline construction, across about 1,000 feet of the alignment.

The alignment crosses at least 2 drainages which have been backfilled during subdivision development. Settlement of inadequately compacted fill has been documented in the area. Construction of the pipeline may require removal and replacement of low density fill.

The Oak Hills alignment also parallels and crosses numerous mapped fault traces associated with the Wasatch Fault Zone throughout the Oak Hills area. The alignment will likely cross other traces which have not been mapped. It is recommended that a geologist be on site during all trench excavations to map fault locations and displacement. Pipeline design should accommodate expected displacement.

REFERENCES

International Engineering, 1984, Geologic hazard overlays for Provo City: Unpublished consultant's report.

Machette, M.N., 1992. Surficial geologic map of the Wasatch Fault Zone, Eastern part of Utah Valley, Utah County and parts of Salt Lake and Juab Counties, Utah: U.S. Geological Survey Map I-2095, scale l:50,000.

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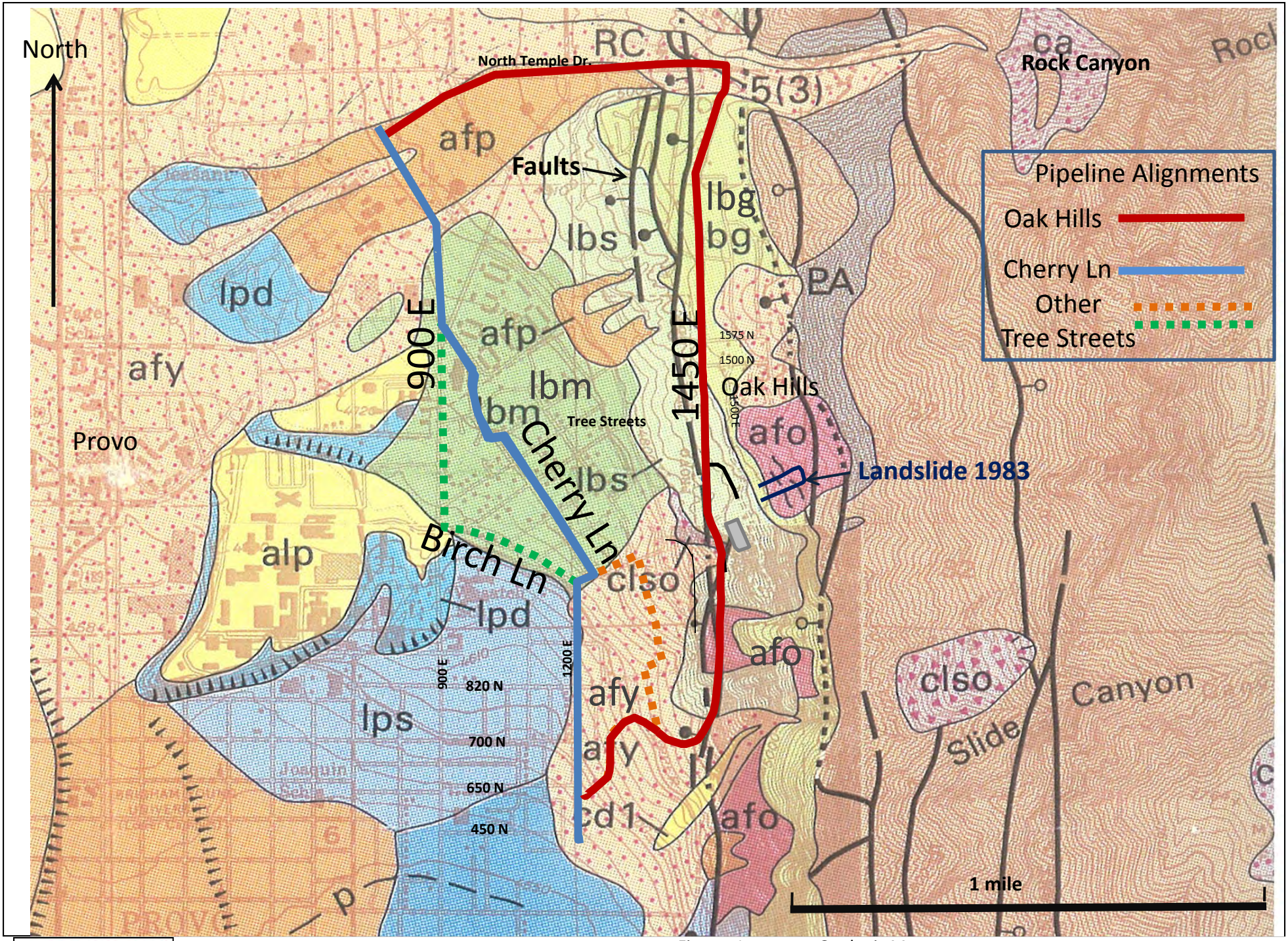

RB&G ENGINEERING, INC.

Map taken and modified from *Surficial Geologic Map of the Wasatch Fault Zone Eastern Part of Utah Valley, Utah County, and Parts of Salt Lake and Juab Counties, Utah.* Michael N. Machette, 1992. Miscellaneous Investigations Series, Map I-2095

Figure 1	Geologic Map
Project	CUWCD ULS Pipe Line
Location	Eastern side, Provo, Ut

LIST OF MAP UNITS

[See Description of Map Units in pamphlet for detailed descriptions of units]

LACUSTRINE DEPOSITS

Deposits younger than the Bonneville Lake Cycle (Holocene to upper Pleistocene)

- ly — Younger lacustrine and marsh deposits
- lely — Lacustrine, marsh, and alluvial deposits, undivided

Deposits of the Provo (regressive) phase of the Bonneville lake cycle (upper Pleistocene)

- lpd — Deltaic deposits
- lpg — Lacustrine gravel
- lps — Lacustrine sand
- lpm — Lacustrine silt and clay

Deposits of the Bonneville (transgressive) phase of the Bonneville lake cycle (upper Pleistocene)

- lbd — Deltaic deposits
- lbg — Lacustrine gravel
- lbs — Lacustrine sand
- lbm — Lacustrine silt and clay

Deposits of the Bonneville lake cycle, undivided by phase (upper Pleistocene)

- lbpg — Lacustrine gravel
- lbps — Lacustrine sand
- lbpm — Lacustrine silt and clay

ALLUVIAL DEPOSITS

Deposits of stream alluvium

- al1 — Stream alluvium, unit 1 (upper Holocene)
- al2 — Stream alluvium, unit 2 (middle Holocene to uppermost Pleistocene)
- aly — Younger stream alluvium, undivided (Holocene to uppermost Pleistocene)
- alp — Stream alluvium related to the Provo phase of the Bonneville lake cycle (uppermost Pleistocene)
- alb — Stream alluvium related to the Bonneville phase of the Bonneville lake cycle (upper Pleistocene)
- al3 — Stream alluvium unit 3, related to undifferentiated phases of the Bonneville lake cycle (upper Pleistocene)
- alo — Older stream alluvium, undivided (upper ? to middle Pleistocene; probably pre-Little Valley lake cycle)

Alluvial-fan deposits

- af1 — Fan alluvium, unit 1 (upper Holocene)
- af2 — Fan alluvium, unit 2 (middle Holocene to uppermost Pleistocene)
- afy — Younger fan alluvium, undivided (Holocene to uppermost Pleistocene)
- afp — Fan alluvium related to the Provo phase of the Bonneville lake cycle (uppermost Pleistocene)
- afb — Fan alluvium related to Bonneville phase of the Bonneville lake cycle (upper Pleistocene)
- af3 — Fan alluvium unit 3, related to undivided phases of the Bonneville lake cycle (upper Pleistocene)
- af4 — Fan alluvium, unit 4 (upper to middle Pleistocene; pre-Bonneville lake cycle)
- af5 — Fan alluvium, unit 5 (middle Pleistocene; pre-Little Valley lake cycle)
- afo — Older fan alluvium, undivided (upper to middle Pleistocene; pre-Bonneville lake cycle)

GLACIAL DEPOSITS

- gbco — Outwash of the Bells Canyon advance (upper Pleistocene, Pinedale equivalent)
- gbct — Till of the Bells Canyon advance (upper Pleistocene, Pinedale equivalent)
- gdco — Outwash of the Dry Creek advance (uppermost middle Pleistocene, Bull Lake equivalent)
- gdct — Till of the Dry Creek advance (uppermost middle Pleistocene, Bull Lake equivalent)

EOLIAN DEPOSITS

- es — Eolian sand and silt (Holocene to uppermost Pleistocene)

COLLUVIAL DEPOSITS

- cd1 — Debris flows, unit 1 (upper Holocene)
- cd2 — Debris flows, unit 2 (middle Holocene to uppermost Pleistocene)
- cdy — Debris flows, undivided (Holocene to uppermost Pleistocene)
- cfs — Fault-scarp colluvium (Holocene to uppermost Pleistocene)
- chs — Hillslope colluvium (Holocene to upper Pleistocene)
- crf — Rockfall deposits (Holocene to upper Pleistocene)
- clsp — Lateral-spread deposits (Holocene to upper Pleistocene)
- clsy — Younger landslide deposits (Holocene to upper Pleistocene)
- clso — Older landslide deposits (upper Pleistocene to upper Tertiary?)
- ca — Colluvium and alluvium, undivided (Holocene to middle Pleistocene)

ARTIFICIAL DEPOSITS

- f — Artificial fill and associated disturbed ground (historic)

BEDROCK

- Ns — Neogene sedimentary rocks
- PEv — Paleogene volcanic rocks
- PEi — Paleogene intrusive rocks
- PEKs — Paleogene and Upper Cretaceous sedimentary rocks, undivided
- Ps — Paleozoic sedimentary rocks, upper part (Lower Permian)
- PIPs — Paleozoic sedimentary rocks, middle part (Lower Permian and Pennsylvanian)
- PCs — Paleozoic sedimentary rocks, lower part (Lower Pennsylvanian, Mississippian, Devonian, and Cambrian)—Stipple pattern indicates Manning Canyon Shale
- PA — Proterozoic and Archean rocks (Precambrian)

Contact—Solid where well located or defined; dashed where approximately located; dotted where concealed

Gradational contact—Contact between two units that intertongue or between two differentiated units (such as al1 and al2) and its undifferentiated counterpart (aly)

AF ? 3(8) **Normal fault**—Bar and solid ball on down-dropped side along Wasatch fault zone; bar and hollow ball along other faults. Dashed where approximately located; dotted where concealed. Height of fault scarp and amount of offset of geomorphic surface (in parentheses) shown in meters. Location of exploratory trenches shown by following symbols: AF, American Fork Canyon; RC, Rock Creek; DH, Deadmans Hollow; HC, Hobble Creek; MN, Mapleton North; MS, Mapleton South; WC, Water Canyon; and WH, Woodland Hills

Thrust fault—Sawteeth on overriding plate or block (mapped in bedrock only); dashed where approximately located; dotted where concealed

Anticline—Solid arrows show folded lake beds as indicated by geophysical surveys of Utah Lake. Hollow arrows show anticline in surficial units

Syncline—Solid arrows show folded lake beds as indicated by geophysical surveys of Utah Lake. Hollow arrows show syncline in surficial units

23 **Dip and strike of deformed Neogene fanglomerate (unit Ns)**

Major, continuous or prominent shorelines related to levels of the Bonneville lake cycle and its successor, Utah Lake—May coincide with contact, topographic escarpment, or topographic crest of lacustrine bar or spit

—B— **Highest shoreline of the Bonneville (transgressive) phase**

—b— **Other shorelines of the Bonneville phase**—Mostly transgressive

—P— **Highest shoreline of the Provo (regressive) phase**—Dotted where buried by younger units or removed by erosion

—p— **Other shorelines below the highest Provo shoreline**—Mostly of the Provo phase, but may include some shorelines of the Bonneville (transgressive) phase

—U— **Shorelines of Utah Lake**

Topographic crest of lacustrine bar or spit

Topographic crest of lateral- or terminal-glacial moraine (units gbct and gdct)

Topographic escarpment—Escarpment along stream channels, terraces, and deltas; formed primarily by fluvial processes. Where escarpment coincides with the contact between map units, points face upslope; dashed where approximately located; queried where position of escarpment is poorly located. Height of escarpment (in meters) shown in selected areas

Landslide escarpment—Major headscarp and (or) fissure in landslide (unit clsy or clso) or lateral spread (unit clsp) deposit; may coincide with geologic contacts

Map legend modified from *Surficial Geologic Map of the Wasatch Fault Zone Eastern Part of Utah Valley, Utah County, and Parts of Salt Lake and Juab Counties, Utah.* Michael N. Machette, 1992. Miscellaneous Investigations Series, Map I-2095

Figure 1 a | Geologic Map Legend
Project | CUWCD ULS Pipe Line
Location | Eastern side, Provo, Ut

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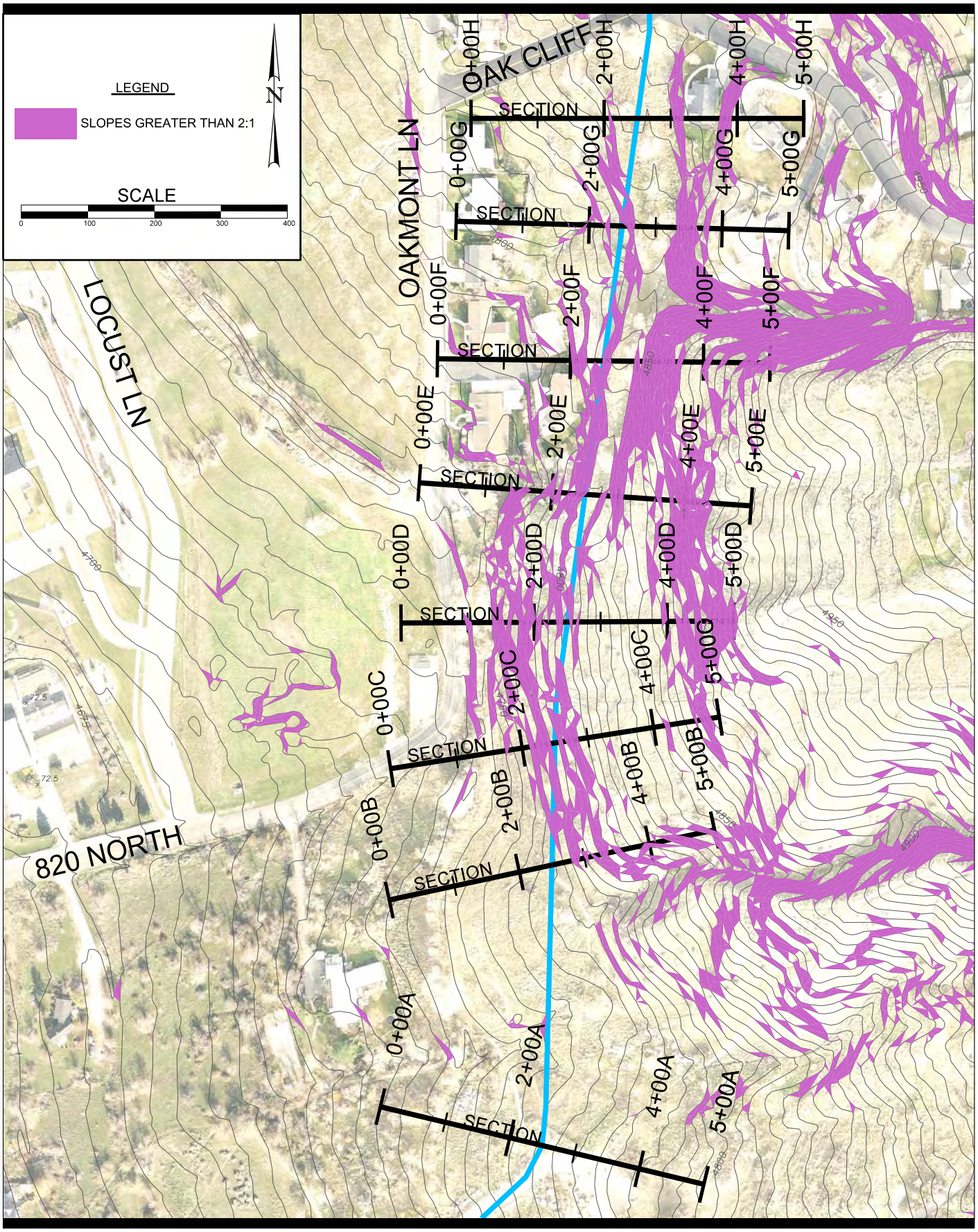

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Figure 2 - Topography and Sections

South of Oak Cliffs Dr.
Provo, Utah

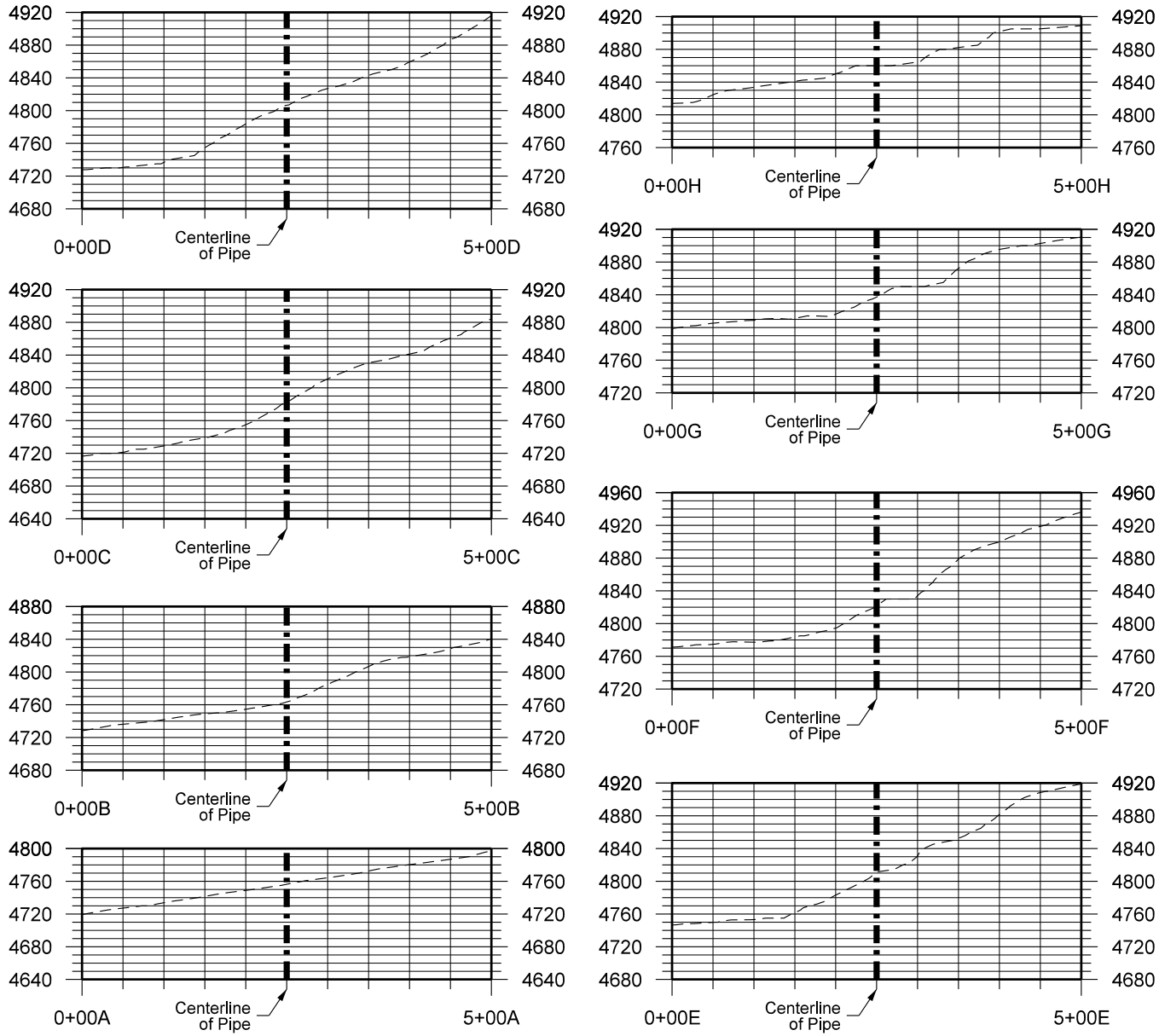

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Figure 3 - Sections

South of Oak Cliffs Dr.
Provo, Utah

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Figure 4	Geologic Hazards Alluvial Fan South of Oak Cliff Drive
Project	CUWCD ULS
Location	Oak Hills area, Provo, Ut

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Figure 5	Geologic Hazards Alluvial Fan South of Oak Cliff Drive
Project	CUWCD ULS
Location	Oak Hills area, Provo, Ut

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Figure 6	Geologic Hazards 1295 North 1450 East
Project	CUWCD ULS
Location	Oak Hills area, Provo, Ut

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Figure 7	Geologic Hazards 1450 East
Project	CUWCD ULS
Location	Oak Hills area, Provo, Ut

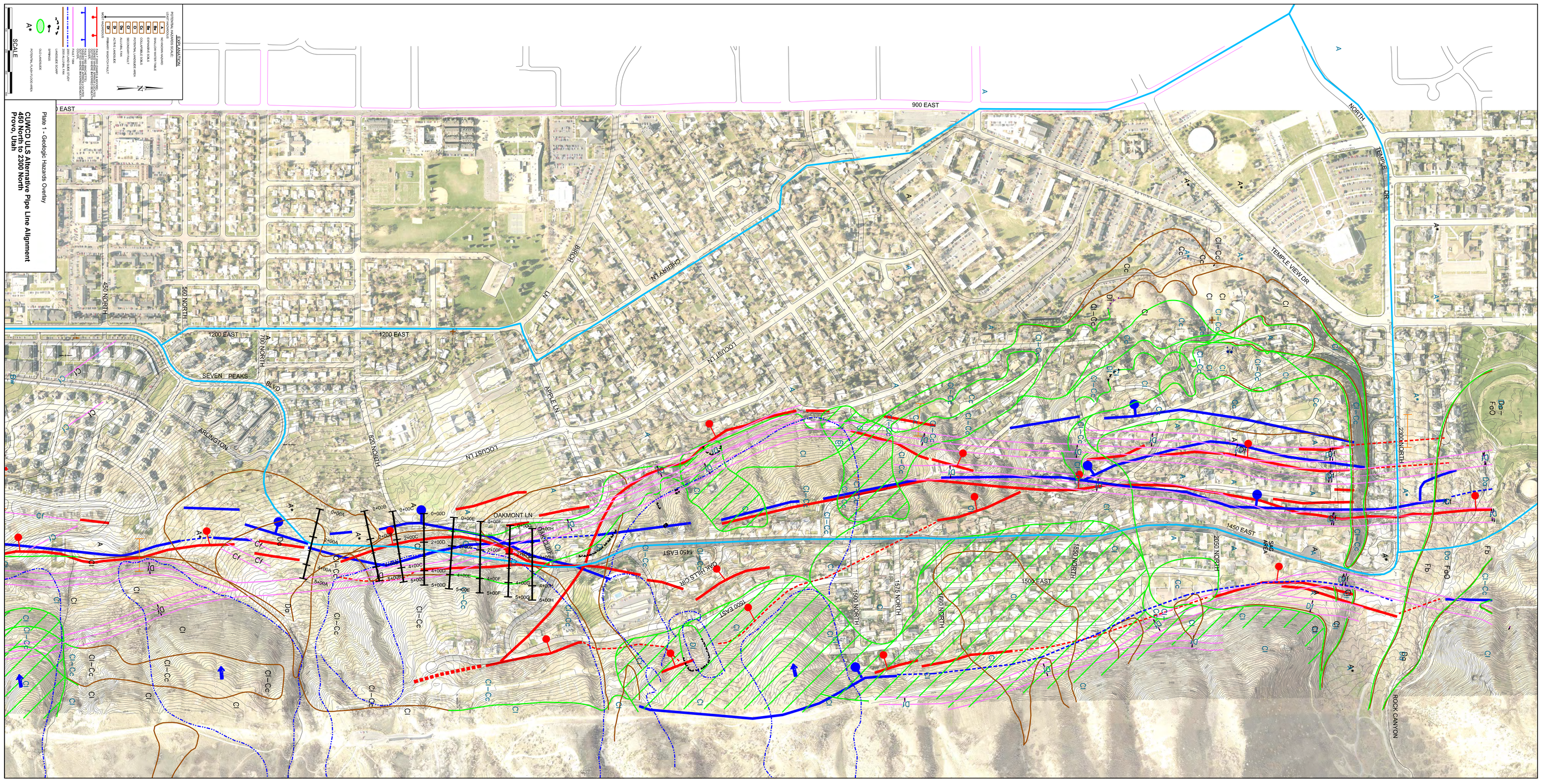
Plate 1 - Geologic Hazards Overlay
CUWCD ULS Alternative Pipe Line Alignment
400 North to 2300 North
Provo, Utah
SCALE
EXPLANATION
900 EAST
1200 EAST
SEVEN PEAKS BLVD
ARLINGTON
LOCUST LN
APPLE LN
OAKMONT LN
1450 EAST
1500 EAST
TEMPLE VIEW DR
NORTH TEMPLE DR
ROCK CANYON
400 NORTH
500 NORTH
620 NORTH
1500 NORTH
1575 NORTH
2050 NORTH
2300 NORTH